PROJECT MANUAL FOR:

CENTRAL FALLS HIGH SCHOOL

CENTRAL FALLS HIGH SCHOOL
10 HIGGINSON AVE, CENTRAL FALLS, RI

100% CONSTRUCTION DOCUMENTS

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VOLUME 2 OF 3
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MARKERBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:

1. Wall mounted fixed markerboards.
2. Horizontal sliding markerboards.
3. Wall mounted tackboards.
4. Tackboard walls.
5. Trim and accessories

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

E. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM A424 - Standard Specification for Steel, Sheet, for Porcelain Enameling.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C543 (Withdrawn Standard) - Specification for Slate Blackboards.
4. PEI - Performance Specifications for Porcelain Enamel Chalkboards.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets for each item furnished hereunder.
2. Selection samples: Manufacturer's sample chain showing finishes and colors available, for both dry-marker boards and chalkboards, for selection by Architect.
3. Provide maintenance information on regular cleaning and stain removal for slate chalkboards.
4. Sustainable Design Submittals: As required by NE CHPS.

1.5 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

B. Provide manufacturer's standard 5 year warranty which shall include coverage of dry-marker board and porcelain enamel chalkboard surfaces from discoloration due to cleaning.

1.6 MAINTENANCE

A. Provide maintenance information on regular cleaning, stain removal for both dry-marker boards and chalkboards.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Claridge Products & Equipment Inc., Harrison AR.
2. AARCO Products, Inc., Yaphank NY.
3. EverWhite Corp. Menomonee Falls, WI.
4. Ghent Corporation, Lebanon OH.
5. Marsh Industries, Inc., New Philadelphia, OH.

2.2 DRY MARKER BOARD

A. Fixed framed markerboards: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Claridge Products &

Equipment Inc., Harrison AR, Product: “Series 8 with LCS-II No. 75 surface of sizes indicated on Drawings

B. Fixed unframed markerboards: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Claridge Products & Equipment Inc., Harrison AR, Product: “LCS^3”surface of sizes indicated on Drawings.

C. Markerboard surfaces:
   1. Face sheet: 24 gage cold rolled enameling steel.
   2. Porcelain enamel writing surface:
      a. Bottom ground coat: 1.5 to 2.2 mils.
      b. Top ground coat: 2.0 to 2.8 mils.
      c. Color coat: 3.0 to 4.0 mils.
   3. Face sheet color: As selected by Architect from at least five standard colors.
   4. Backing sheet: steel sheet or aluminum, minimum 0.015 inch thick.

D. Aluminum framed dry markerboards, of sizes indicated on Drawings.
   1. Exposed trim: Extruded 6063-T5 alloy aluminum, anodized, satin finished.
   2. Top rail:
      a. 1 inch high display rail with cork insert and end trim.

E. Horizontal sliding markerboards: Equal to Claridge two track sliding markerboard Model No. HS410. Left panel fixed panel to include 48 inch by 48 inch graph. Provide two 48 inch by 60 inch sliding panels with no graphics. Provide map rail cork inserts as specified in this Section.

F. Tackboard surfaces, where indicated: Self-healing, mildew resistant vinyl embossed fabric covered 1/4 inch thick natural cork laminated to 1/4 inch thick fiberboard Equal to Claridge Series 8 trim.
   1. Divider strip at combination units: 1-1/4 inch mullion trim, finished to match frame.
   2. Fabric covering as selected by the Architect from the manufacturer’s full range of available colors and patterns. Up to three colors shall be required for the project. Provide Color 1 as selected unless otherwise noted on the Drawings

G. Marker boards walls:
   1. Type MW-1: Claridge product: “Claridge LCS Porcelain Marker Walls”, model MW1 having ‘LCS’ steel skins with matched butt joints and Claridge Number 18 adhesive.
      a. Porcelain color as selected by Architect.
   2. Type MW-2: Claridge product: “Claridge LCS Porcelain Marker Walls”, model MW2 having 1-5/8 inch profile face, extruded 6063-T5 alloy aluminum, equal to Claridge No. 1016 snap-on trim, with factory painted finish matching porcelain color, over No. 1015 ground trim.
      a. Porcelain color as selected by Architect.

3. Type MW-3: Claridge product: “Claridge LCS Porcelain Marker Walls”, model MW3 having having 3/4 inch profile face, extruded 6063-T5 alloy aluminum, equal to Claridge No. 1195 snap-on trim with factory painted finish matching porcelain color, over No. 1194 ground trim,
   a. Porcelain color as selected by Architect.
4. Tackstrip/maprail (all locations, except where otherwise indicated): Extruded 6063-T5 alloy aluminum, anodized, satin finished equal to Claridge No. 74EZ.

H. Tackboards walls: Claridge Tack Walls, product No. TW1D with fabric covered H bar or approved equal. Panel sizes indicated on Drawings.
1. Exposed trim Extruded 6063-T5 alloy aluminum, equal to Claridge 1016FC fabric covered.
2. Fabric covering as selected by the Architect from the manufacturer’s full range of available colors and patterns. Up to three colors shall be required for the project. Provide Color 1 as selected unless otherwise noted on the Drawings

2.3 ACCESSORIES

A. Provide sliding aluminum accessories, hook type, to fit display rail.
1. Provide two sliding aluminum map supports for every 8 linear feet of markerboard.
2. For each room provide two roller map brackets.

B. Provide instructions for dry-marker board cleaning on metal plate attached to perimeter frame near chalk-trough for each room.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and internal wall blocking are ready to receive work of this Section.

B. Beginning of installation means acceptance of existing substrate.

3.2 INSTALLATION

A. Install markerboards in accordance with manufacturer's instructions. Protect porcelain enamel facing from chipping and damage during handling and installation. Install units’ level and plumb utilizing concealed continuous hangers wherever possible and where fasteners must be exposed, use tamperproof-type fasteners.

B. Install dry-marker boards in accordance with manufacturer's instructions. Protect edges and porcelain enamel writing surface from chipping and damage during handling and installation. Secure units’ level and plumb in wood frames provided under Section 06 20 00 - FINISH CARPENTRY.

C. Establish top of units at 83 inches above finished floor or as otherwise indicated on the Contract Drawings.

3.3 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover boards with protective cover taped to frame. Remove cover on Date of Substantial Completion.

End of Section

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Section 10 12 00

DISPLAY CASES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:

1. Art display cases, semi-recessed custom, where indicated on Drawings, and as scheduled at the end of this Section.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 04 20 00 - UNIT MASONRY: Masonry enclosure.

D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

E. Division 26 – ELECTRICAL.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements
    a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

C. Scheduling:
1. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets.
2. Shop drawings, include sections of typical members, elevations, anchorages, and indicate finishes.
3. Selection samples: Manufacturer's sample chain showing finishes and colors available, for back panel surfaces, for selection by Architect.
4. Verification samples of each exposed material, showing finish, color, and qualities of fabrication and design.
5. Sustainable Design Submittals: As required by NE CHPS.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation:
    a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.7 FIELD MEASUREMENTS

A. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Tab & Ticket Company, West Chicago, IL.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Tab & Ticket Company, West Chicago, IL.
2. ABC Bulletin & Directory Division of Nelson Harkins.
3. Claridge Products and Equipment, Inc.
4. Greensteel, Inc.
5. Poblocki & Sons, Inc.

2.2 WALL MOUNTED CASES

A. Art CasesSemi-Recessed display case all glass case with aluminum header and base, and light.

1. Dimensions: Nominally 4’-0” high by width indicated.
   a. Extends out from wall maximum 4 inches.
2. Glazing:1/4 inch thick clear tempered safety glass complying with FS DD-G-1403, Kind FT, Condition A, Type I, Class 1 - transparent.
3. Backboard: Polyester panel fabric, stain and soil resistant, with a flame spread rating of Class A (ASTM E84), laminated to 7/32" thick cork sheet on 1/4" thick hardboard backing with edges wrapped; color and texture as selected.
4. Lighting: Provide manufacturer’s LED difused lighting in header.
5. Trim: Powder Coat finish with custom color to match hollow metal.
6. Provide lock hardware for glass doors.

2.3 FABRICATION

A. General: Fabricate items to comply with requirements indicated for materials and design. Miter and reinforce corners of frames, conceal fasteners. Provide graphics for name strips and headers to comply with letter style, size, spacing and other characteristics indicated. Equip covers with manufacturer's standard hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and internal wall blocking are ready to receive work of this Section.

B. Beginning of installation means acceptance of substrate.

3.2 INSTALLATION

A. Assemble factory shipped knock-down cases in accordance with manufacturer's written instructions.

B. Install display case and bulletin boards in accordance with manufacturer's instructions. Secure units' level and plumb.

3.3 CLEANING

A. Clean display cases and bulletin boards in accordance with manufacturer's instructions.

End of Section

Section 10 14 00 SIGNAGE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is direction to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 SECTION INCLUDES

A. The work of this section consists of the following sign categories:

1. Exterior

a. Building Identification
b. Informational
c. Regulatory

2. Interior

a. Room, Office and Area Identification
b. Informational
c. Directional
d. Regulatory
e. Dedication
f. Graphic Surface Covering

B. The items below are included as part of this specification.

1. General sign type drawings, including overall sign shape, size and graphic layout
2. Mounting drawings, showing mounting heights and relationships to site and/or building elements
3. Detailed sign type drawings, indicating type styles, symbols, dimensioned graphic layouts, methods of graphic application, colors and primary materials
4. Construction drawings, showing fabrication and mounting details
5. Preliminary sign schedule, listing sign location number, sign type quantity and notes of clarification, if any
6. Sign location plans, indicating the location of each sign with its number

1.3 RELATED SECTIONS

1.4 ACTION SUBMITTALS

A. The sign contractor shall submit the following to the general contractor prior to fabrication, under the provisions of Section 01330 SUBMITTAL PROCEDURES

1. Construction ship drawings for all sign types showing shape, size, type styles, symbols, dimensioned graphic layouts, methods of graphic application, colors, materials, and fabrication and mounting details
2. Sign mounting drawings showing mounting heights and relationship to site and/or building elements
3. Final sign message schedule

a. The sign contractor will meet with the architect, owner and general contractor, as directed and as necessary, to confirm all text and graphic content for each sign element; particular attention is directed to the room overall sign message schedule review; the sign contractor will amend the preliminary sign message schedule included in these construction documents, as necessary

b. The resulting sign message schedule will be submitted by the sign contractor for approval, and will listed each individual sign, together with a unique sign location umber, sign type designation, sign message and graphic content, quantity and notes of clarification, if any

4. Sign location plans indicating the location of each sign with its number
5. Two full size printed layouts of artwork proofs for each sign type and each unique layout
6. Two samples of the following Sign Types: 11, 15B, 21, 35, 40, 42B (individual letter), 48 (corner assembly only), and 80 (individual letter)
7. Two printed samples of full-scale graphic image (corner only on the specified material) of the following Sign Types: 50 and 84
8. Two color chip samples of each color and finish of exposed materials, minimum 4” x 4”, applied to actual sign material substrates

B. All signage samples are to be delivered for review and approval in a single submission package.

1.5 INFORMATION SUBMITTALS

A. The sign subcontractor shall submit the names of five projects, completed in the last three years, which are similar in scope to this project. The sign subcontractor shall provide information for each project including contact name, telephone number and email address.

1.6 SIGN CONTRACTOR QUALIFICATION

A. Subject to compliance with requirements, pre-qualified acceptable signage subcontractors include, but are not limited to, the following:

1. Poblocki Sign Company Northeast
   Medway, MA 02053
   508-533-9000
   www.advancedsigning.com

2. Welch Sign
   7 Lincoln Avenue
   Scarborough, ME 04074
   800-635-3506
   www.welchsign.com

3. Poyant Signs Incorporated
   125 Samuel Barnet Boulevard
   New Bedford, MA 02745
   800-544-0961
   www.poyantsigns.com

4. Sign Works Group, Inc.
   60 Arsenal Street
   Watertown, MA 02472
   617-924-0292

1.7 REGULATORY REQUIREMENTS

A. Provide all signs in accordance with, and as required by Federal, State or local building code or ordinances including ADAAG – Americans with Disabilities Act Accessibility Guidelines, 2010 Standards, as issued by the US Department of Justice. Code compliant signage shall include, but not be limited to, building egress, elevator operation, fire safety regulations, and health and safety requirements.

1.8 COORDINATION

A. The sign contractor will notify the general contractor of any special anchoring provisions, such as blocking, to be made in walls and ceilings prior to sign installation. The notifications will be timely, before walls and ceilings are closed.

1.9 PERMITS

A. The sign contractor will obtain any permits required for signs, if these permits are separate from the basic building permit obtained by the general contractor.

PART 2 - PRODUCTS

2.1 SIGNAGE GENERAL

A. A room numbering system will be provided to the sign fabricator by the architect in a timely fashion and shall be incorporated into the signs. The room numbers and text shown on the sign schedule are preliminary and are subject to revision.

2.2 INTERIOR SIGNS

A. Flush Wall Mount Plaque. Flush wall mount plaques will be fabricated and installed by sign contractor. Flush wall mount plaques will consist of acrylic plaques with digitally printed graphics, insert plaques with removable paper inserts, thermoformed plaques with raised graphics and Braille, and mounting adhesives. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Types 10-21, 23-30, and 37-38.

B. Flag Mount Sign. Flag Mount Sign will be fabricated and installed by sign contractor. Flag mount sign will consist of acrylic face plaques with digitally printed graphics and aluminum mounting brackets. All components to be cut on CNC equipment, and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Type 35.

C. Cast Bronze Plaque. Cast bronze plaque will be manufactured by Matthews Architectural Products of Pittsburgh, PA, www.matthewsid.com,and installed by sign contractor. Product will be used for Sign Types 40 and 41.

D. Vinyl Graphics. Vinyl graphics will be fabricated and installed by sign contractor. Surface applied vinyl graphics will be applied to designated building surfaces. Product will be used for Sign Types 22 and 39.

E. Acrylic Letters. Acrylic letters will be manufactured by Steel Art Company of Norwood MA, www.steelartco.com, and installed by sign contractor. Acrylic letters will be cut with a CNC controlled abrasive waterjet cutting system. All letter and graphic forms shall have sharp inside and outside corners. Product will be used for Sign Types 42A-42C.

F. Decorative Wall Covering. Wall covering will be fabricated and installed by sign contractor. Wall covering will consist of DreamScape Type II Vinyl Wall Covering or equivalent material with digitally printed image. Require for new wall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints. Install per manufactures recommendation. Use corner protector over wall covering at the corner of wall surface. Product will be used for Sign Type 50.

G. Reception Desk School Logo. Reception desk school logo will be fabricated and installed by sign contractor. Sign will consist of aluminum letters and contour cut aluminum graphics. Aluminum letters and graphics will be cut with a CNC controlled abrasive waterjet cutting system. All letter and graphic forms shall have sharp inside and outside corners. Product will be used for Sign Type 52.

H. Acrylic Graphics Panel. Graphics panel will be fabricated and installed by sign contractor. Graphics panel will consist of acrylic panel with digitally printed graphics. Panel mounts to designated architectural surface with Gyford mounting hardware. Product will be used for Sign Types 48 and 48A.

2.3 EXTERIOR SIGNS

A. Flush Wall Mount Plaque. Flush wall mount plaques will be fabricated and installed by sign contractor. Flush wall mount plaques will consist of thermoformed plaques with raised graphics and Braille, with digitally printed

graphics, and mounting adhesives. All components to be cut on CNC equipment and all dimensional and alignment tolerances shall not exceed +/- .005". Product will be used for Sign Type 60.

B. Vinyl Graphics. Vinyl graphics will be fabricated and installed by sign contractor. Surface applied vinyl graphics will be applied to designated building surfaces. Product will be used for Sign Types 71 and 74.

C. Aluminum Plaque. Aluminum plaques will be fabricated and installed by sign contractor. Aluminum plaque sign will be painted aluminum with applied vinyl graphics. Sign mounts to exterior wall with recessed shim plate. Product will be used for Sign Type 75.

D. School Logo, Halo-Lit. School Logo will be fabricated and installed by sign contractor. Logo will consist of fabricated aluminum letterforms with reverse channel LED letterforms for halo-lit effect. Logo will be cut with a CNC controlled abrasive waterjet cutting system. All graphic forms shall have sharp inside and outside corners. Sign mounts on wall with spacer. Products will be used for Sign Type 83.

E. Metal Letters, Halo-Lit. Metal letters will be manufactured by Steel Art Company of Norwood MA, www.steelartco.com, and installed by sign contractor. Letters will consist of fabricated aluminum letterforms with reverse channel LED letterforms for halo-lit effect. Letters will be cut with a CNC controlled abrasive waterjet cutting system. All graphic forms shall have sharp inside and outside corners. Sign mounts on wall with spacer. Product will be used for Sign Types 80-82.

F. Decorative Glass Graphics. Glass graphics film will be fabricated and installed by sign contractor. Glass graphics will consist of optically clear vinyl film, IJ8150 or equivalent, with digitally printed image, and over laminate for protection. Following application of overlaminate, graphics will be contour cut. Require glass panels to be cleaned prior to film installation. Product will be used for Sign Type 84.

2.4 BASIS FOR DESIGN

A. The product(s) shown for each sign type is intended to be the basis for design. Equal sign products from other manufacturers may be submitted to the architect for approval prior to bidding. All work will be as shown on the construction drawings.

2.5 MATERIALS

A. The following is a list of primary materials to be used on the project:

1. Acrylic shall be clear Acrylate cast acrylic sheet, smooth both surfaces, as manufactured by Evonik Industries, Parsippany, NJ, www.acrylite.net.
2. Polycarbonate shall be clear, matte finish one face, as manufactured by Sheffield Plastics, Sheffield, MA., www.sheffieldplastics.com.
3. Paint shall be acrylic polyurethane MAP, as manufactured by Matthews Paint, Delaware, OH, www.matthewspaint.com.
4. Foam tape shall be 4416, as manufactured by 3M Company, St. Paul, MN, www.3M.com.

5. VHB foam tape shall be 4950, as manufactured by 3M Company, St. Paul, MN, www.3M.com.
6. Silicone adhesive shall be 732 Multipurpose RTV Sealant, as manufactured by Dow Corning, Midland, MI, www.dowcorning.com.
7. Pressure sensitive vinyl graphic film shall be Scotchcal 77125 Electrocut Graphic Film, as manufactured by 3M Company, St. Paul, MN, www.3M.com.
8. Wall covering graphic film shall be DreamScape Type II Vinyl Graphic Film, as manufactured by Roysons Corporation, Rockway, NJ, www.dreamscapewalls.com.
9. Cast bronze plaque shall be manufactured by Matthews Architectural Products of Pittsburgh, PA, https://www.matthewsid.com.

B. All other secondary materials shall be as shown on the construction drawings.

2.6 FABRICATION STANDARDS

A. The following general fabrication standards will apply

1. All graphic elements, including text and symbols, will be reproduced from computer generated digital artwork. All vector artwork created for graphic reproduction will be output at a minimum resolution of 1200 dpi. All computer generated non-vector artwork will be saved at 300 dpi, at full size, and will be output at a minimum resolution of 300 dpi.
2. All graphic elements, including text and symbols, will be reproduced with sharp inside and outside corners and edges. No rounded corners or edges shall be permitted.
3. All graphic elements will be produced in such a manner that all edges and corners of letterforms, symbols, color bands, rules, and borders, are true and clean. All printed inks shall be applied evenly without pinholes, scratches, or orange-peel texture.
4. All painted components will be spray finished in such a manner that exposed surfaces are free of dust under the paint surface, orange-peel texture, runs, color streaks, or build-up at edges. Sharp edges and corners will be broken prior to painting. All surfaces shall be prepared, primed, and finished in accordance with the published application instructions of the paint manufacturer.
5. Colors and metal finishes will be selected by the architect from the standard offering of each manufacturer. Custom colors, if desired, will be shown on sign construction drawings.
6. Type styles and symbols will be as shown on the general and detailed sign type drawings.
7. All Braille on tactile signs shall be accurate Grade 2 translations, and shall conform to the provisions of ADAAG and ICC/ANSI A117.1 with regard to size, position, spacing, and profile (domed top) characteristics.
8. Thermoformed acrylic plaques with raised graphics and Braille shall be produced utilizing a high-pressure thermoforming process at 4,000 psi, and 350 degree F, and shall form a monolithic component.
9. All fabrication workmanship shall be of best quality in every particular, complete in every detail, and strictly in accordance with best practices. All exposed and fabricated joints shall be tight and completely smooth. All

sign faces shall be free of cupping, oil-canning, or other deflections.

2.7 PACKAGING

A. Every effort should be made to use biodegradable and recyclable packaging materials.

B. Pack each sign so as to prevent scratches and surface damage.

C. See 3.7 for disposal of waste.

2.8 WARRANTY

A. All products will be guaranteed against defects in materials and workmanship for a period of three years from the date of installation. Warranty is void if product is not maintained according to the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, HANDLING

A. If stored at the site, all materials will be in an elevated, dry location, protected by a waterproof covering. The location will be coordinated with the general contractor.

3.2 ENVIRONMENTAL CONDITIONS

A. Store all adhesives at room temperature of no less than 55 degrees.

3.3 SITE INSPECTION

A. Examine mounting surfaces, areas and conditions with the general contractor present. Check for compliance with requirements for installation, and other factors affecting the performance of the work.

3.4 INSTALLATION

A. Install all signs, according to the manufacturer's recommendations, and as shown on the construction drawings.

B. Install all signs plumb and level at specific locations shown on the sign location plans and construction drawings.

C. Exposed fasteners will not be permitted, unless specifically shown and required on the construction drawings, or approved by the architect.

D. All signs will be shop-fabricated, and where practical, delivered to the site completely assembled. All signs that cannot be delivered fully assembled shall be erected and assembled so that all parts fit accurately with hairline joints.

3.5 PROJECT SCHEDULE

A. All work will be performed in accordance with a schedule approved by the general

contractor. The sign contractor shall assume that all signs will be installed in two separate phases occurring within a period of 36 months

B. All sign installation work will be completed prior to occupancy permit inspections. Temporary signs are not included.

3.6 CLEANING

A. Clean all signs following installation with a mild, non-streaking, wall cleaning solution for normal dirt and fingerprints. Care should be taken not to scratch the sign surface.

3.7 WASTE MANAGEMENT

A. Separate and recycle materials and packaging in accordance with the project Waste Management Plan.

B. Remove from the site any materials and packaging not included in the Waste Management Plan.

3.8 RE-ORDER PROCESS

A. Upon completion of the installation, the sign contractor will submit as-built drawings, and maintenance instructions to the facility representative.

B. The sign contractor will supply to the facility representative re-order instructions for replacement of sign parts such as name strips, and for the ordering of new signs.

End of Section

Summary

Sign Type	Sign Type Name	Quantity	Notes
10	Room Number ID-Academic	14	
11	Room Number w Insert-Academic	17	
12A	Room ID-Academic	109	
12B	Room ID-Public	13	
12C	Room ID-Support	29	
13A	Room ID w Print-Academic	2	
13B	Room ID w Print-Public	9	
13C	Room ID w Print-Support	10	
15A	Restroom ID-Academic	25	
15B	Restroom ID-Public	4	
15C	Restroom ID, General	8	
17A	Stair ID-Academic	12	
17B	Stair ID-Public	2	
17C	Stair ID, General	3	
18	Stair Level ID	18	
18A	Stair Level ID, General	5	
19	Stair Landing Regulatory	14	
19A	Stair Landing Regulatory, General	4	
21	Elevator Regulatory Map	8	
22	Elevator Jamb Regulatory	2	
23	Elevator Machine Room Regulatory	2	
24	Occupancy	7	
27	Regulatory/Info, Small	20	
28	Interior FD Regulatory	3	
30	Corridor Directional	8	
35	Flag Mounted ID-Academic	5	
35A	Flag Mounted ID-General	2	
37	Safety	20	
38	Evacuation map	60	
39	Interior Vinyl Door Number	11	
40	Dedication Plaque	1	
41	Donor Plaque	4	
42A	Interior Letters	1	

Sign Type	Sign Type Name	Quantity	Notes
42B	Interior Letters	7	
42C	Interior Letters	5	
48	Sustainable Graphics Panel	4	
48A	Sustainable Graphics Panel, Large	1	
50	Wall Graphics	13	
52	School Logo, Desk	3	
60	Exterior Door ID	10	
71	No Smoking Vinyl	2	
74	Exterior Vinyl Door Number	11	
75	Exterior FD Regulatory	2	
80	Exterior Letters, Illuminated	1	
81	Exterior Letters, Illuminated	1	
82	Exterior Letters, Illuminated	1	
83	Exterior School Logo, Illuminated	2	
84	Exterior Media Center Window Graphic	1	
TOTAL		**516**	

Sign Schedule

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1-01	38	(evacuation map)	Active		60	
1-02	41	(donor recognition plaque)	Active		4	
1-03	42B	(TBD-15 letters)	Active		4	
1-04	42C	(TBD-15 letters)	Active		4	
1A-01	74	10	Active		1	
1A-02	39	10	Active		1	
1A-03	60	STAIR 1 (braille)	Active		1	
1A-04	18	EXIT (braille)	Active		1	
1A-05	18	LEVEL 1 (braille)	Active		1	
1A-06	19	STAIR 1 No Roof Access 1 Levels 1-4 Exit This Level	Active		1	
1A-07	17A	EXIT STAIR 1 (braille)	Active		1	
1A-08	12A	102 CLASSROOM (braille)	Active		1	Yes
1A-09	12A	104 CLASSROOM (braille)	Active		1	Yes
1A-10	12A	101 DIVERSE LEARNERS (braille)	Active		1	Yes
1A-11	12A	101A CALMING ROOM (braille)	Active		1	
1A-12	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
1A-13	10	103 (braille)	Active		1	
1A-14	10	101 (braille)	Active		1	
1A-15	12A	103B STORAGE (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1A-16	12A	103A SMALL GROUP (braille)	Active		1	Yes
1A-17	12A	103 DIVERSE LEARNERS (braille)	Active		1	Yes
1A-18	10	105 (braille)	Active		1	
1A-19	10	103 (braille)	Active		1	
1A-20	12A	105 DIVERSE LEARNERS (braille)	Active		1	
1A-21	12A	105A CALMING ROOM (braille)	Active		1	
1A-22	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
1A-23	12C	106 IDF (braille)	Active		1	
1A-24	35	(side A) (f/m/HC symbol) ----- (side B) (f/m/HC symbol)	Active		1	
1A-25	12C	108 CUSTODIAL (braille)	Active		1	
1A-26	15A	(m/HC symbol) MEN (braille)	Active		1	
1A-27	15A	(f/HC symbol) WOMEN (braille)	Active		1	
1A-28	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
1A-29	13C	107 ELECTRIC ROOM (braille) NO STORAGE	Active		1	
1A-30	12A	107A SMALL GROUP (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1A-31	50	(wall graphics)	Active		1	
1A-32	12A	110A STORAGE (braille)	Active		1	
1A-33	37	(safety sign)	Active		1	
1A-34	12A	110 ENGINEERING/ ROBOTICS (braille)	Active		1	
1A-35	12A	109 BIOMEDICAL SCIENCE (braille)	Active		1	
1A-36	37	(safety sign)	Active		1	
1A-37	12A	109A PREP ROOM (braille)	Active		1	
1A-38	10	109 (braille)	Active		1	
1A-39	48	(CHPS demonstration area sign)	Active		1	
1B-01	10	111 (braille)	Active		1	
1B-02	12A	109A PREP ROOM (braille)	Active		1	
1B-03	12A	111 BIOLOGY (braille)	Active		1	
1B-04	37	(safety sign)	Active		1	
1B-05	12A	110 ENGINEERING/ ROBOTICS (braille)	Active		1	
1B-06	13A	112 NURSE OFFICE (braille) SMART CLINIC (spanish) (portugues)	Active		1	
1B-07	42C	SMART CLINIC	Active		1	
1B-08	12A	112 NURSE OFFICE (braille)	Active		1	
1B-09	12A	112G EXAM ROOM (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1B-10	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
1B-11	12A	112H EXAM ROOM (braille)	Active		1	
1B-12	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
1B-13	12A	112B BEHAVIORAL HEALTH (braille)	Active		1	
1B-14	12A	112C OFFICE (braille)	Active		1	
1B-15	12A	112D LAB (braille)	Active		1	
1B-16	12A	112E BREAK ROOM (braille)	Active		1	
1B-17	50	(wall graphics)	Active		1	
1B-18	12A	113 TEACHING ACADEMY (braille)	Active		1	
1B-19	21	LEVEL 1 ELEVATOR 1 (map) (info)	Active		1	
1B-20	22	Elevator 1 Control Room Located on Level 4	Active		1	
1B-21	30	(arrow left) 101-113 ---------- (arrow up) 115-121 Main Office (spanish) (portugues) --------- (arrow up) 123-132 Gymnasium (spanish) (portugues)	Active		1	
1B-22	37	EMERGENCY MEDICAL BUTTON	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1B-23	12A	112 NURSE OFFICE (braille)	Active		1	
1B-24	50	(wall graphics)	Active		1	
1B-25	17A	EXIT STAIR 2 (braille)	Active		1	
1B-26	18	LEVEL 1 (braille)	Active		1	
1B-27	19	STAIR 2 No Roof Access 1 Levels 1-4 Exit This Level	Active		1	
1B-28	18	EXIT (braille)	Active		1	
1B-29	60	STAIR 2 (braille)	Active		1	
1B-30	74	11	Active		1	
1B-31	39	11	Active		1	
1B-32	12A	121 MAIN OFFICE (braille)	Active		1	
1B-33	15A	(f/m/HC symbol) RESTROOM (braille)	Active		1	
1B-34	11	115 (braille) [insert]	Active		1	
1B-35	12A	116 KICHEN (braille)	Active		1	
1B-36	11	117 (braille) [insert]	Active		1	
1B-37	12A	118 CONREFENCE ROOM (braille)	Active		1	
1B-38	11	119 (braille) [insert]	Active		1	
1B-39	12A	118 CONREFENCE ROOM (braille)	Active		1	
1B-40	52	(school logo, desk)	Active		1	
1B-41	37	EMERGENCY MEDICAL BUTTON	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1B-42	13A	120 MAIN OFFICE (braille) (spanish) (portugues)	Active		1	
1B-43	12A	120 MAIN OFFICE (braille)	Active		1	
1B-44	71	(symbol) NO SMOKING ON SCHOOL PROPERTY	Active		1	
1B-45	74	1	Active		1	
1B-46	39	1	Active		1	
1B-47	40	(dedication plaque)	Active		1	
1B-48	30	(blue) (arrow left) 101-113 --------- (blue) (arrow up) 115-121 Main Office (spanish) (portugues) ---------- (red) (arrow right) 123-132 Gymnasium (spanish) (portugues)	Active		1	
1B-49	37	EMERGENCY MEDICAL BUTTON	Active		1	
1B-50	39	9	Active		1	
1B-51	74	9	Active		1	
1B-52	71	(symbol) NO SMOKING ON SCHOOL PROPERTY	Active		1	
1B-53	12C	124 KITCHEN (braille)	Active		1	
1B-54	21	LEVEL 1 ELEVATOR 2 (map) (info)	Active		1	
1B-55	22	Elevator 2 Control Room Located on Level 3	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1B-56	30	(blue) (arrow right) 101-113 ------ (blue) (arrow right) 115-121 Main Office (spanish) (portugues) --------- (red) (arrow left) 123-132 Gymnasium (spanish) (portugues)	Active		1	
1B-57	17A	EXIT STAIR 3 (braille)	Active		1	
1B-58	18	LEVEL 1 (braille)	Active		1	
1B-59	19	STAIR 3 No Roof Access 1 Levels 1-3 Exit This Level	Active		1	
1B-60	18	EXIT (braille)	Active		1	
1B-61	39	2	Active		1	
1B-62	74	2	Active		1	
1B-63	60	STAIR 3 (braille)	Active		1	
1C-01	60	KITCHEN (braille)	Active		1	
1C-02	74	8	Active		1	
1C-03	39	8	Active		1	
1C-04	74	7	Active		1	
1C-05	39	7	Active		1	
1C-06	60	STAIR 4 (braille)	Active		1	
1C-07	18	EXIT (braille)	Active		1	
1C-08	19	STAIR 4 No Roof Access 1 Levels 1-3 Exit This Level	Active		1	
1C-09	18	LEVEL 1 (braille)	Active		1	
1C-10	17B	EXIT STAIR 4 (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1C-11	27	(kitchen regulatory signs)	Active		20	
1C-12	12C	124C STORGAE (braille)	Active		1	
1C-13	37	EMERGENCY MEDICAL BUTTON	Active		1	
1C-14	12C	124D KITCHEN OFFICE (braille)	Active		1	
1C-15	12C	124B KITCHEN OFFICE (braille)	Active		1	
1C-16	12C	124 KITCHEN (braille)	Active		1	
1C-17	50	(wall graphics)	Active		1	
1C-18	35A	(side A) (f/m/HC symbol) ----- (side B) (f/m/HC symbol)	Active		1	
1C-19	15C	(f/HC symbol) WOMEN (braille)	Active		1	
1C-20	15C	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
1C-21	15C	(f/m/HC symbol) STAFF RESTROOM (braille)	Active		1	
1C-22	15C	(m/HC symbol) MEN (braille)	Active		1	
1C-23	13B	126 GYMNAISUM (braille) (spanish) (portuguese)	Active		1	
1C-24	37	EMERGENCY MEDICAL BUTTON	Active		1	
1C-25	42B	GYMNASIUM	Active		1	
1C-26	24	Maximum Occupancy XXX	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1C-27	12C	127B CUSTODIAL (braille)	Active		1	
1C-28	12B	123 BOYS LOCKER ROOM (braille)	Active		1	
1C-29	12B	125 GYM STORAGE (braille)	Active		1	
1C-30	12B	127 HEALTH INSTRUCTOR (braille)	Active		1	
1C-31	15B	(shower symbol) RESTROOM/ SHOWER (braille)	Active		1	
1C-32	15B	(shower symbol) RESTROOM/ SHOWER (braille)	Active		1	
1C-33	12B	128 ALL GENDER LOCKER ROOM (braille)	Active		1	
1C-34	12B	129 GIRLS LOCKER ROOM (braille)	Active		1	
1C-35	13B	126 GYMNAISUM (braille) (spanish) (portuguese)	Active		1	
1C-36	24	Maximum Occupancy XXX	Active		1	
1C-37	42B	GYMNASIUM	Active		1	
1C-38	12C	126C IDF (braille)	Active		1	
1C-39	12B	126B SOUND CLOSET (braille)	Active		1	
1C-40	12B	126A GYM STORAGE (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1C-41	12B	126A GYM STORAGE (braille)	Active		1	
1C-42	18	EXIT (braille)	Active		1	
1C-43	39	6	Active		1	
1C-44	74	6	Active		1	
1C-45	60	GYMNASIUM (braille)	Active		1	
1C-46	12C	133 GYM STORAGE (braille)	Active		1	
1C-47	12C	130 TRASH (braille)	Active		1	
1C-48	13C	131 ELECTRIC ROOM (braille) NO STORAGE	Active		1	
1C-49	75	FDC	Active		1	
1C-50	39	3	Active		1	
1C-51	74	3	Active		1	
1C-52	75	FIRE PUMP ROOM	Active	on door	1	
1C-53	60	FIRE PUPM ROOM (braille)	Active		1	
1C-54	60	TRASH ROOM (braille)	Active		1	
1C-55	74	4	Active		1	
1C-56	39	4	Active		1	
1C-57	17C	EXIT STAIR 5 (braille)	Active		1	
1C-58	18A	LEVEL 1 (braille)	Active		1	
1C-59	19A	STAIR 5 Roof Access 1 Levels 1-3, R Exit This Level	Active		1	
1C-60	18A	EXIT (braille)	Active		1	
1C-61	39	5	Active		1	
1C-62	74	5	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
1C-63	60	STAIR 5 (braille)	Active		1	
2A-01	81	CENTRAL FALLS HIGH SCHOOL	Active	Higginson	1	
2A-02	19	STAIR 1 No Roof Access 2 Levels 1-4 Exit Level 1 (down arrow)	Active		1	
2A-03	18	LEVEL 2 (braille)	Active		1	
2A-04	17A	EXIT STAIR 1 (braille)	Active		1	
2A-05	12A	201 CLASSROOM (braille)	Active		1	Yes
2A-06	12A	202 DIVERSE LEARNERS (braille)	Active		1	Yes
2A-07	12A	201A SMALL GROUP (braille)	Active		1	Yes
2A-08	12A	203 CLASSROOM (braille)	Active		1	Yes
2A-09	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
2A-10	10	204 (braille)	Active		1	
2A-11	10	202 (braille)	Active		1	
2A-12	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
2A-13	12A	204 DIVERSE LEARNERS (braille)	Active		1	Yes
2A-14	12A	205 CLASSROOM (braille)	Active		1	Yes
2A-15	12C	206 IDF (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
2A-16	35	(side A) (f/m/HC symbol) ----- (side B) (f/m/HC symbol)	Active		1	
2A-17	12C	208 CUSTODIAL (braille)	Active		1	
2A-18	15A	(m/HC symbol) MEN (braille)	Active		1	
2A-19	15A	(f/m/HC symbol) STAFF RESTROOM (braille)	Active		1	
2A-20	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
2A-21	15A	(f/HC symbol) WOMEN (braille)	Active		1	
2A-22	13C	207 ELECTRIC ROOM (Braille) NO STORAGE	Active		1	
2A-23	12A	207A SMALL GROUP (braille)	Active		1	
2A-24	50	(wall graphics)	Active		1	
2A-25	12A	210 CLASSROOM (braille)	Active		1	Yes
2A-26	12A	212 CLASSROOM (braille)	Active		1	Yes
2A-27	12A	209 BIOMEDICAL SCIENCE (braille)	Active		1	Yes
2A-28	37	(safety sign)	Active		1	
2A-29	12A	209A PREP ROOM (braille)	Active		1	
2A-30	10	209 (braille)	Active		1	
2A-31	82	CENTRAL FALLS HIGH SCHOOL	Active	Bus Stop	1	
2A-32	48	(CHPS demonstration area sign)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
2B-01	10	211 (braille)	Active		1	
2B-02	12A	209A PREP ROOM (braille)	Active		1	
2B-03	12A	211 BIOLOGY (braille)	Active		1	Yes
2B-04	37	(safety sign)	Active		1	
2B-05	12A	214 TEACHER PLANNING (braille)	Active		1	Yes
2B-06	15A	(f/m/HC symbol) RESTROOM (braille)	Active		1	
2B-07	12A	214A CONFERENCE ROOM (braille)	Active		1	
2B-08	12A	214A CONFERENCE ROOM (braille)	Active		1	
2B-09	50	(wall graphics)	Active		1	
2B-10	52	(school logo, desk)	Active		1	
2B-11	21	LEVEL 2 ELEVATOR 1 (map) (info)	Active		1	
2B-12	30	(arrow left) 201-214 ---------- (arrow right) 215-226 ---------- (arrow up) 228-234	Active		1	
2B-13	12A	213 MEDIA COMMONS (braille)	Active		1	
2B-14	17A	EXIT STAIR 2 (braille)	Active		1	
2B-15	18	LEVEL 2 (braille)	Active		1	
2B-16	19	STAIR 2 No Roof Access 2 Levels 1-4 Exit Level 1 (down arrow)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
2B-17	12A	215 GUIDACE (braille)	Active		1	Yes
2B-18	12A	216 STORAGE (braille)	Active		1	
2B-19	11	217 (braille) [insert]	Active		1	Yes
2B-20	11	218 (braille) [insert]	Active		1	Yes
2B-21	11	219 (braille) [insert]	Active		1	Yes
2B-22	11	220 (braille) [insert]	Active		1	
2B-23	11	221 (braille) [insert]	Active		1	
2B-24	37	EMERGENCY MEDICAL BUTTON	Active		1	
2B-25	11	222 (braille) [insert]	Active		1	
2B-26	12A	226 CAREER CENTER (braille)	Active		1	
2B-27	11	223 (braille) [insert]	Active		1	
2B-28	12A	225 CONFERENCE ROOM (braille)	Active		1	
2B-29	11	224 (braille) [insert]	Active		1	
2B-30	80	CENTRAL FALLS HIGH SCHOOL	Active	Lonsdale	1	
2B-31	28	PUMP ROOM	Active	on door	1	
2B-32	12C	227 PUMP ROOM (braille)	Active		1	
2B-33	50	(wall graphics)	Active		1	
2B-34	42A	CENTRAL FALLS HIGH SCHOOL	Active	mount on soffit	1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
2B-35	50	(wall graphics)	Active		1	
2B-36	50	(wall graphics)	Active		1	
2B-37	21	LEVEL 2 ELEVATOR 2 (map) (info)	Active		1	
2B-38	12A	228C STORAGE (braille)	Active		1	
2B-39	17A	EXIT STAIR 3 (braille)	Active		1	
2B-40	30	(arrow left) 201-214 ------- (arrow right) 215-226 ------- (arrow right) 228-234	Active		1	
2B-41	18	LEVEL 2 (braille)	Active		1	
2B-42	19	STAIR 3 No Roof Access 2 Levels 1-3 Exit Level 1 (down arrow)	Active		1	
2C-01	17A	EXIT STAIR 4 (braille)	Active		1	
2C-02	12A	228 FITNESS CENTER (braille)	Active		1	
2C-03	19	STAIR 4 No Roof Access 2 Levels 1-3 Exit Level 1 (down arrow)	Active		1	
2C-04	12A	228B OT/PT (braille)	Active		1	Yes
2C-05	12A	228 FITNESS CENTER (braille)	Active		1	
2C-06	37	EMERGENCY MEDICAL BUTTON	Active		1	
2C-07	12A	229 ATHLETIC DIRECTOR (braille)	Active		1	Yes

Number	Type	Message	Status	Notes	Quantity	Glass Mount
2C-08	12A	229A STORAGE (braille)	Active		1	
2C-09	35	(side A) (f/m/HC symbol) ----- (side B) (f/m/HC symbol)	Active		1	
2C-10	12A	230B TRAINERS ROOM (braille)	Active		1	
2C-11	12C	230A CUSTODIAL (braille)	Active		1	
2C-12	15A	(f/HC symbol) WOMEN (braille)	Active		1	
2C-13	15A	(m/HC symbol) MEN (braille)	Active		1	
2C-14	12C	230 MECHANICAL (braille)	Active		1	
2C-15	28	MAIN ELECTRIC ROOM	Active	on door	1	
2C-16	13C	231 ELECTRIC ROOM (braille) ACCESS TO EMERGENCY ELECTRIC	Active		1	
2C-17	13C	231A EMERGENCY ELECTRIC ROOM (braille) NO STORAGE	Active		1	
2C-18	12C	232A NETWORK/ TELECOM (braille)	Active		1	
2C-19	13C	231 ELECTRIC ROOM (braille) ACCESS TO EMERGENCY ELECTRIC	Active		1	
2C-20	28	MAIN ELECTRIC ROOM	Active	on door	1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
2C-21	13C	232 IT OFFICE (braille) ACCESS TO NETWORK/TELECOM	Active		1	
2C-22	12C	233B CUSTODIAL OFFICE (braille)	Active		1	
2C-23	12C	233 GENERAL RECEIVING (braille)	Active		1	
2C-24	12C	234 GYM STORAGE (braille)	Active		1	
2C-25	17C	EXIT STAIR 5 (braille)	Active		1	
2C-26	18A	LEVEL 2 (braille)	Active		1	
2C-27	19A	STAIR 5 Roof Access 2 Levels 1-3, R Exit Level 1 (down arrow)	Active		1	
3A-01	17A	EXIT STAIR 1 (braille)	Active		1	
3A-02	18	LEVEL 3 (braille)	Active		1	
3A-03	19	STAIR 1 No Roof Access 3 Levels1-4 Exit Level 1 (down arrow)	Active		1	
3A-04	12A	301 CLASSROOM (braille)	Active		1	Yes
3A-05	12A	303 CLASSROOM (braille)	Active		1	Yes
3A-06	12A	301A SMALL GROUP (braille)	Active		1	
3A-07	12A	302 MLL (braille)	Active		1	Yes
3A-08	12A	304 MLL (braille)	Active		1	Yes

Number	Type	Message	Status	Notes	Quantity	Glass Mount
3A-09	12A	305 CLASSROOM (braille)	Active		1	Yes
3A-10	12C	306 IDF (braille)	Active		1	
3A-11	35	(side A) (f/m/HC symbol) ----- (side B) (f/m/HC symbol)	Active		1	
3A-12	12C	308 IDF (braille)	Active		1	
3A-13	15A	(m/HC symbol) MEN (braille)	Active		1	
3A-14	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
3A-15	15A	(f/HC symbol) WOMEN (braille)	Active		1	
3A-16	83	(school logo)	Active		1	
3A-17	13C	307 ELECRTRIC ROOM (braille) NO STORAGE	Active		1	
3A-18	12A	307A SMALL GROUP (braille)	Active		1	Yes
3A-19	12A	310A STORAGE (braille)	Active		1	
3A-20	50	(wall graphics)	Active		1	
3A-21	12A	310 COMMUNITY LAW (braille)	Active		1	Yes
3A-22	12A	310 COMMUNITY LAW (braille)	Active		1	Yes
3A-23	12A	309 PHYSICAL SCIENCE (braille)	Active		1	Yes
3A-24	37	(safety sign)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
3A-25	12A	309A PREP ROOM (braille)	Active		1	
3A-26	10	309 (braille)	Active		1	
3A-27	84	(school logo graphics)	Active		1	
3A-28	48	(CHPS demonstration area sign)	Active		1	
3B-01	10	311 (braille)	Active		1	
3B-02	12A	309A PREP ROOM (braille)	Active		1	
3B-03	12A	311 PHYSICAL SCIENCE (braille)	Active		1	Yes
3B-04	37	(safety sign)	Active		1	
3B-05	12A	313 MEDIA COMMONS (braille)	Active		1	
3B-06	12A	312 CLASSROOM (braille)	Active		1	Yes
3B-07	12A	314A CONFERENCE ROOM (braille)	Active		1	Yes
3B-08	12A	314A CONFERENCE ROOM (braille)	Active		1	Yes
3B-09	12A	314 TEACHER PLANNING (braille)	Active		1	Yes
3B-10	12A	313A MEDIA OFFICE (braille)	Active		1	Yes
3B-11	15A	(f/m/HC symbol) RESTROOM (braille)	Active		1	
3B-12	12A	314C MOTHERS ROOM (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
3B-13	21	LEVEL 3 ELEVATOR 1 (map) (info)	Active		1	
3B-14	30	(arrow left) 301-314 ------- (arrow right) 315-316 -------- (arrow up) 317-326 Auditorium (spanish) (portugues)	Active		1	
3B-15	52	(school logo, desk)	Active		1	
3B-16	50	(wall graphics)	Active		1	
3B-17	17A	EXIT STAIR 2 (braille)	Active		1	
3B-18	18	LEVEL 3 (braille)	Active		1	
3B-19	19	STAIR 2 No Roof Access 3 Levels 1-4 Exit Level 1 (down arrow)	Active		1	
3B-20	12A	351 ART (braille)	Active		1	Yes
3B-21	12A	316 ART (braille)	Active		1	Yes
3B-22	12A	317A ART STORAGE (braille)	Active		1	
3B-23	12A	317B ART KILN (braille)	Active		1	
3B-24	37	EMERGENCY MEDICAL BUTTON	Active		1	
3B-25	12A	319 ROOF TERRACE (braille)	Active		1	Yes
3B-26	21	LEVEL 3 ELEVATOR 2 (map) (info)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
3B-27	30	(arrow right) 301-317 -------- (arrow left) Auditorium (spanish) (portugues)	Active		1	
3B-28	50	(wall graphics)	Active		1	
3B-29	21	LEVEL 3 ELEVATOR 2 (map) (info)	Active		1	
3B-30	23	ELEVATOR CONTROL ROOM NO STORAGE ALLOWED --------- DANGER ACCESS ONLY ALLOWED WHEN ACCOMPANIED BY A MASSACHUSETTS-LICENSED ELEVATOR MECHANIC	Active	on door	1	
3B-31	12C	320 ELEVATOR 2 CONTROL ROOM (braille)	Active		1	
3B-32	17A	EXIT STAIR 3 (braille)	Active		1	
3B-33	18	LEVEL 3 (braille)	Active		1	
3B-34	19	STAIR 3 No Roof Access 3 Levels 1-3 Exit Level 1 (down arrow)	Active		1	
3B-35	48A	(CHPS biophilic educational sign)	Active		1	
3C-01	19	STAIR 4 No Roof Access 3 Levels 1-3 Exit Level 1 (down arrow)	Active		1	
3C-02	18	LEVEL 3 (braille)	Active		1	
3C-03	17B	EXIT STAIR 4 (braille)	Active		1	
3C-04	12C	321D CONTROL ROOM (braille)	Active		1	
3C-05	12C	321B IDF (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
3C-06	13C	321E ELECTRIC ROOM (braille) NO STORAGE	Active		1	
3C-07	13B	EXIT STAIR 4 (braille) ACCESS TO ELECTRIC ROOM	Active		1	
3C-08	12A	319 ROOF TERRACE (braille)	Active		1	Yes
3C-09	35A	(side A) (f/m/HC symbol) ----- (side B) (f/m/HC symbol)	Active		1	
3C-10	15C	(f/HC symbol) WOMEN (braille)	Active		1	
3C-11	15C	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
3C-12	15C	(f/m/HC symbol) STAFF RESTROOM (braille)	Active		1	
3C-13	15C	(m/HC symbol) MEN (braille)	Active		1	
3C-14	83	(school logo)	Active		1	
3C-15	37	EMERGENCY MEDICAL BUTTON	Active		1	
3C-16	13B	322 CHORUS (braille) (spanish) (portuguese)	Active		1	
3C-17	24	Maximum Occupancy XX	Active		1	
3C-18	12B	322A PRACTICE (braille)	Active		1	
3C-19	12B	322B PRACTICE (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
3C-20	13B	322 CHORUS (braille) (spanish) (portuguese)	Active		1	
3C-21	24	Maximum Occupancy XX	Active		1	
3C-22	13B	324 BAND (braille) (spanish) (portuguese)	Active		1	
3C-23	12B	324A PRACTICE (braille)	Active		1	
3C-24	12C	325 CUSTODIAL (braille)	Active		1	
3C-25	13B	324 BAND (braille) (spanish) (portuguese)	Active		1	
3C-26	13B	321 AUDITORIUM (braille) (spanish) (portuguese)	Active		1	
3C-27	42B	AUDITORIUM	Active		1	
3C-28	24	Maximum Occupancy XXX	Active		1	
3C-29	37	EMERGENCY MEDICAL BUTTON	Active		1	
3C-30	13B	321 AUDITORIUM (braille) (spanish) (portuguese)	Active		1	
3C-31	24	Maximum Occupancy XXX	Active		1	
3C-32	12B	323 STAGE (braille)	Active		1	
3C-33	24	Maximum Occupancy XXX	Active		1	
3C-34	37	EMERGENCY MEDICAL BUTTON	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
3C-35	12B	326 MUSIC STORAGE (braille)	Active		1	
3C-36	15B	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
3C-37	15B	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
3C-38	17C	EXIT STAIR 5 (braille)	Active		1	
3C-39	18A	LEVEL 3 (braille)	Active		1	
3C-40	19A	STAIR 5 Roof Access 3 Levels 1-3, R Exit Level 1 (down arrow)	Active		1	
4A-01	17A	EXIT STAIR 1 (braille)	Active		1	
4A-02	18	LEVEL 4 (braille)	Active		1	
4A-03	19	STAIR 1 No Roof Access 4 Levels 1-4 Exit Level 1 (down arrow)	Active		1	
4A-04	12A	401 COMPUTER SCIENCE (braille)	Active		1	Yes
4A-05	12A	401A CTE (braille)	Active		1	
4A-06	12A	402 CLASSROOM (braille)	Active		1	Yes
4A-07	12A	403 CLASSROOM (braille)	Active		1	Yes
4A-08	12A	404 CLASSROOM (braille)	Active		1	Yes
4A-09	12A	405 CLASSROOM (braille)	Active		1	Yes
4A-10	12C	406 IDF (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
4A-11	35	(side A) (f/m/HC symbol) ----- (side B) (f/m/HC symbol)	Active		1	
4A-12	12C	408 CUSTODIAL (braille)	Active		1	
4A-13	15A	(m/HC symbol) MEN (braille)	Active		1	
4A-14	15A	(f/m/HC symbol) STAFF RESTROOM (braille)	Active		1	
4A-15	15A	(toilet/HC symbol) ALL GENDER RESTROOM (braille)	Active		1	
4A-16	15A	(f/HC symbol) WOMEN (braille)	Active		1	
4A-17	13C	409 ELECTRIC ROOM (braille) NO STORAGE	Active		1	
4A-18	50	(wall graphics)	Active		1	
4A-19	12A	409A SMALL GROUP (braille)	Active		1	Yes
4A-20	12A	411 CHEMISTRY (braille)	Active		1	Yes
4A-21	37	(safety sign)	Active		1	
4A-22	12A	411A PREP ROOM (braille)	Active		1	
4A-23	10	411 (braille)	Active		1	
4A-24	48	(CHPS demonstration area sign)	Active		1	
4B-01	10	413 (braille)	Active		1	
4B-02	12A	411A PREP ROOM (braille)	Active		1	
4B-03	12A	413 CHENISTRY (braille)	Active		1	Yes

Number	Type	Message	Status	Notes	Quantity	Glass Mount
4B-04	37	(safety sign)	Active		1	
4B-05	12A	415 MIDEA COMMONS (braille)	Active		1	Yes
4B-06	12A	415 MEDIA COMMONS (braille)	Active		1	Yes
4B-07	12A	410 CLASSROOM (braille)	Active		1	Yes
4B-08	12A	412 CLASSROOM (braille)	Active		1	Yes
4B-09	12A	412A SMALL GROUP (braille)	Active		1	Yes
4B-10	12A	412A SMALL GROUP (braille)	Active		1	Yes
4B-11	12C	416 ELEVATOR 1 CONTROL ROOM (braille)	Active		1	
4B-12	23	ELEVATOR CONTROL ROOM NO STORAGE ALLOWED --------- DANGER ACCESS ONLY ALLOWED WHEN ACCOMPANIED BY A MASSACHUSETTS-LICENSED ELEVATOR MECHANIC	Active	on door	1	
4B-13	21	LEVEL 4 ELEVATOR 1 (map) (info)	Active		1	
4B-14	30	(arrow left) 401-415 ------ (arrow right) 417-425	Active		1	
4B-15	12A	414 TEACHING ACADEMY (braille)	Active		1	Yes
4B-16	17A	EXIT STAIR 2 (braille)	Active		1	
4B-17	18	LEVEL 4 (braille)	Active		1	

Number	Type	Message	Status	Notes	Quantity	Glass Mount
4B-18	19	STAIR 4 No Roof Access 4 Levels 1-4 Exit Level 1 (down arrow)	Active		1	
4B-19	12A	417 CONFERENCE ROOM (braille)	Active		1	Yes
4B-20	12A	418 CHEMISTRY STORAGE (braille)	Active		1	
4B-21	12A	401A DIVERSE LEARNERS (braille)	Active		1	Yes
4B-22	11	419 (braille) [insert]	Active		1	Yes
4B-23	11	420 (braille) [insert]	Active		1	Yes
4B-24	12A	421 CLAMING ROOM (braille)	Active		1	
4B-25	11	422 (braille) [insert]	Active		1	Yes
4B-26	11	424 (braille) [insert]	Active		1	Yes
4B-27	11	423 (braille) [insert]	Active		1	Yes
4B-28	11	425 (braille) [insert]	Active		1	Yes
4B-29	12A	426 CONFERENCE ROOM (braille)	Active		1	Yes
4C-01	19A	STAIR 5 Roof Access R Levels 1-3, R Exit Level 1 (down arrow)	Active		1	
4C-02	18A	ROOF (braille)	Active		1	
4C-03	60	STAIR 5 (braille)	Active		1	

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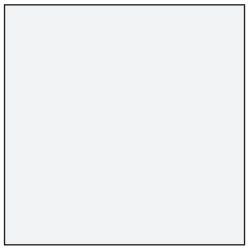
Colors

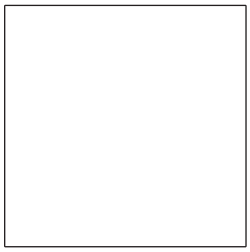
COL-01
Plaques & graphics
Blue
Custom color by Architect

COL-02
Plaques & graphics
Red
Custom color by Architect



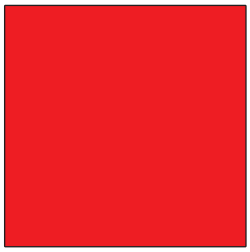
COL-03
Plaques & graphics
Light Gray
Custom color by Architect

COL-04
Plaques
Charcoal Gray
Custom color by Architect



COL-05
Graphics
White
3M-220-10 White, vinyl

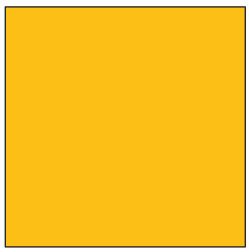
COL-06
Graphics
Black
3M-220-12 Black, vinyl



COL-07
Plaques & graphics
MP15024 Red Dragon

COL-08
Graphics
MP 13540 Green Party

COL-09
Graphics
PMS 287C



COL-10
Graphics
PMS 124C

These colors are listed for color matching purpose only.

Paint used on signs shall be acrylic polyurethane
MAP, as manufactured by Matthews Paint, Delaware, OH, www.matthewspaint.com.

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Graphic Elements
Colors

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: NTS Rev.:
Drawn: HM/CM Dwg: 100

Typefaces

MAIN
Room
Oficina

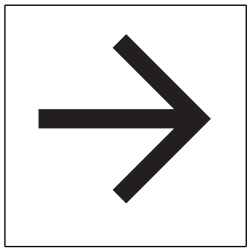
Plaques
Lexend
Light

101
FIRE
STOP

Exterior ID
Lexend
Regular

Logo

Arrow and Symbols

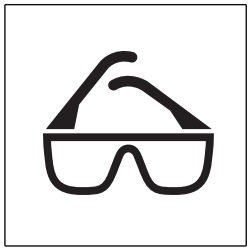


Arrow

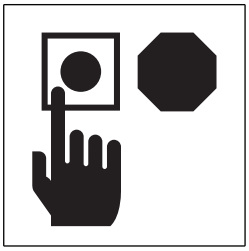
Restroom

Evacuation

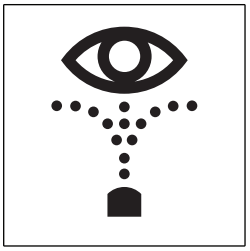
Fire Extinguisher



Goggle



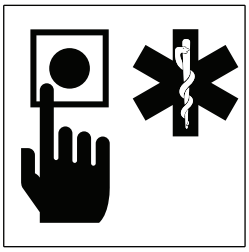
Emergency Stop



Eye Wash

Flammable

Chemical Storage



Emergency Medical Button

Accessible

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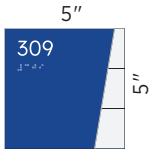
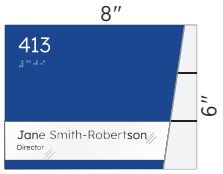
Graphic Elements
Typefaces, Arrow & Symbols

Central Falls High School
Central Falls, RI

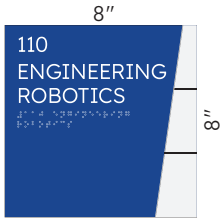
Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	NTS	Rev.:
Drawn:	HM/CM	Dwg: 101



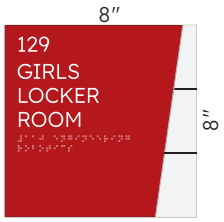
10
Room Number ID, Academic



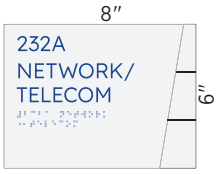
11
Room Number ID w/Insert, Academic (paper insert by owner)



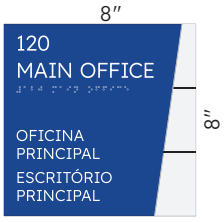
12A
Room ID, Academic



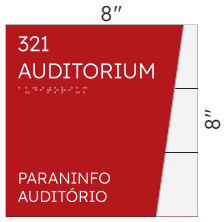
12B
Room ID, Public



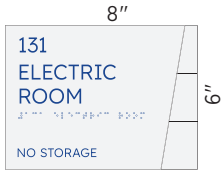
12C
Room ID, Support



13A
Room ID w/Print, Academic



13B
Room ID w/Print, Public

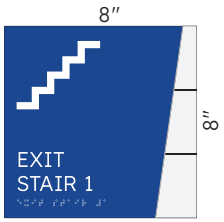


13C
Room ID w/Print, Support

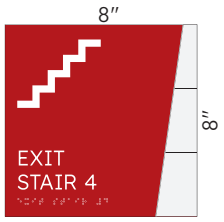
15A
Restroom ID, Academic

15B
Restroom ID, Public

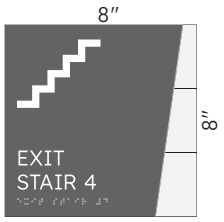
15C
Restroom ID, General



17A
Stair ID, Academic



17B
Stair ID, Public



17C
Stair ID, General

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Sign Types
Interior

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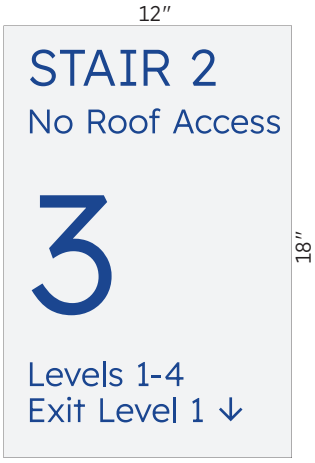
Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/8″= 1″	Rev.:	
Drawn:	HM/CM	Dwg:	102

18
Stair Level ID

18A
Stair Level ID, General



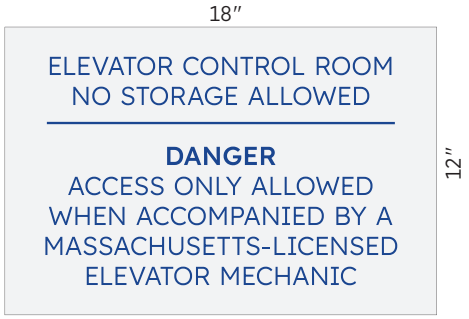
19
Stair Landing Regulatory

19A
Stair Landing Regulatory, General

21
Elevator Regulatory Map

Elevator 1 Control Room Located on Level 4 1″

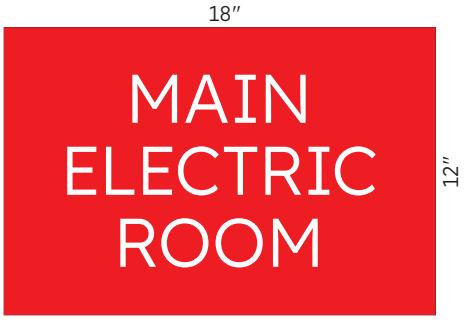
22
Elevator Jamb Regulatory



23
Elevator Machine Room Regulatory

24
Occupancy

27
Regulatory, Small



28
Interior FD Regulatory

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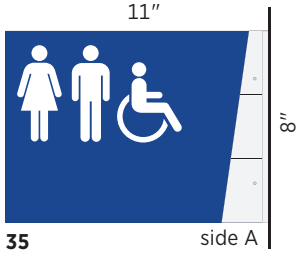
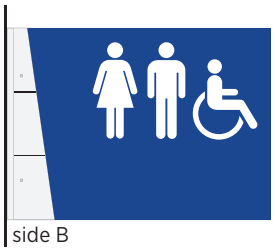
Sign Types
Interior

Central Falls High School
Central Falls, RI

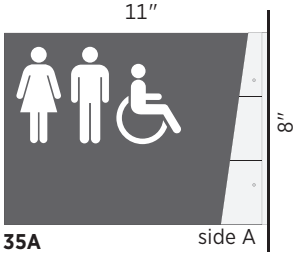
Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/8″= 1″	Rev.:	
Drawn:	HM/CM	Dwg:	103

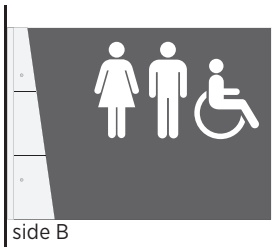
30
Corridor Directional



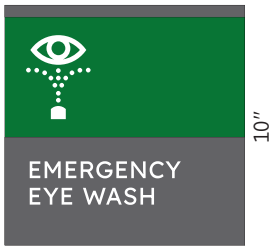


35
Flag Mounted ID,
Academic

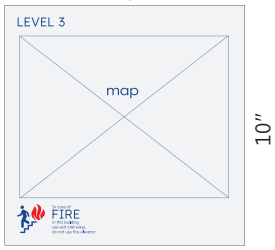




35A
Flag Mounted ID,
General

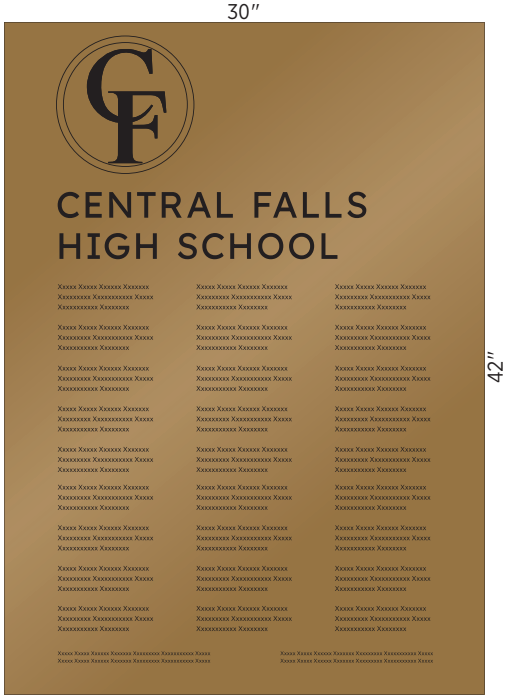


37
Lab Safety

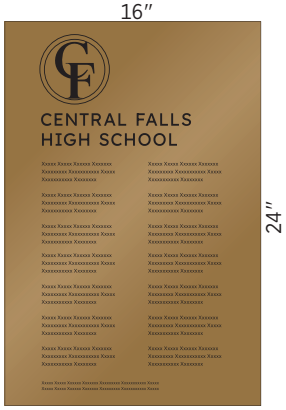


38
Evacuation Map

39
Interior Vinyl
Door Number



40
Dedication Plaque (scale: 1″= 1′-0″)



41
Donor Plaque
(scale: 1″= 1′-0″)

100% Construction Documents

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Sign Types
Interior

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/8″= 1″	Rev.:	
Drawn:	HM/CM	Dwg:	104

CENTRAL FALLS

12″

42A
Interior Letters

AUDITORIUM

8″

42B
Interior Letters

SMART CLINIC

5″

42C
Interior Letters

12″

24″

48
Sustainable Graphics Panel (scale: 1″= 1′-0″)

36″

24″

48A
Sustainable Graphics Panel, Large (scale: 1″= 1′-0″)

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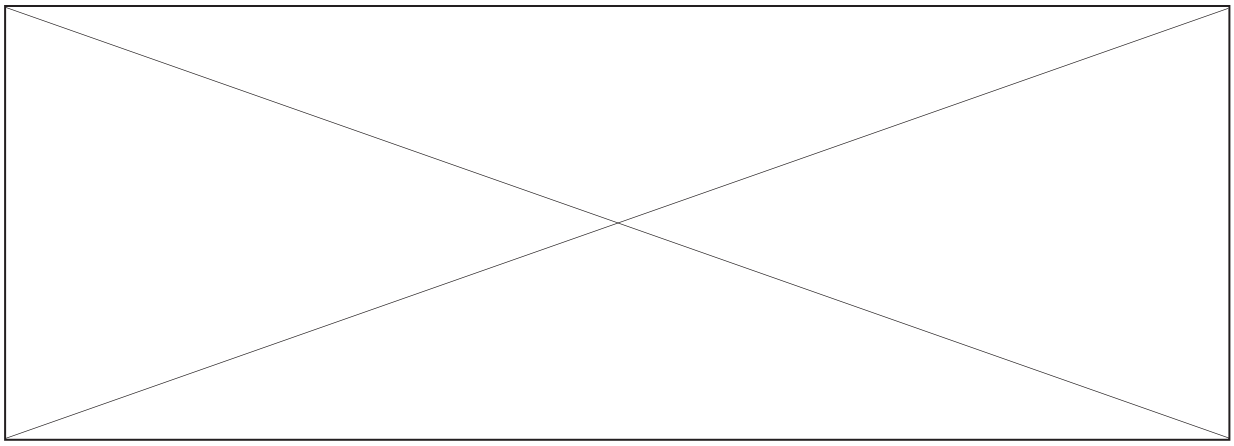
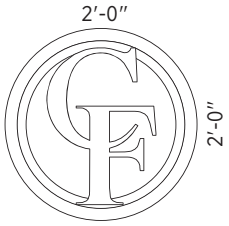
Sign Types
Interior

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1/2″= 1′- 0″	Rev.:
Drawn:	HM/CM	Dwg: 105



50
Wall Graphics



52
School Logo, Desk

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Sign Types
Interior

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1/2"= 1'- 0"	Rev.:
Drawn:	HM/CM	Dwg: 106

60
Exterior Door ID

71
No Smoking Vinyl

74
Exterior Vinyl
Door Number

75
Exterior FD Regulatory

80
Exterior Letters, Illuminated (scale: 1/8″= 1′-0″)

81
Exterior Letters, Illuminated (scale: 1/8″= 1′-0″)

82
Exterior Letters, Illuminated (scale: 1/8″= 1′-0″)

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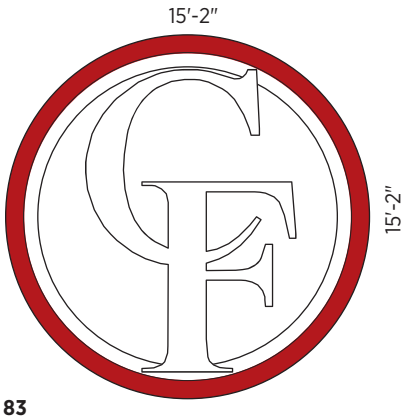
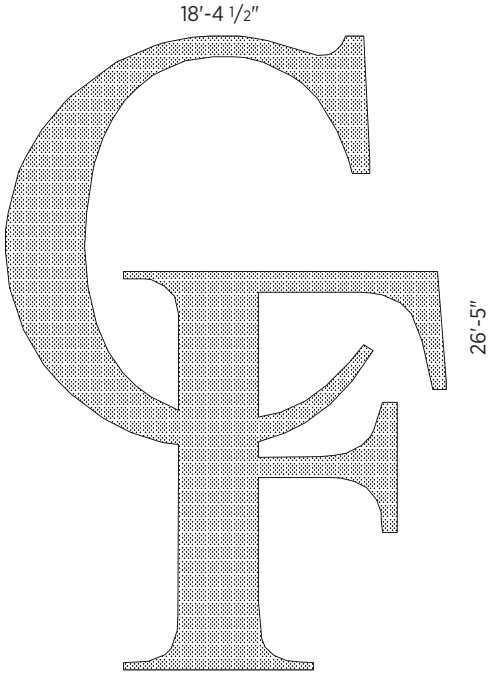
Sign Types
Exterior

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/8″= 1″ Rev.:
Drawn: HM/CM Dwg: 107



83
Exterior School Logo, Illuminated



84
Exterior Media Center Window Graphics

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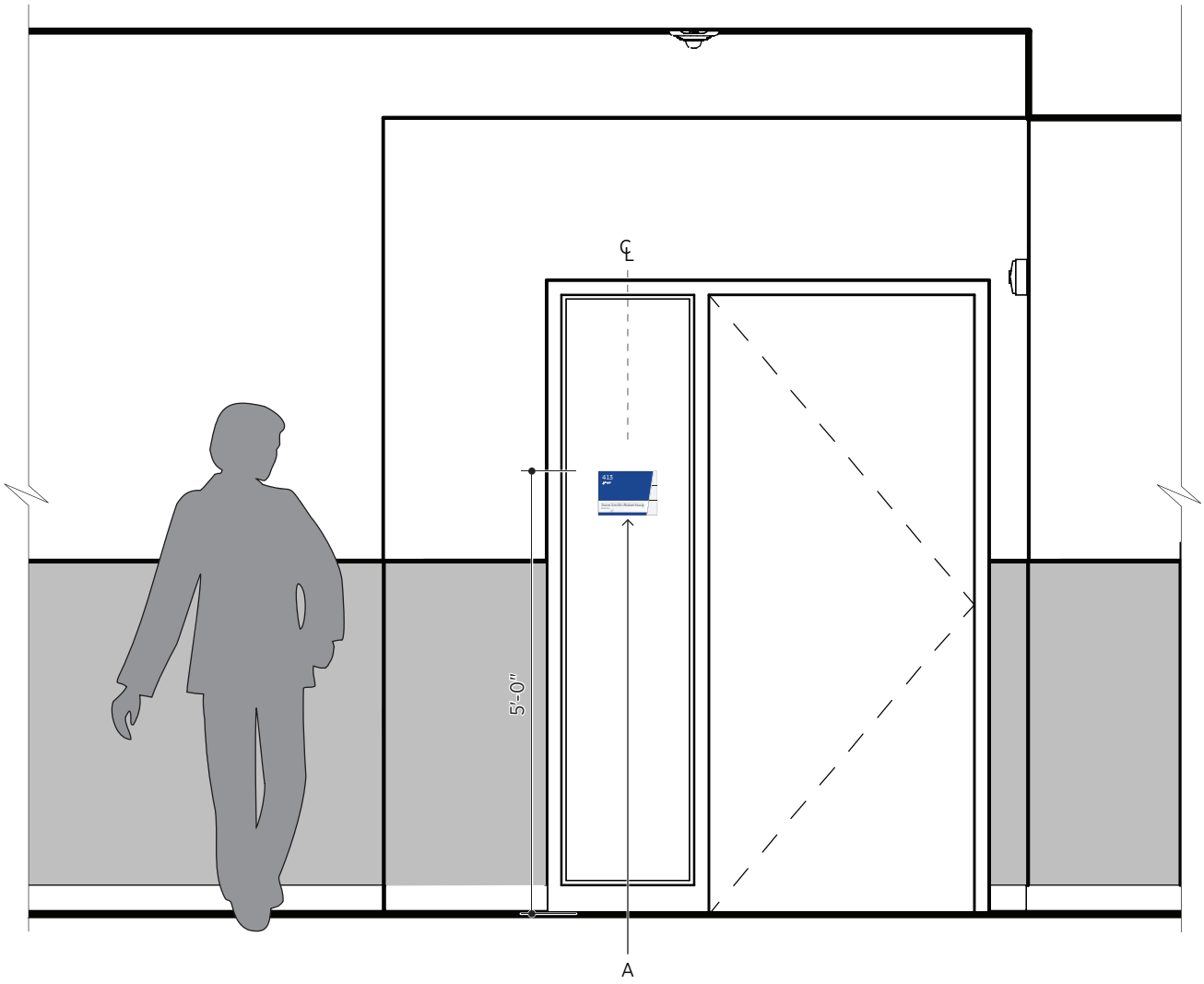
Sign Types
Exterior

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1/8"= 1'- 0"	Rev.:
Drawn:	HM/CM	Dwg: 108



Notes

A Sign Type 11: Room Number ID w/Insert, Academic

100% Construction Documents

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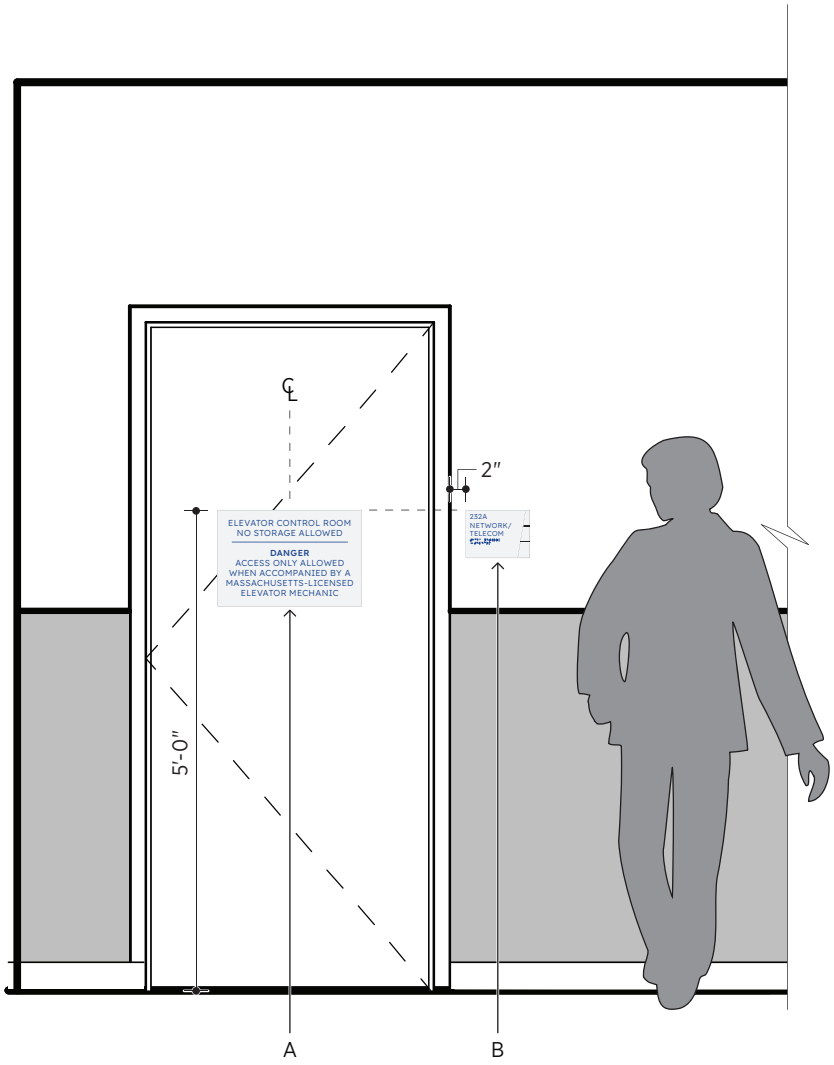
Elevation
Sign Type 11

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/2"= 1'- 0"	Rev.:	
Drawn:	HM/CM	Dwg:	211



Notes

A Sign Type 23: Elevator Machine Room Regulatory
B Sign Type 12C: Room ID, Support

100% Construction Documents

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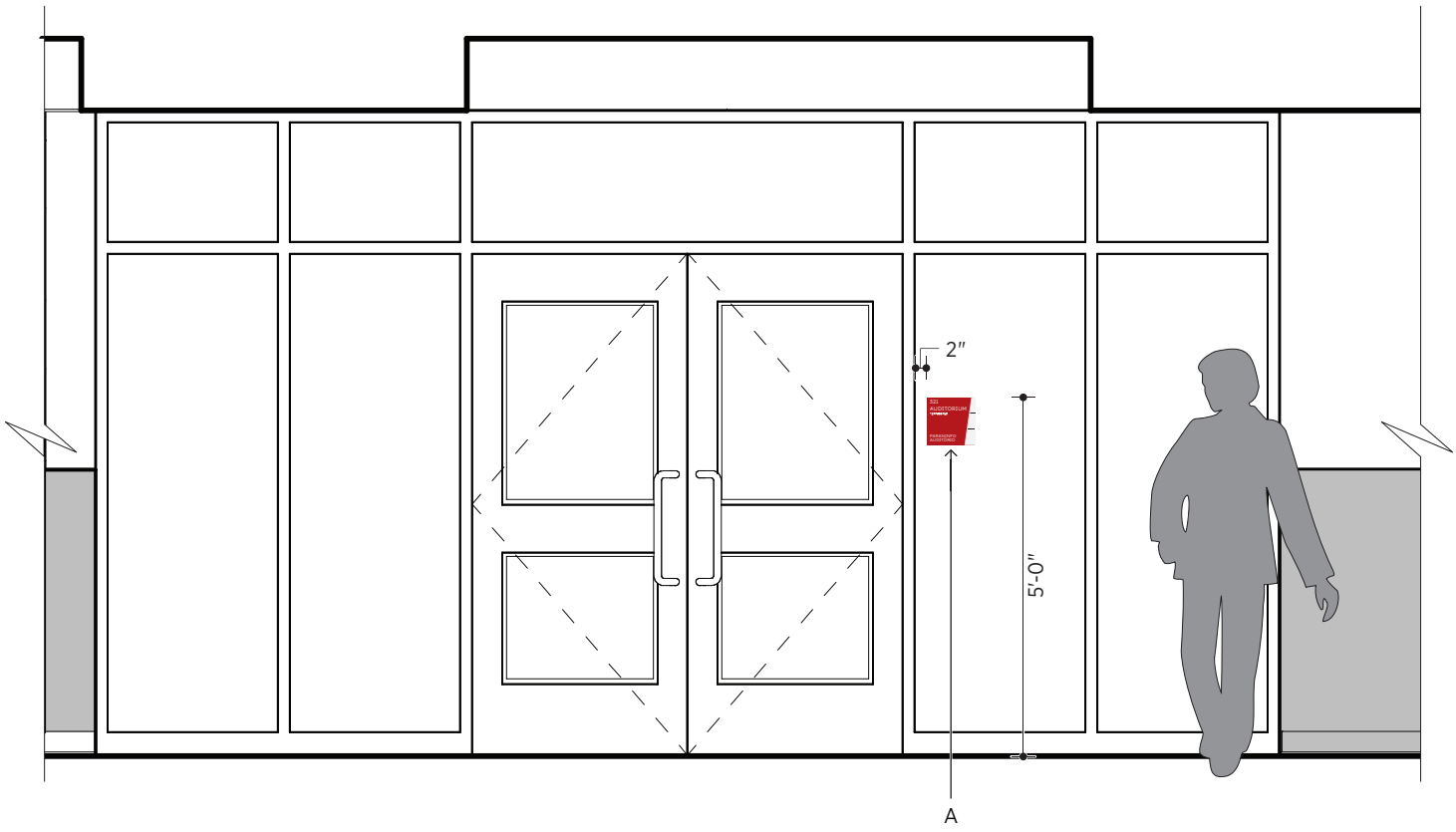
Elevation
Sign Types 12C, 23

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/2″= 1′- 0″ Rev.:
Drawn: HM/CM Dwg: 212



Notes

A Sign Type 13B: Room ID w/Print, Public

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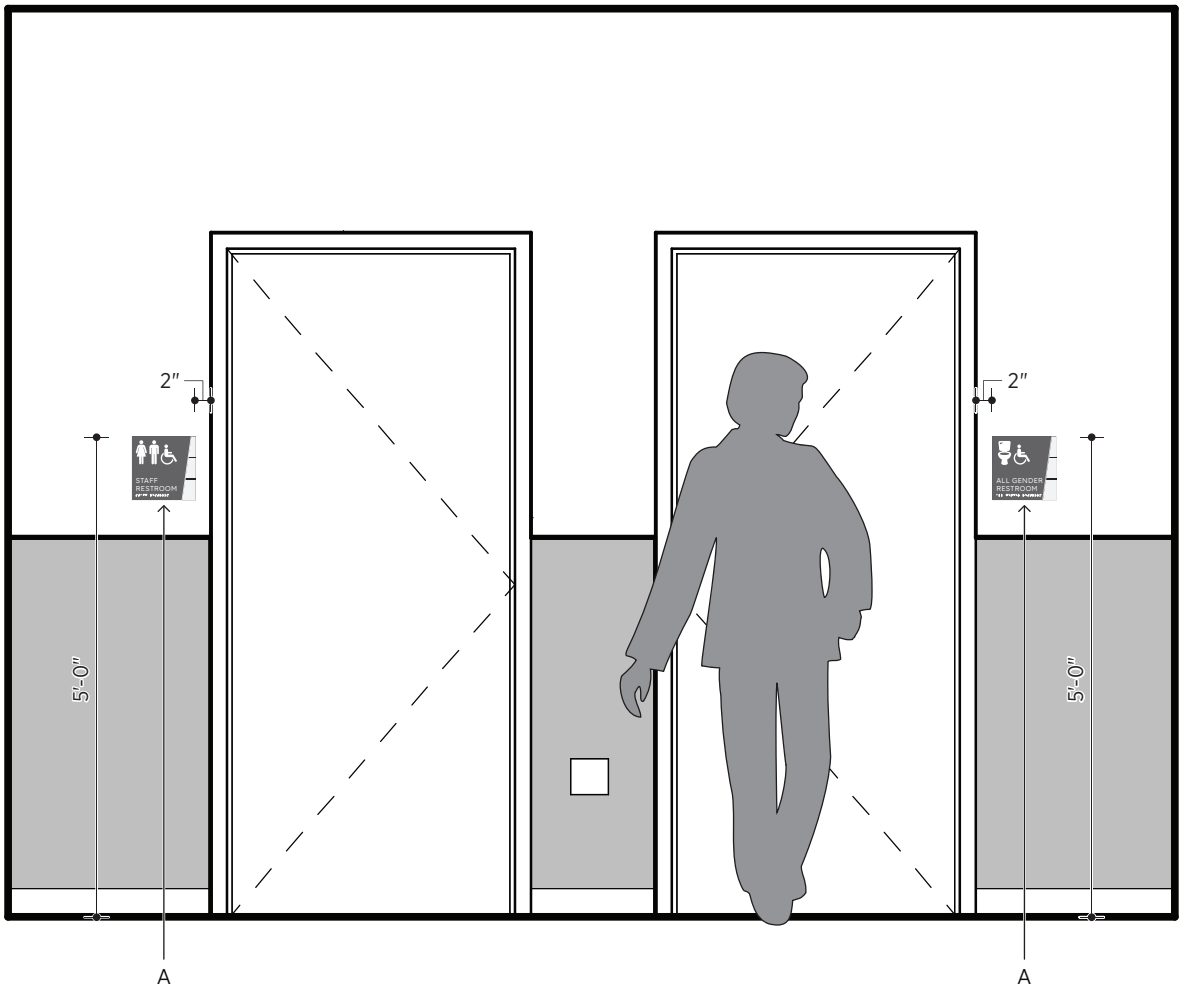
Elevation
Sign Type 13B

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3/8"= 1'- 0"	Rev.:	
Drawn:	HM/CM	Dwg:	213



Notes

A Sign Type 15C: Restroom ID, General

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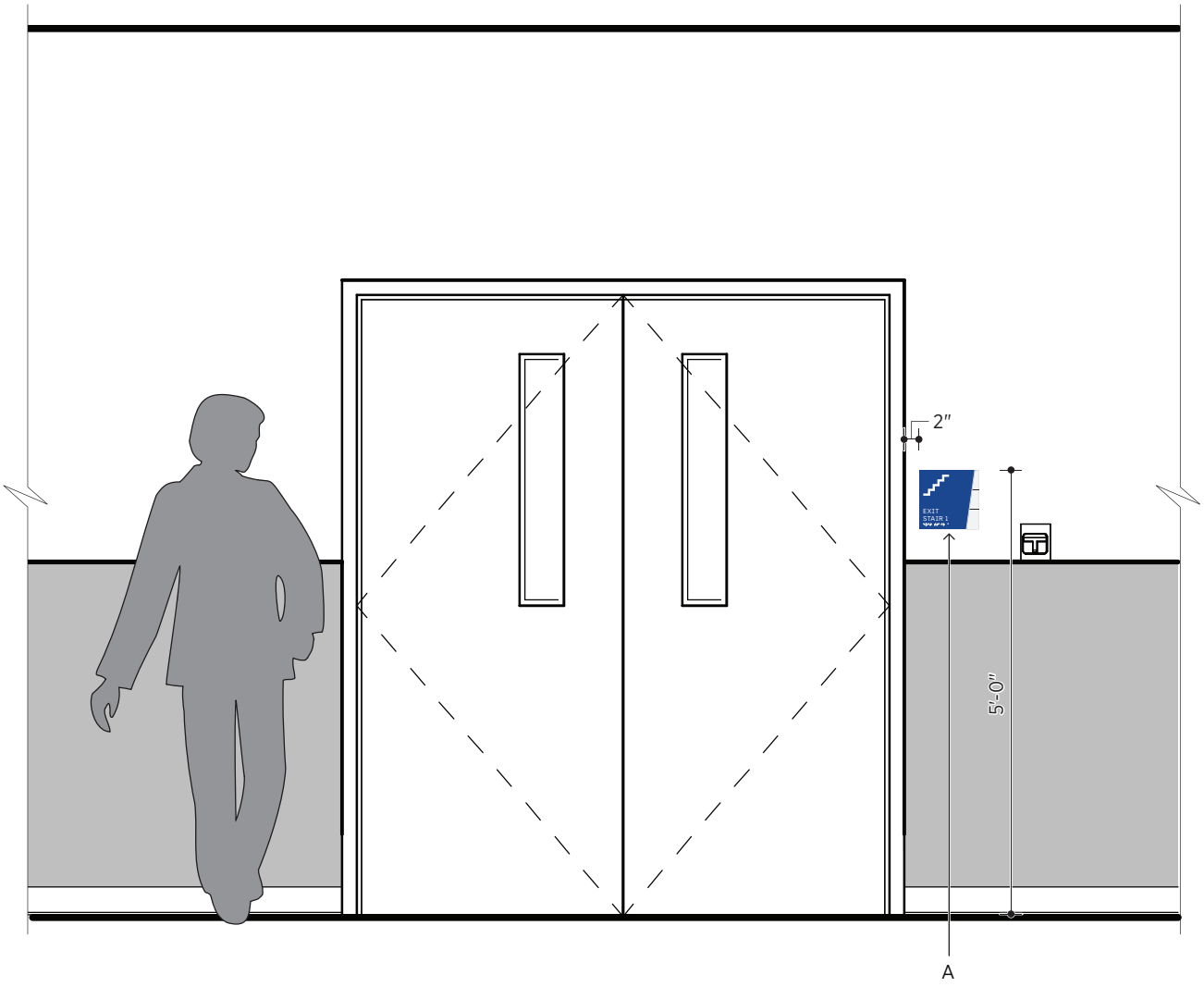
Elevation
Sign Type 15C

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023	
Scale:	1/2"= 1'- 0"	Rev.:	
Drawn:	HM/CM	Dwg:	215



Notes

A Sign Type 17A: Stair ID, Academic (at corridor side)

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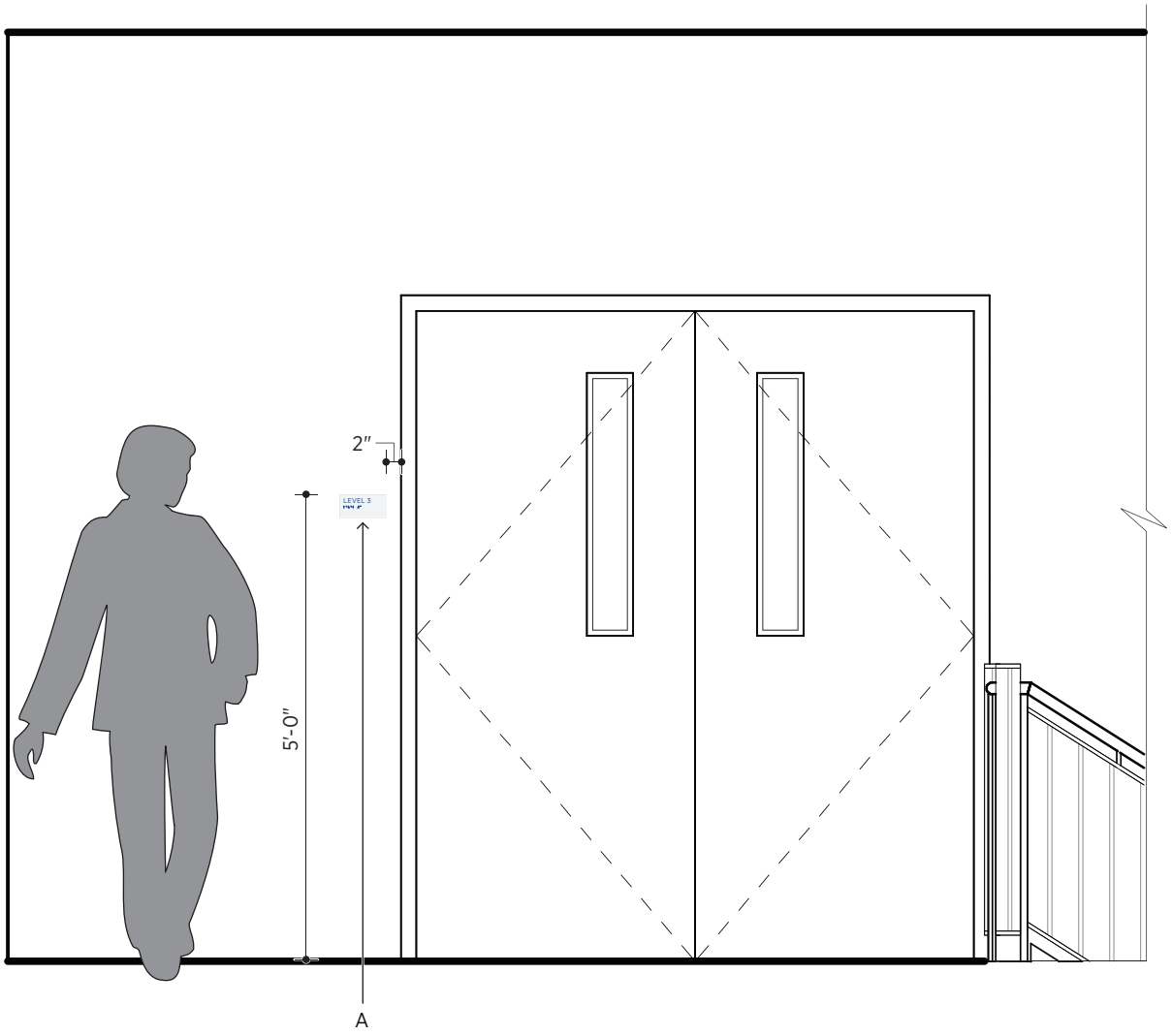
Elevation
Sign Type 17A

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/2"= 1'- 0"	Rev.:	
Drawn:	HM/CM	Dwg:	217



Notes

A Sign Type 18: Stair Level ID (at stairwell side)

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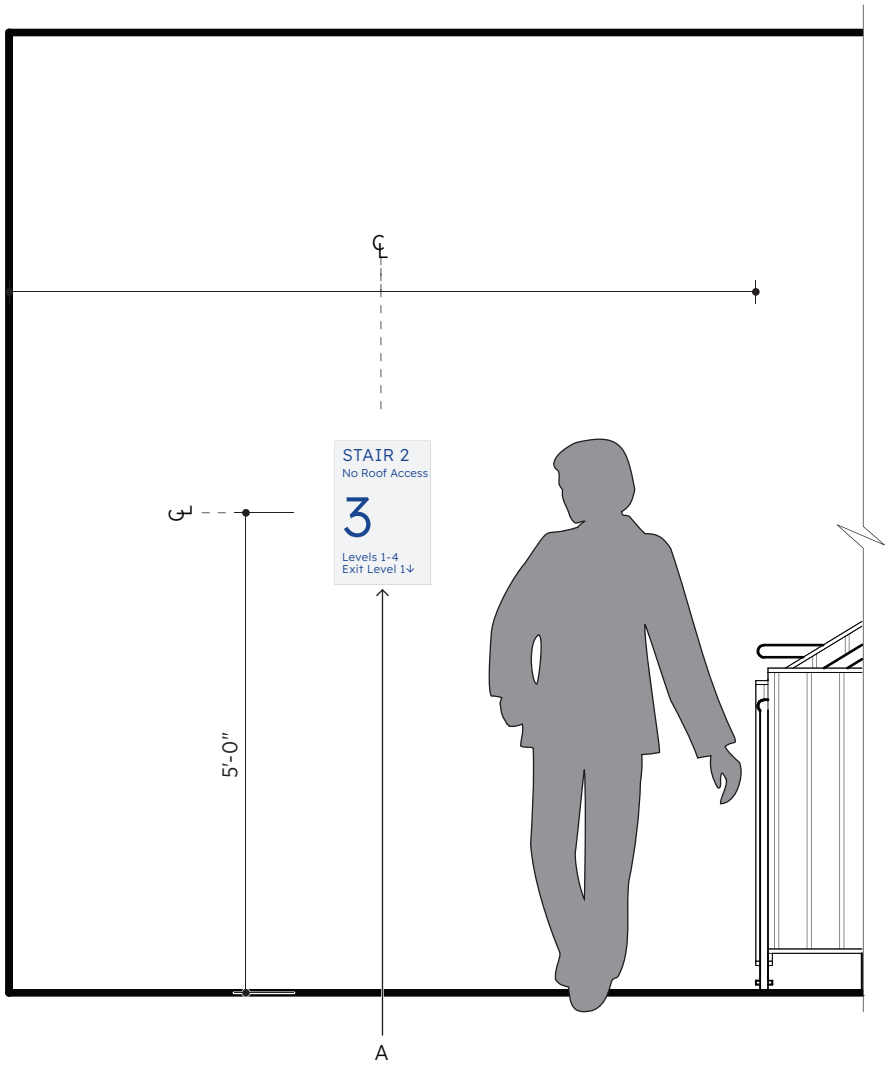
Elevation
Sign Type 18

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1/2"= 1'- 0"	Rev.:
Drawn:	HM/CM	Dwg: 218



Notes

A Sign Type 19: Stair Landing Regulatory (at stairwell)

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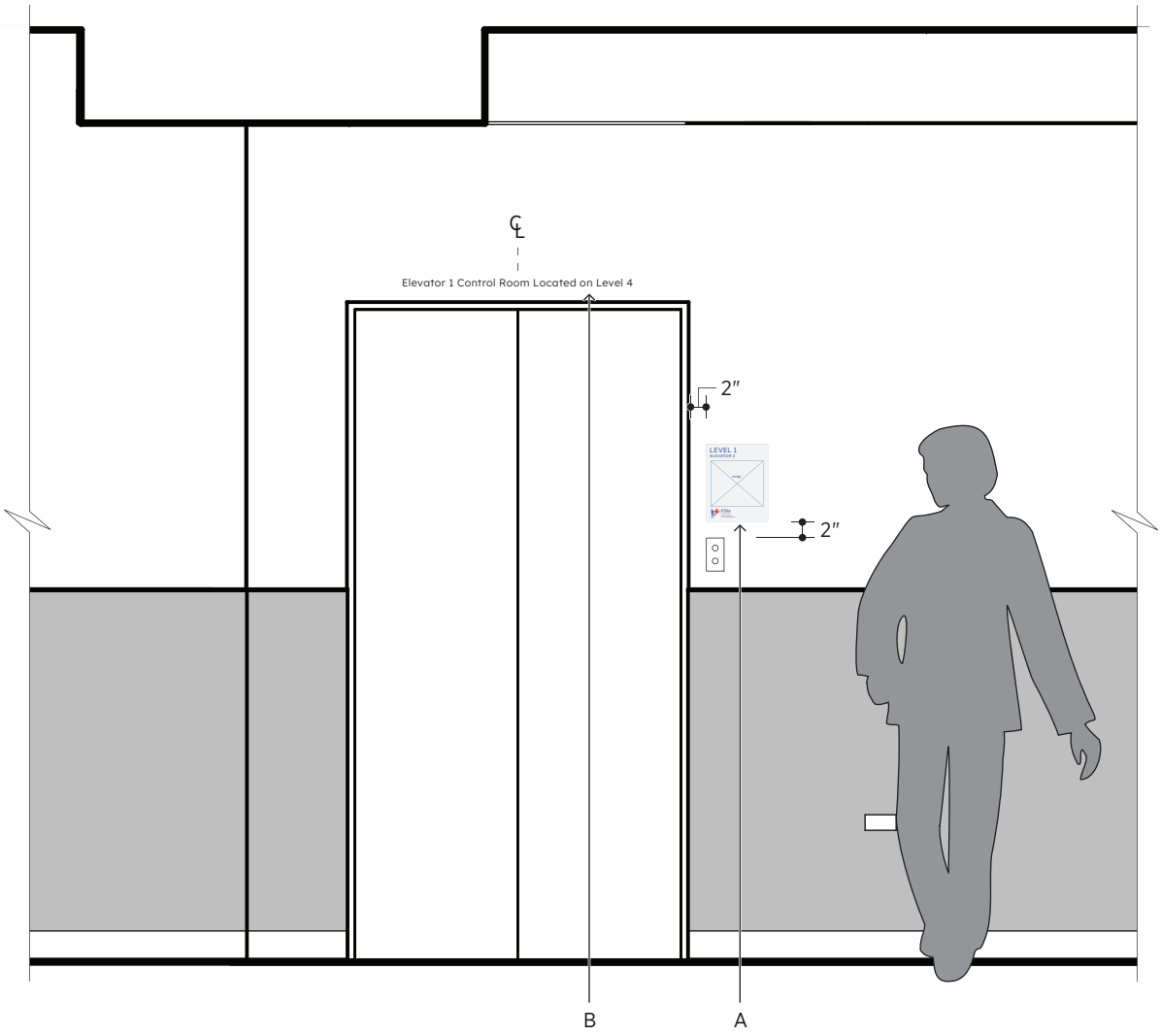
Elevation
Sign Type 19

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1/2"= 1'- 0" Rev.:

Drawn: HM/CM Dwg: 219



Notes

A Sign Type 21: Elevator Regulatory Map
B Sign Type 22: Elevator Jamb Regulatory

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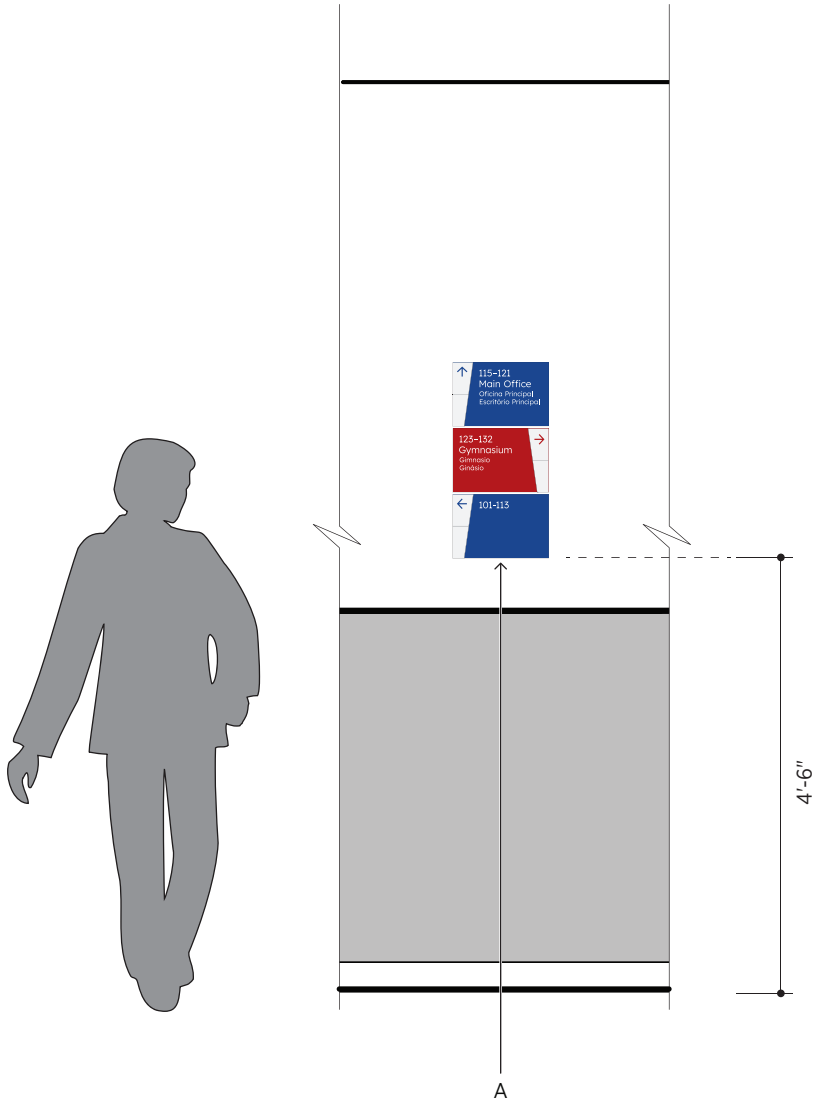
Elevation
Sign Type 21

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/2"= 1'- 0" Rev.:
Drawn: HM/CM Dwg: 221



Notes

A Sign Type 30: Corridor Directional

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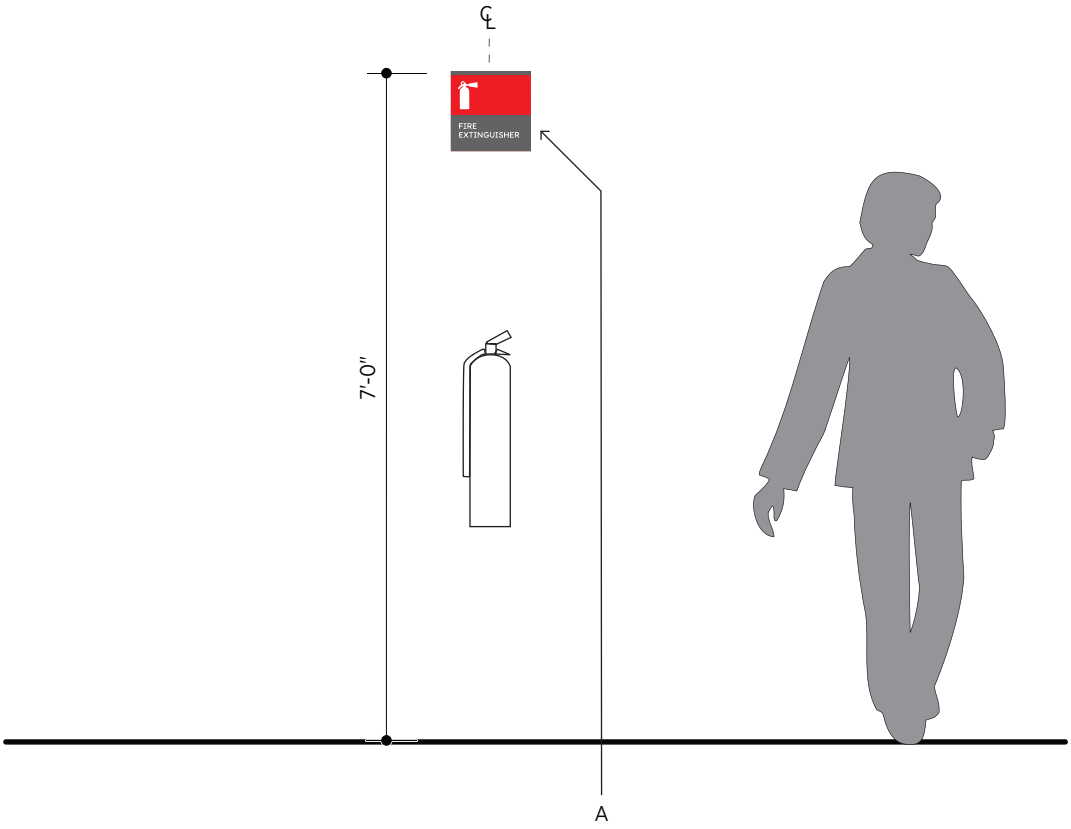
Elevation
Sign Types 30

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/2"= 1'- 0"	Rev.:	
Drawn:	HM	Dwg:	230



Notes

A Sign Type 37A: Safety, Fire Extinguisher
B Similar mounting condition for Sign Types 37B, 37C, 37D, 37E, 37F, 38G, and 38H

100% Construction Documents

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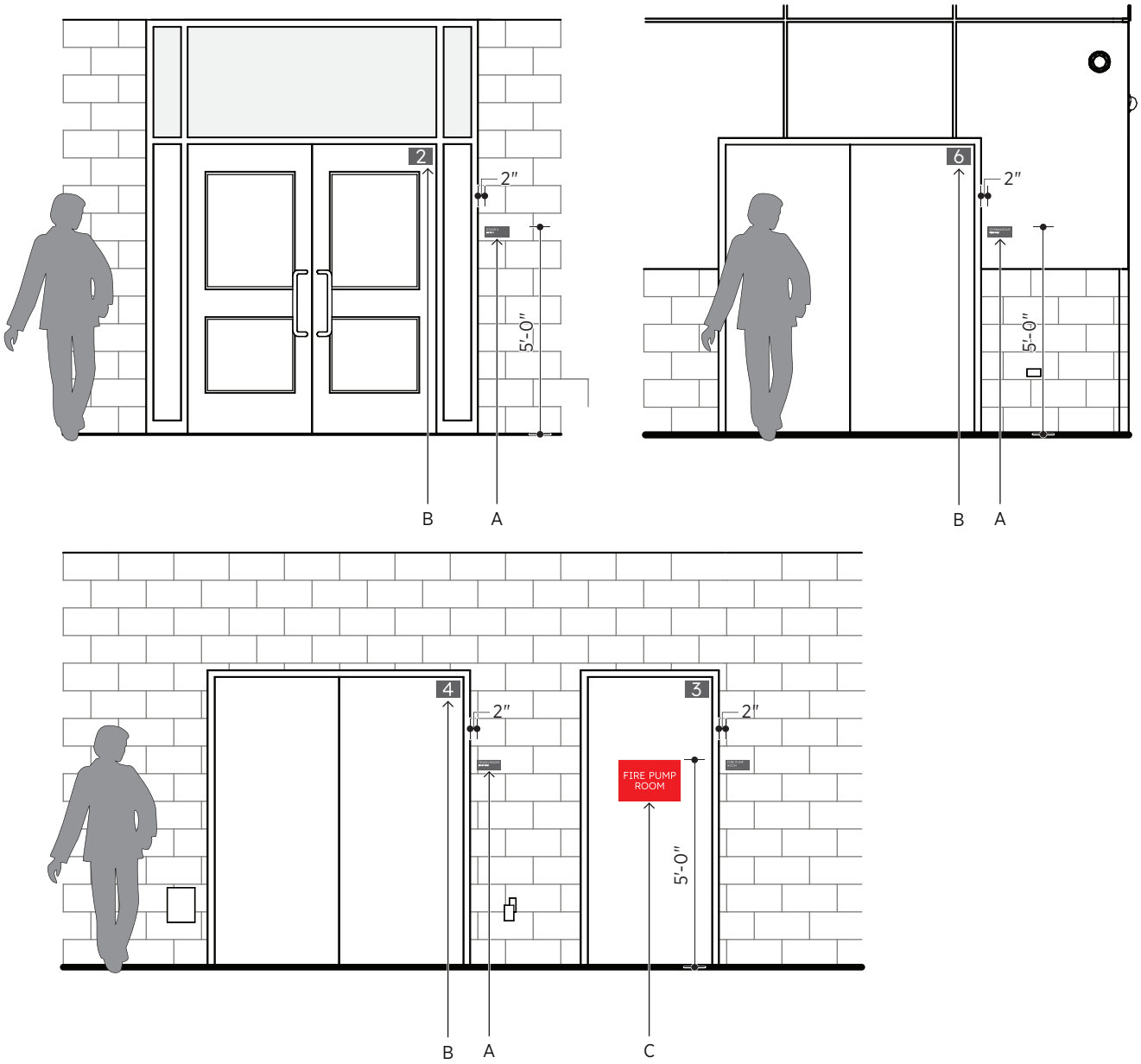
Elevation
Sign Type 37A

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/2"= 1'- 0"	Rev.:	
Drawn:	HM/CM	Dwg:	237



Notes

A Sign Type 60: Exterior Door ID
B Sign Type 74: Exterior Vinyl Door Number
C Sign Type 75: Exterior FD Regulatory

100% Construction Documents

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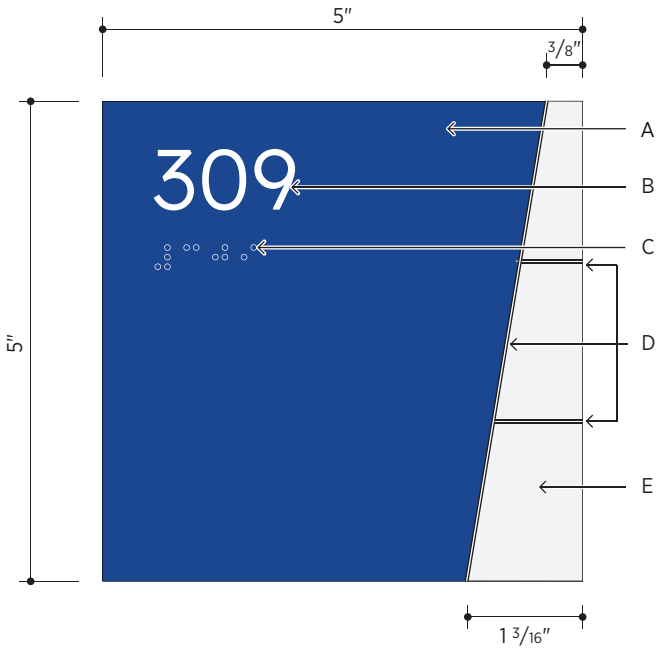
Elevation
Sign Types 60, 74, & 75

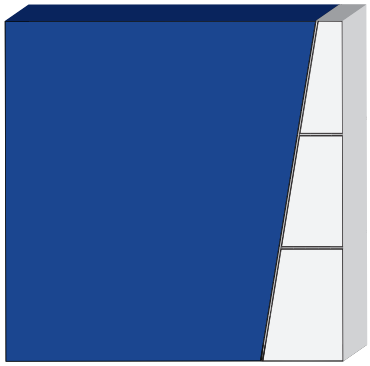
Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

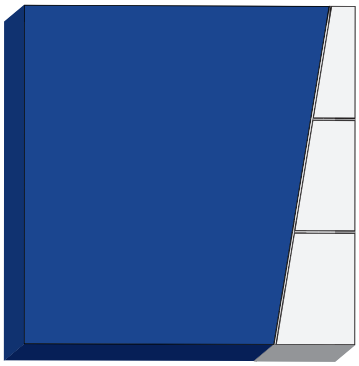
Scale: 1/4"= 1'- 0" Rev.:

Drawn: HM Dwg: 260





Top/right view



Bottom/left view

Notes

A	Thermoformed acrylic plaque, painted COL-01, face and left portion of returns
B	Tactile text, Lexend Light, COL-05
C	Grade II Braille
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Masked and painted COL-03, face and right portion of returns

100% Construction Documents

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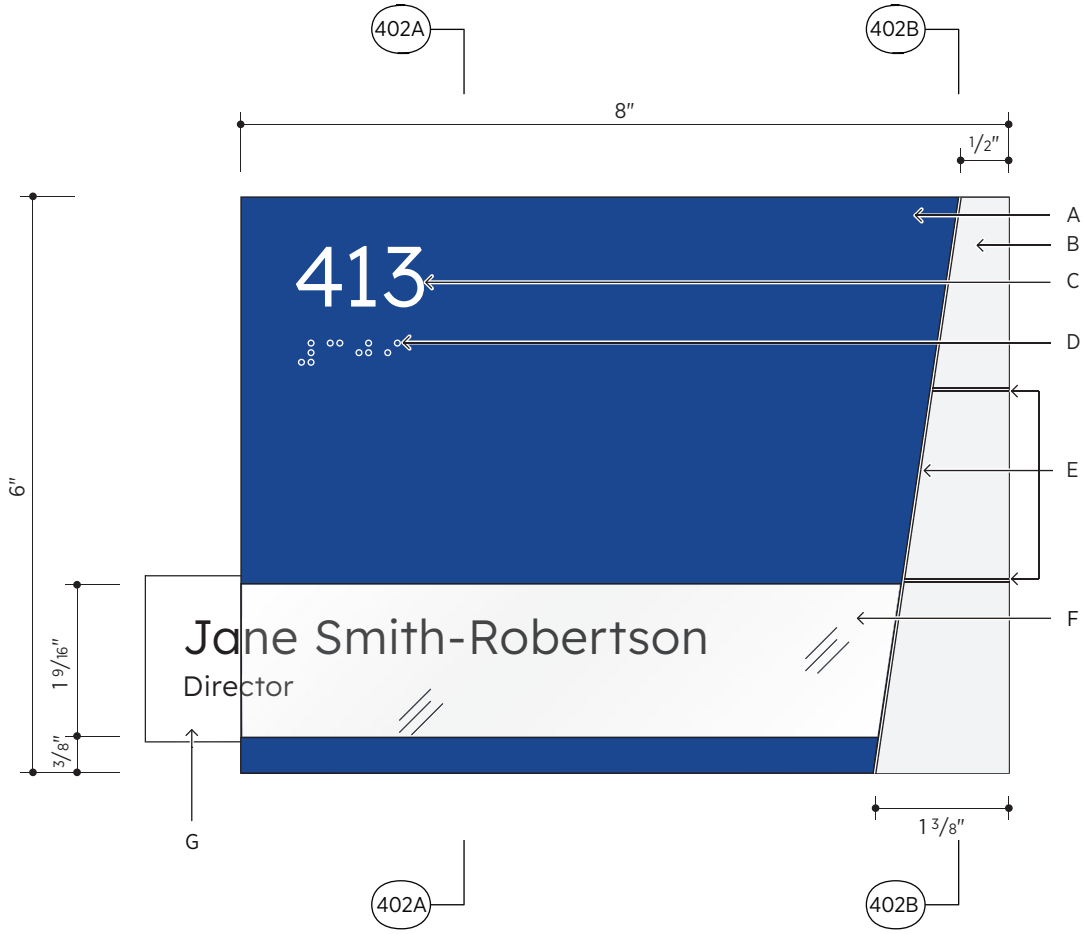
Sign Type 10
Room Number ID
Academic

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1:2	Rev.:
Drawn:	HM/CM	Dwg: 310



Notes

A	Thermoformed acrylic plaque, painted COL-01, face and left portion of returns
B	Masked and painted COL-03, face and right portion of returns
C	Tactile text, Lexend Light, COL-05
D	Grade II Braille
E	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
F	Insert window, face and returns masked and left clear
G	Paper insert, by Owner

100% Construction Documents

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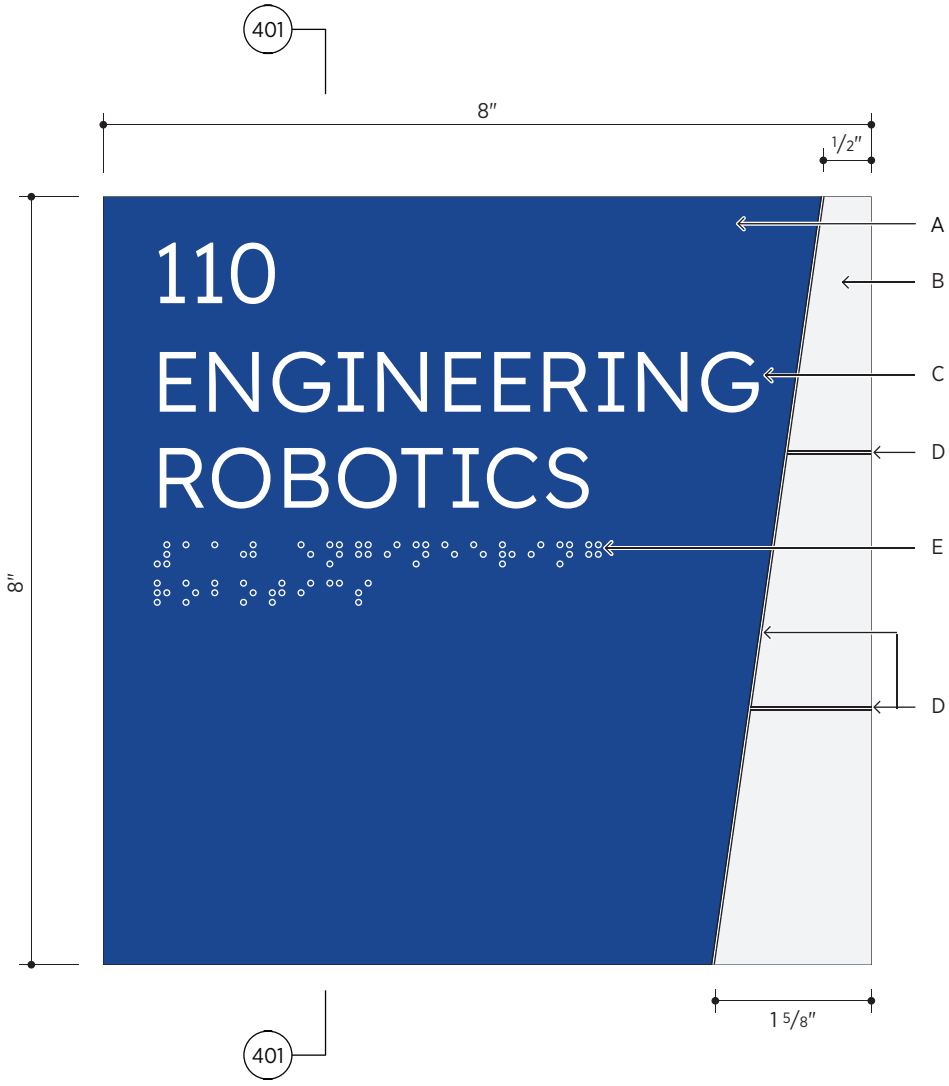
Sign Type 11
Room Number ID with Insert
Academic

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1:2 Rev.:

Drawn: HM/CM Dwg: 311



Notes

A	Thermoformed acrylic plaque, painted COL-01, face and left portion of returns
B	Masked and painted COL-03, , face and right portion of returns
C	Tactile text, Lexend Light, COL-05
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Grade II Braille

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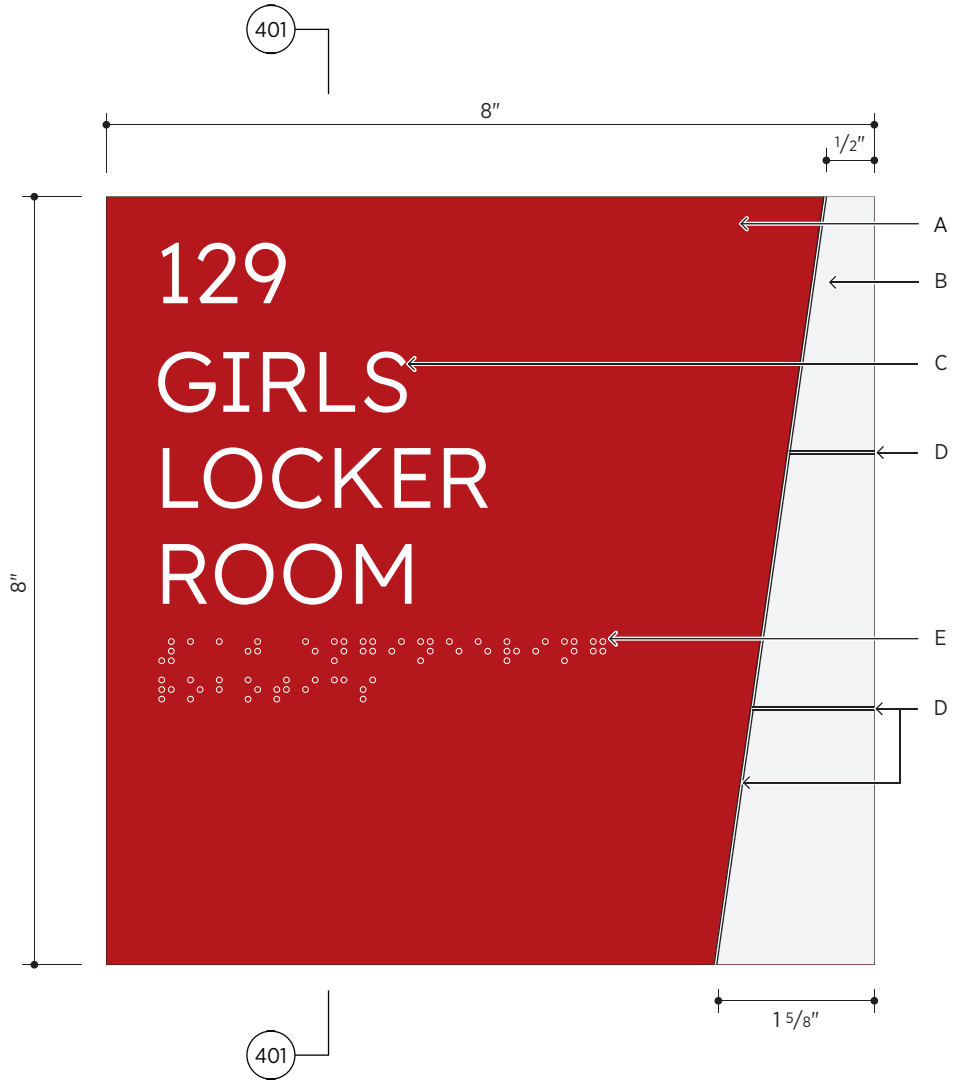
Sign Type 12A
Room ID
Academic

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1:2	Rev.:	
Drawn:	HM/CM	Dwg:	312A



Notes

A	Thermoformed acrylic plaque, painted COL-02, face and left portion of returns
B	Masked and painted COL-03, face and right portion of returns
C	Tactile text, Lexend Light, COL-05
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Grade II Braille

100% Construction Documents

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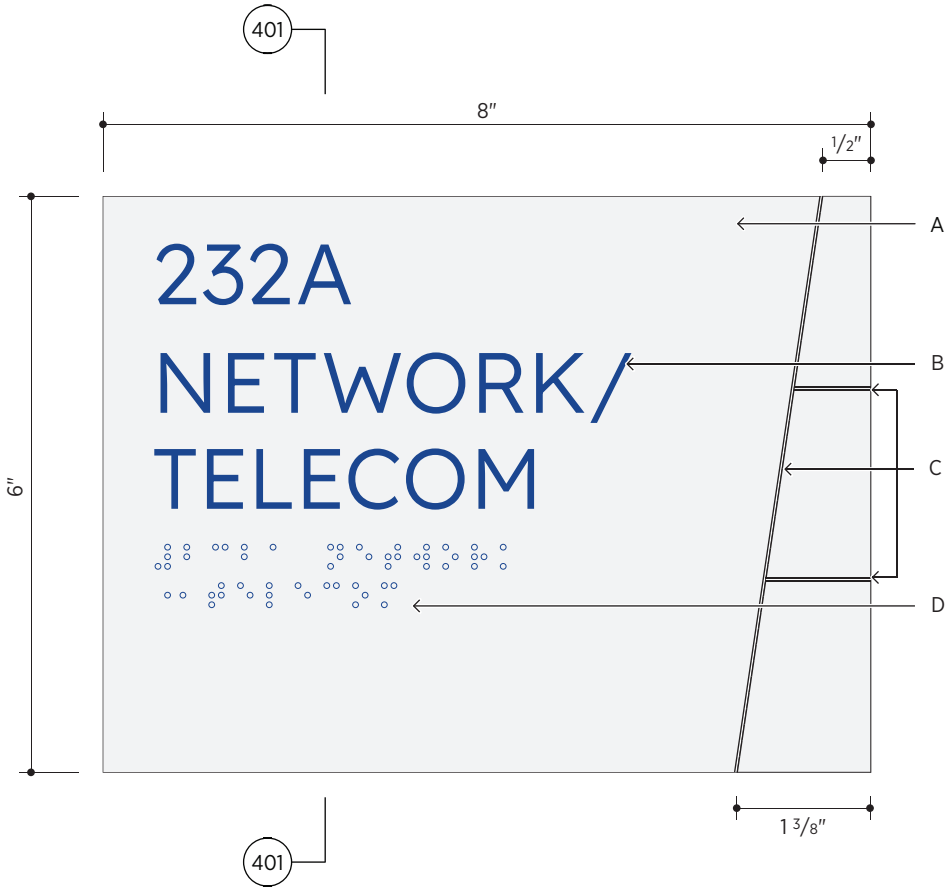
Sign Type 12B
Room ID
Public

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1:2 Rev.:

Drawn: HM/CM Dwg: 312B



Scale: 1/4"= 1"

Notes

A Thermoformed acrylic plaque, painted COL-03 face and returns
B Tactile text, Lexend Light, COL-01
C 1/16" thick x 1/32" deep machine routed line, painted COL-03
D Grade II Braille

100% Construction Documents

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Sign Type 12C
Room ID
Support

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1:2	Rev.:	
Drawn:	HM/CM	Dwg:	312C

A	Thermoformed acrylic plaque, painted COL-01, face and left portion of returns
B	Masked and painted COL-03, face and right portion of returns
C	Tactile text, Lexend Light, COL-05
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Grade II Braille
F	Digitally printed text, Lexend Light, COL-05

100% Construction Documents

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Sign Type 13A
Room ID with Print
Academic

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1:2 Rev.:

Drawn: HM/CM Dwg: 313A

A	Thermoformed acrylic plaque, painted COL-02, face and left portion of returns
B	Masked and painted COL-03, face and right portion of returns
C	Tactile text, Lexend Light, COL-05
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Grade II Braille
F	Digitally printed text, Lexend Light, COL-05

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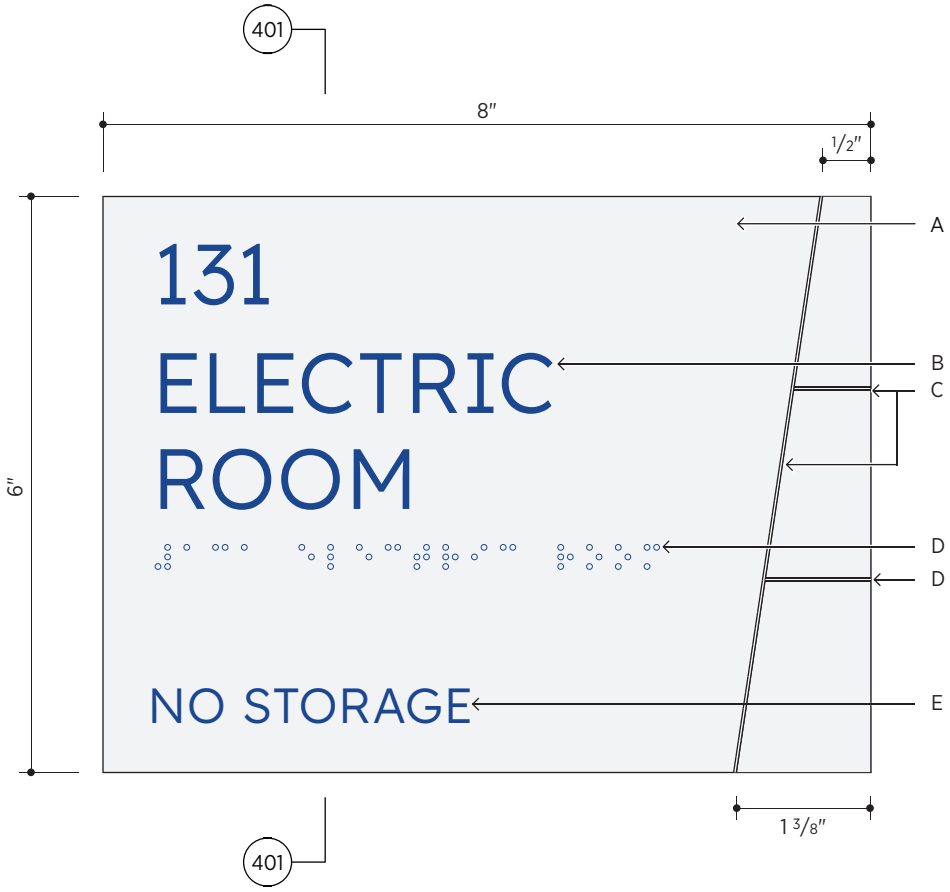
Sign Type 13B
Room ID with Print
Public

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1:2 Rev.:

Drawn: HM/CM Dwg: 313B



Notes

A Thermoformed acrylic plaque, painted COL-03 face and returns
B Tactile text, Lexend Light, COL-01
C 1/16" thick x 1/32" deep machine routed line, painted COL-03
D Grade II Braille
E Digitally printed text, Lexend Light, COL-01

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
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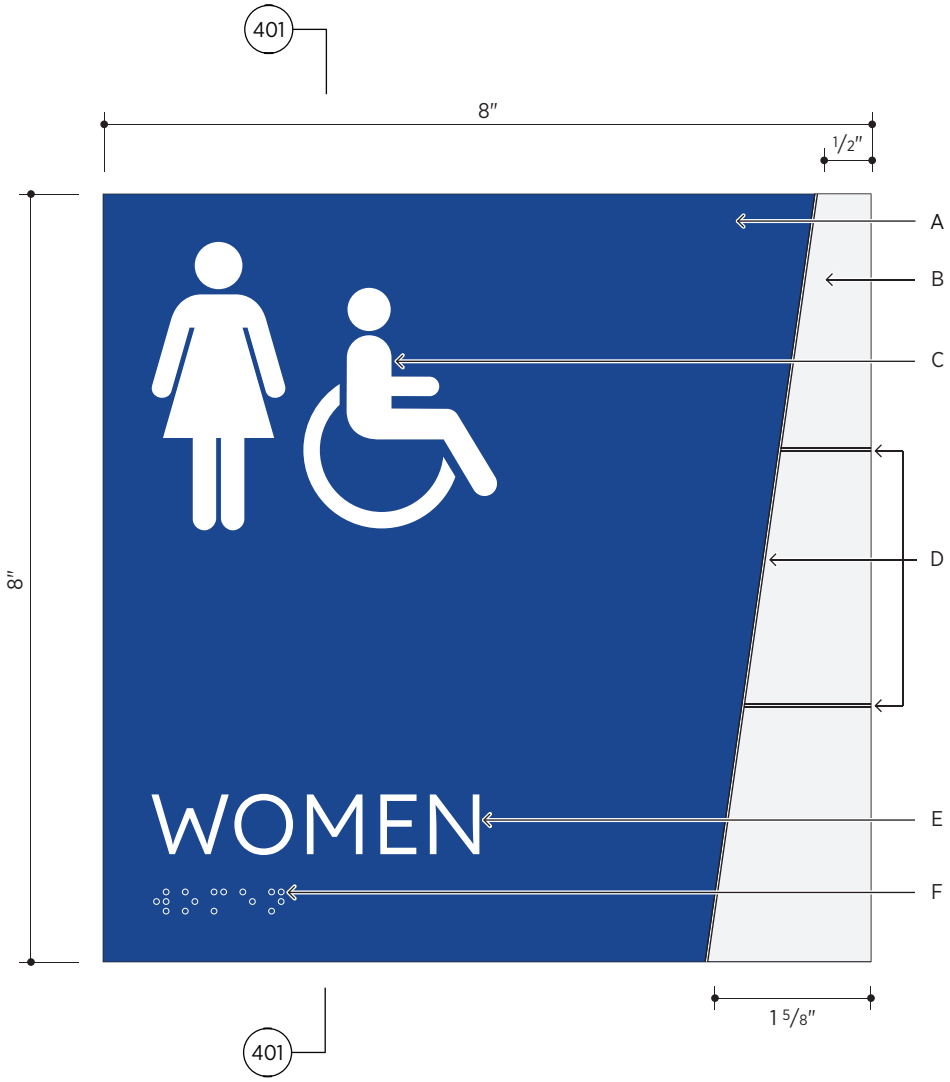
Sign Type 13C
Room ID with Print Support

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1:2 Rev.:
Drawn: HM/CM Dwg: 313C



Notes

A	Thermoformed acrylic plaque, painted COL-01, face and left portion of returns
B	Masked and painted COL-03, face and right portion of returns
C	Tactile symbol, COL-05
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Tactile text, Lexend Light, COL-05
F	Grade II Braille

100% Construction Documents

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Framingham, MA 01701

508-358-0790
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Sign Type 15A
Restroom ID
Academic

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1:2 Rev.:

Drawn: HM/CM Dwg: 315A

Notes

A	Thermoformed acrylic plaque, painted COL-02, face and left portion of returns
B	Masked and painted COL-03 , face and right portion of returns
C	Tactile symbol, COL-05
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Tactile text, Lexend Light, COL-05
F	Grade II Braille

100% Construction Documents

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Framingham, MA 01701

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Sign Type 15B
Restroom ID
Public

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1:2	Rev.:
Drawn:	HM/CM	Dwg: 315B

Notes

A Thermoformed acrylic plaque, painted COL-04, face and left portion of returns
B Masked and painted COL-03 , face and right portion of returns
C Tactile symbol, COL-05
D 1/16" thick x 1/32" deep machine routed line, painted COL-03
E Tactile text, Lexend Light, COL-05
F Grade II Braille

100% Construction Documents

Ai3 Architects
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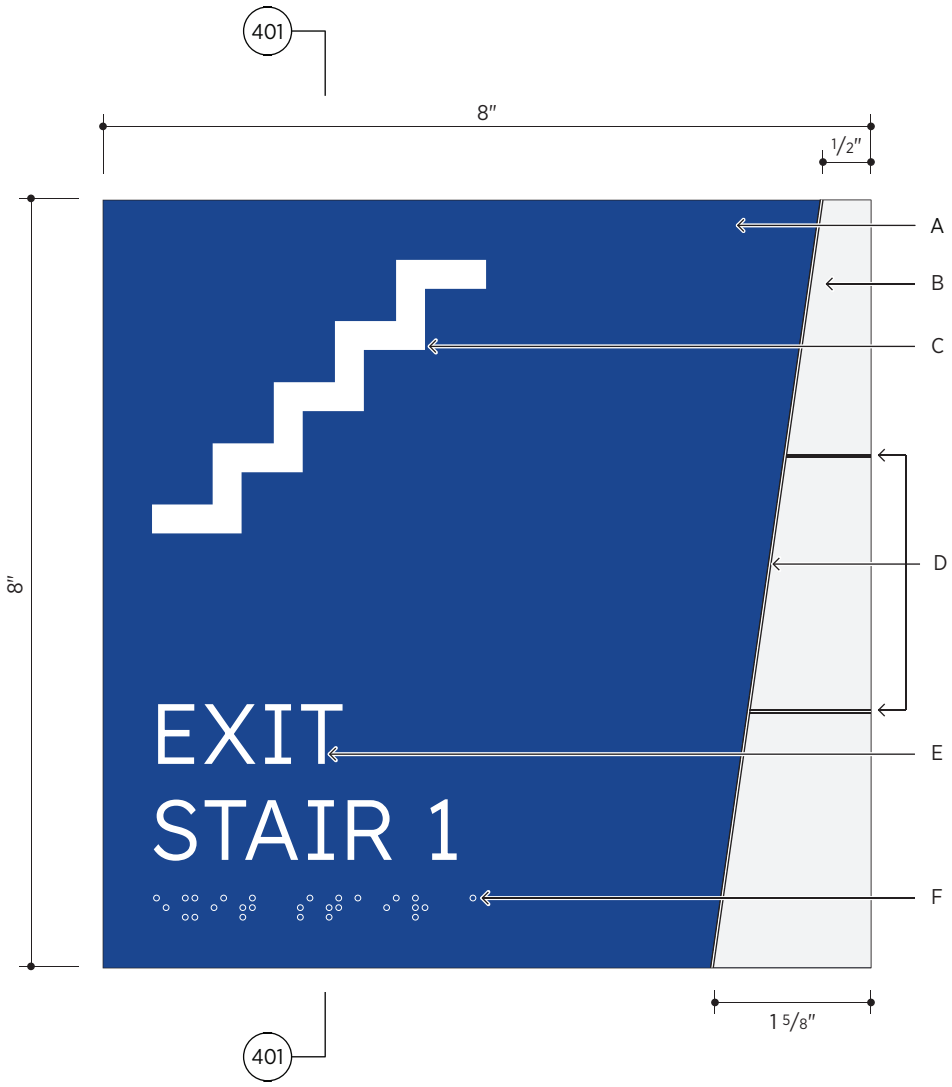
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 15C
Restroom ID
General

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1:2 Rev.:
Drawn: HM/CM Dwg: 315C



Notes

A Thermoformed acrylic plaque, painted COL-01, face and left portion of returns
B Masked and painted COL-03, face and right portion of returns
C Tactile symbol, COL-05
D 1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E Tactile text, Lexend Light, COL-05
F Grade II Braille

100% Construction Documents

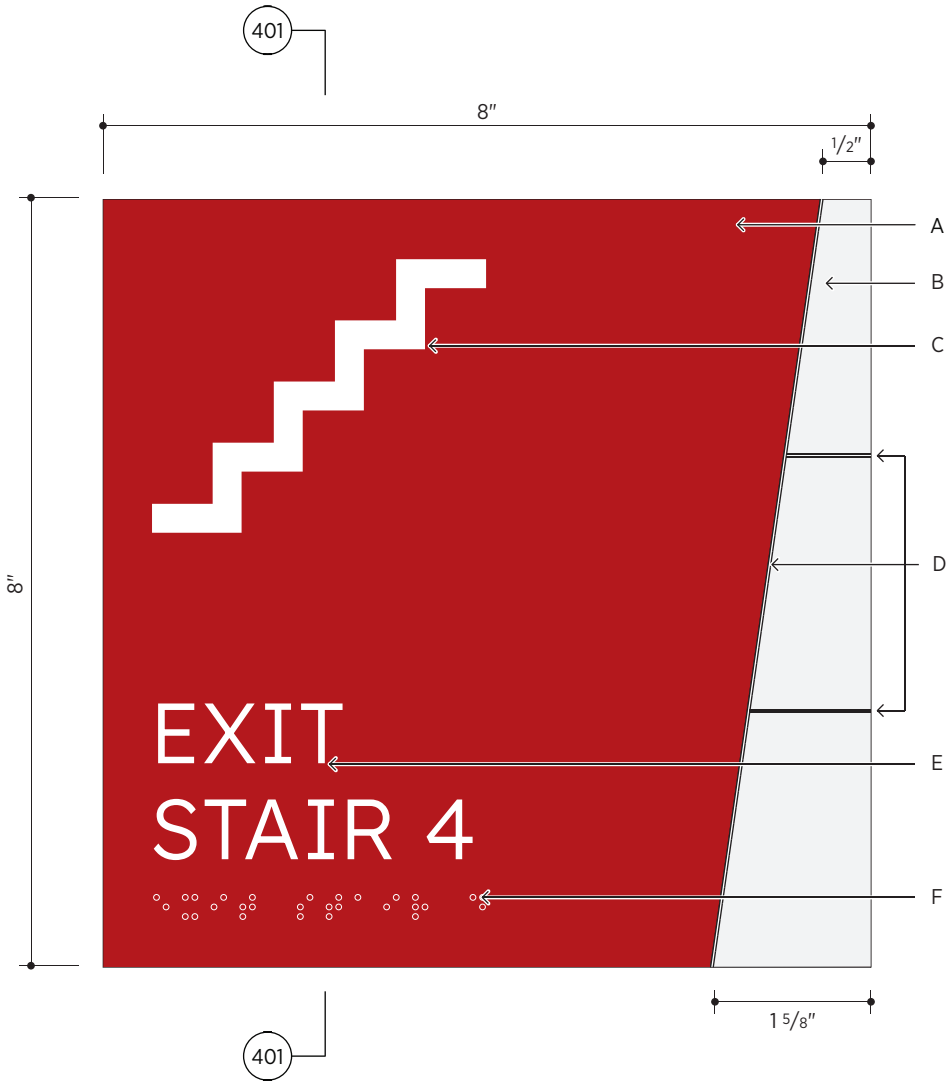
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 17A
Stair ID
Academic

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1:2 Rev.:
Drawn: HM/CM Dwg: 317A



Notes

A Thermoformed acrylic plaque, painted COL-02, face and left portion of returns
B Masked and painted COL-03 , face and right portion of returns
C Tactile symbol, COL-05
D 1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E Tactile text, Lexend Light, COL-05
F Grade II Braille

100% Construction Documents

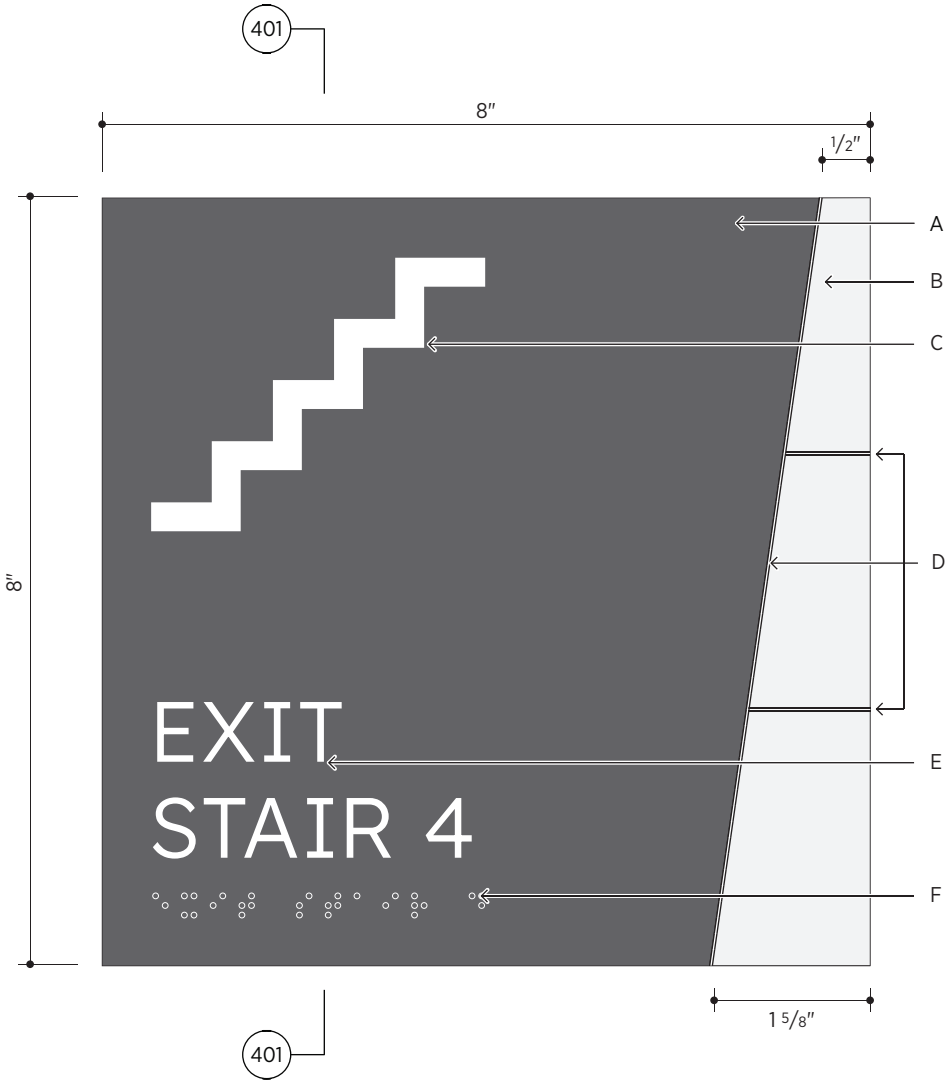
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 17B
Stair ID
Public

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1:2	Rev.:
Drawn:	HM/CM	Dwg: 317B



Notes

A Thermoformed acrylic plaque, painted COL-04, face and left portion of returns
B Masked and painted COL-03 , face and right portion of returns
C Tactile symbol, COL-05
D 1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E Tactile text, Lexend Light, COL-05
F Grade II Braille

100% Construction Documents

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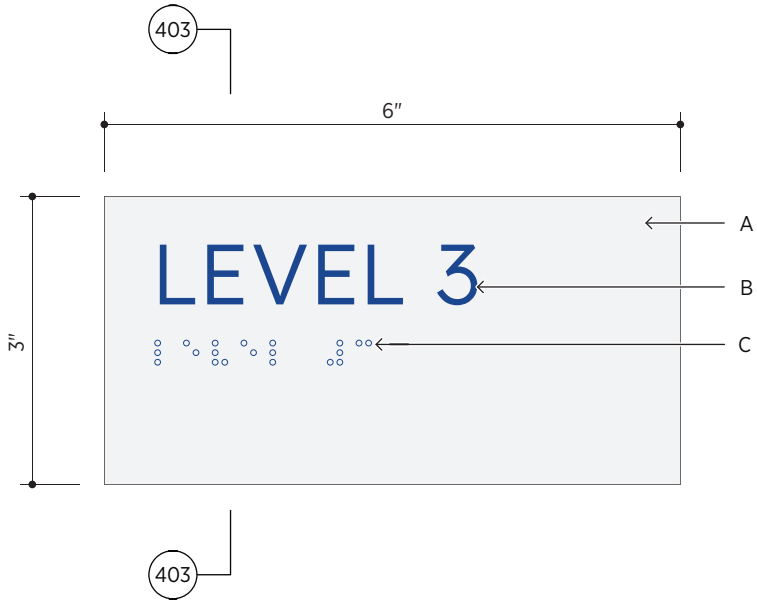
Sign Type 17C
Stair ID
General

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1:2 Rev.:
Drawn: HM/CM Dwg: 317C



Notes

A Thermoformed acrylic plaque, painted COL-03 face and returns
B Tactile text, Lexend Light, COL-01
C Grade II Braille

100% Construction Documents

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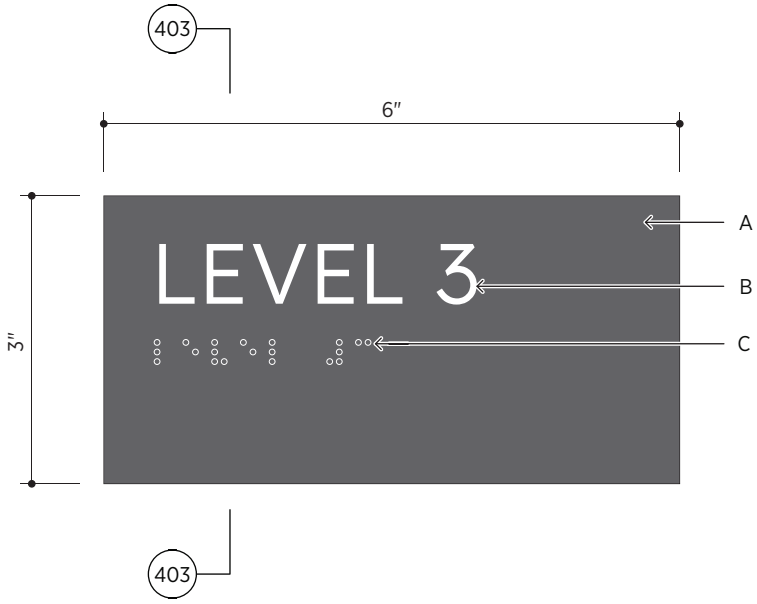
Sign Type 18
Stair Level ID

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1:2 Rev.:
Drawn: HM/CM Dwg: 318



Notes

A Thermoformed acrylic plaque, painted COL-04 face and returns
B Tactile text, Lexend Light, COL-05
C Grade II Braille

100% Construction Documents

Ai3 Architects
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Framingham, MA 01701

508-358-0790
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Sign Type 18A
Stair Level ID
General

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1:2	Rev.:	
Drawn:	HM/CM	Dwg:	318A

Notes

A Acrylic plaque, painted COL-03 face and returns
B Digitally printed text, Lexend Light, COL-01
C Digitally printed arrow, COL-01

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
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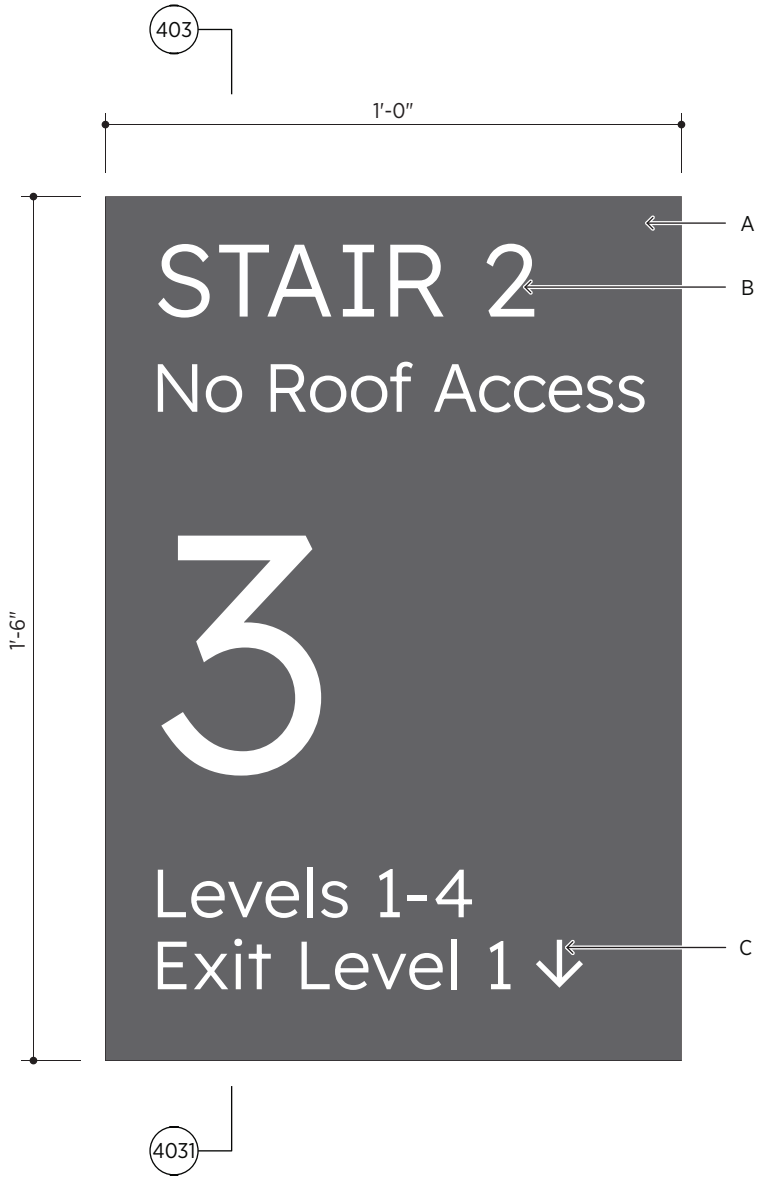
Sign Type 19
Stair Landing Regulatory

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3"= 1'	Rev.:	
Drawn:	HM/CM	Dwg:	319



Notes

A Acrylic plaque, painted COL-04 face and returns
B Digitally printed text, Lexend Light, COL-05
C Digitally printed arrow, COL-01

100% Construction Documents

Ai3 Architects
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Framingham, MA 01701

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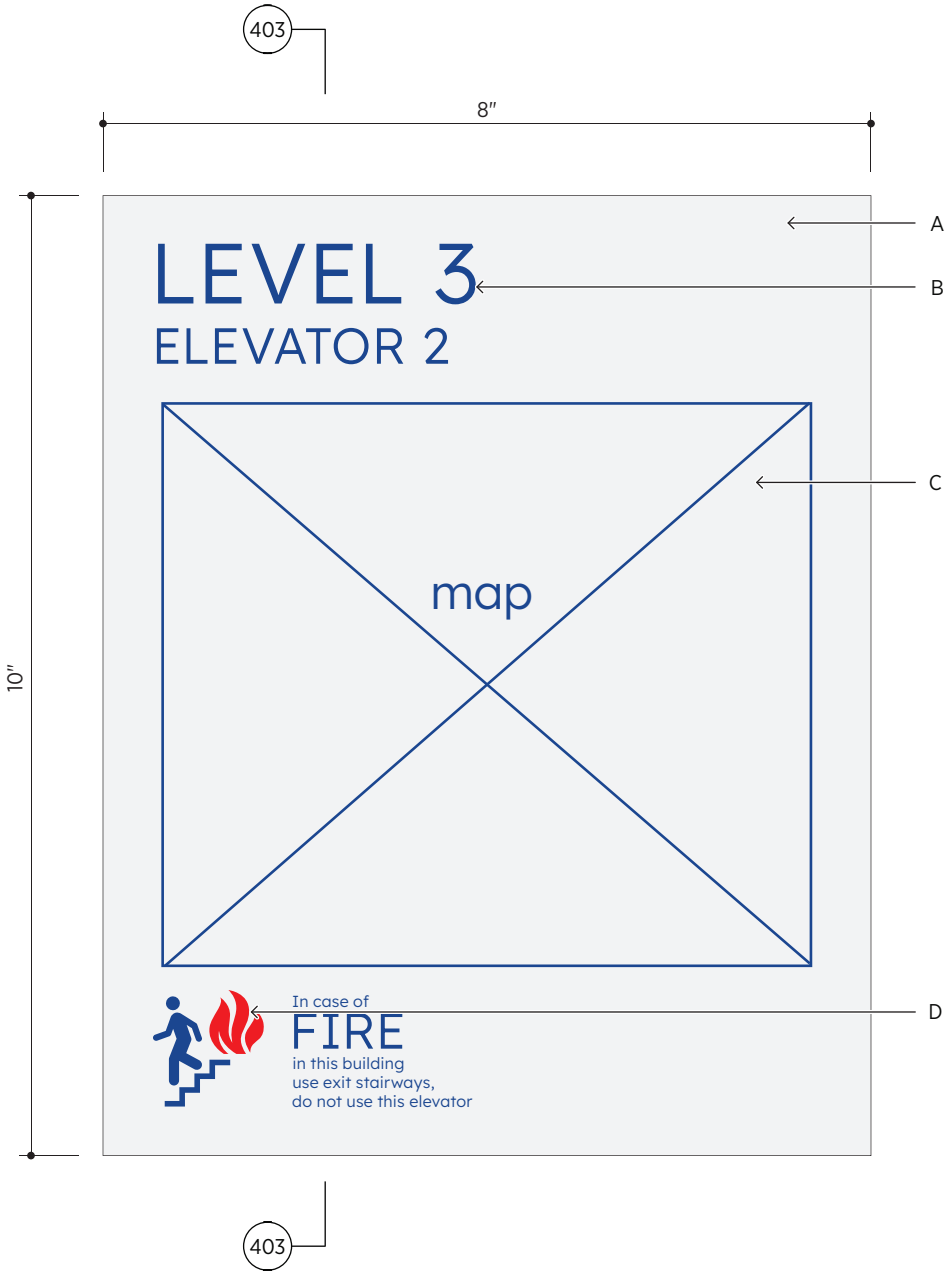
Sign Type 19A
Stair Landing Regulatory
General

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3"= 1'	Rev.:	
Drawn:	HM/CM	Dwg:	319A



Notes

A Acrylic plaque, painted COL-03 face and returns
B Digitally printed text, Lexend Light, COL-01
C Digitally printed map, COL-01, COL-05, COL-06, & COL-07
D Digitally printed symbol, COL-01 & COL-07

100% Construction Documents

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Framingham, MA 01701

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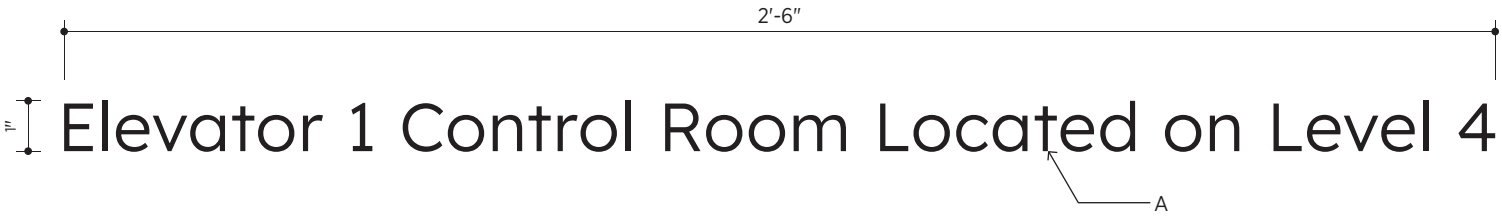
Sign Type 21
Elevator Regulatory Map

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1:2	Rev.:	
Drawn:	HM/CM	Dwg:	321



Notes

A Cut vinyl letters, Lexend Light, COL-06

100% Construction Documents

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Sign Type 22
Elevator Jamb Regulatory

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023	
Scale:	3"= 1"	Rev.:	
Drawn:	HM/CM	Dwg: 322	

Notes

A	Acrylic plaque, painted COL-03 face and returns
B	Digitally printed text, Lexend Light, COL-01
C	Digitally printed rule, COL-01
B	Digitally printed text, Lexend Medium, COL-01

100% Construction Documents

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Framingham, MA 01701

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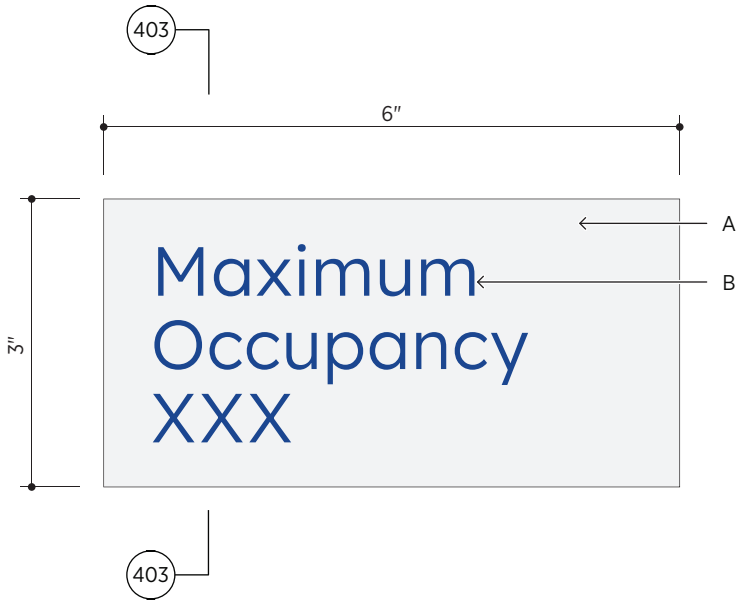
Sign Type 23
Elevator Machine Room
Regulatory

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3"= 1'	Rev.:	
Drawn:	HM/CM	Dwg:	323



Notes

A Acrylic plaque, painted COL-03 face and returns
B Digitally printed text, Lexend Light, COL-01

100% Construction Documents

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Sign Type 24
Occupancy

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1:2 Rev.:

Drawn: HM/CM Dwg: 324

Employees must wash hands before returning to work

Notes

A Acrylic plaque, painted COL-03 face and returns
B Digitally printed text, Lexend Light, COL-01

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

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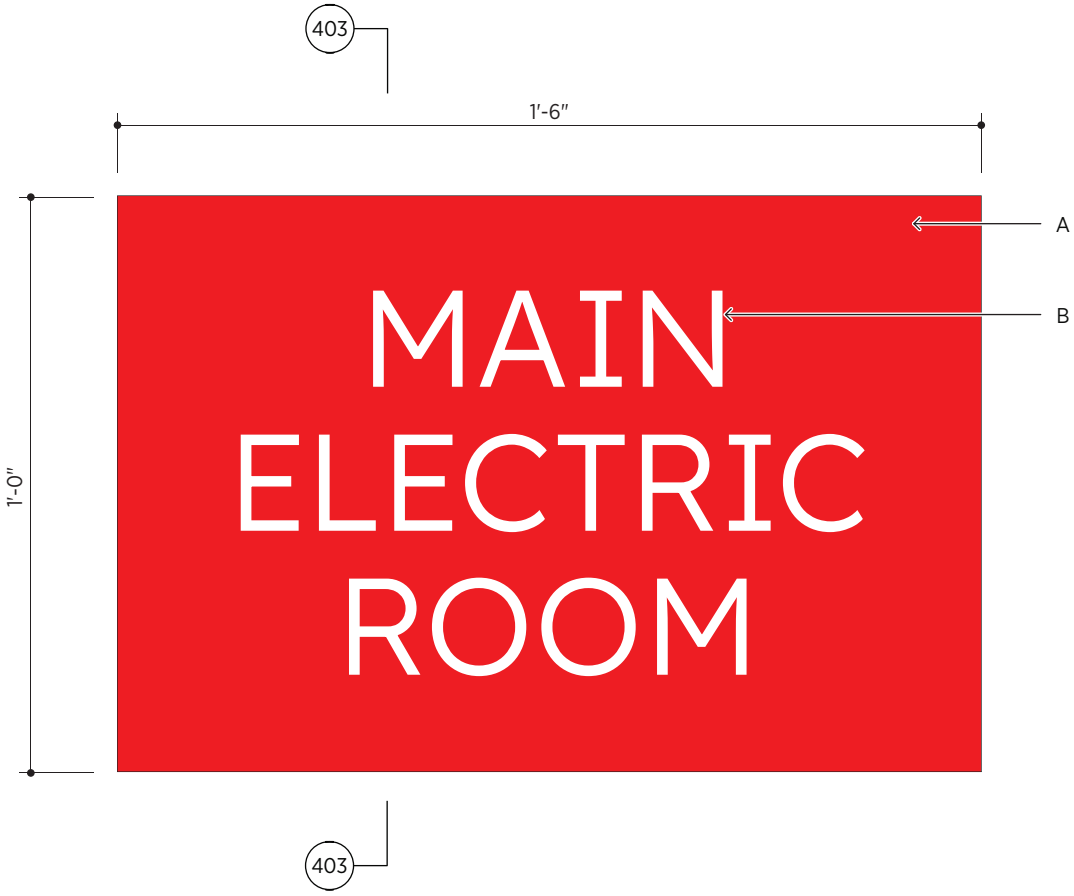
www.ai3architects.com

Sign Type 27
Regulatory/Information, Small

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1:1 Rev.:
Drawn: HM/CM Dwg: 327



Notes

A Acrylic plaque, painted COL-07 face and returns
B Digitally printed text, Lexend Light, COL-05

100% Construction Documents

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Framingham, MA 01701

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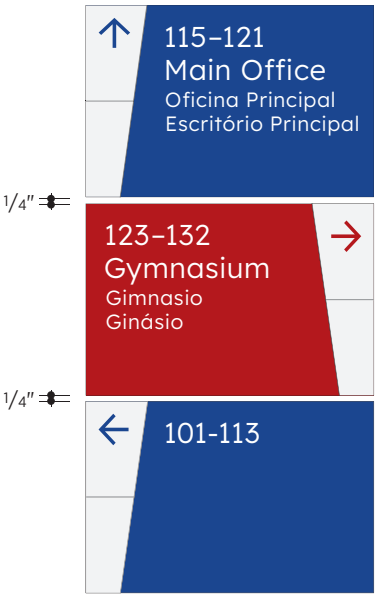
Sign Type 28
Interior FD Regulatory

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 3"= 1' Rev.:

Drawn: HM/CM Dwg: 328



Scale: 1/8″= 1″

Notes

A Digitally printed arrow, COL-01
B Digitally printed text, Lexend Light, COL-05
C 1/16″ thick x 1/32″ deep machine routed line, painted COL-03
D Masked and painted COL-03, face and right portion of returns
E Acrylic plaque, painted COL-01, face and left portion of returns

100% Construction Documents

Ai3 Architects
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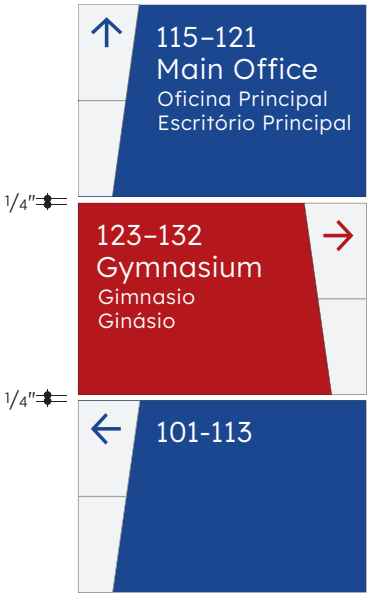
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 30
Corridor Directional

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 3/8″ = 1″ Rev.:
Drawn: HM/CM Dwg: 330



Notes

Scale: 1/8″= 1″

A Digitally printed arrow, COL-02
B Digitally printed text, Lexend Light, COL-05
C 1/16″ thick x 1/32″ deep machine routed line, painted COL-03
D Masked and painted COL-03, face and left portion of returns
E Acrylic plaque, painted COL-02, face and right portion of returns

100% Construction Documents

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Framingham, MA 01701

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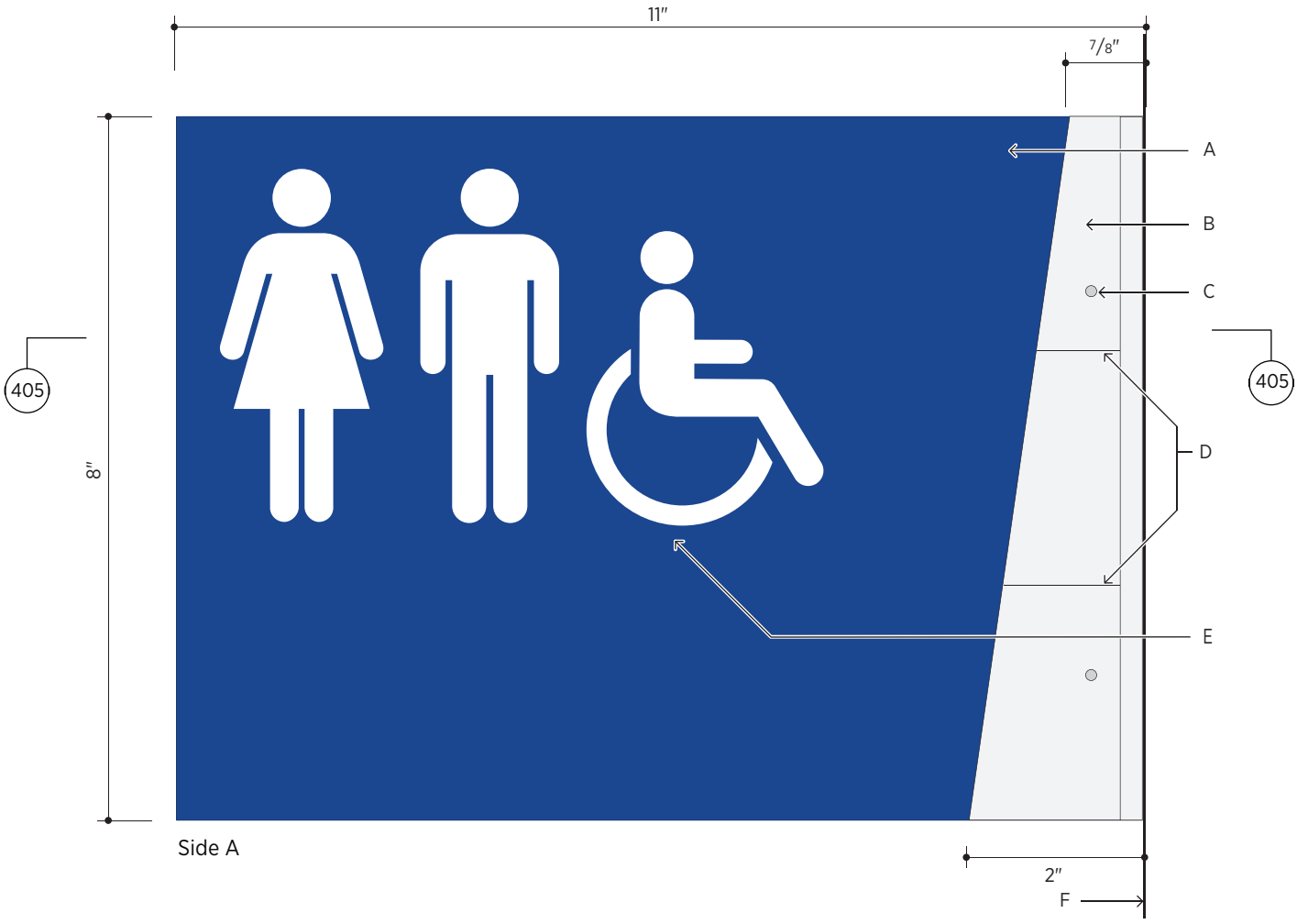
Sign Type 30.1
Corridor Directional

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3/8″ = 1″	Rev.:	
Drawn:	HM/CM	Dwg:	330.1



Notes

A	Acrylic plaque, painted COL-01, all exposed surfaces
B	Aluminum bracket, painted COL-03 all exposed surfaces; mechanically fastened to wall
C	Stainless steel set screw 7/8″ long
D	1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E	Digitally printed symbol, on sides A and B
F	Mounting surface

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
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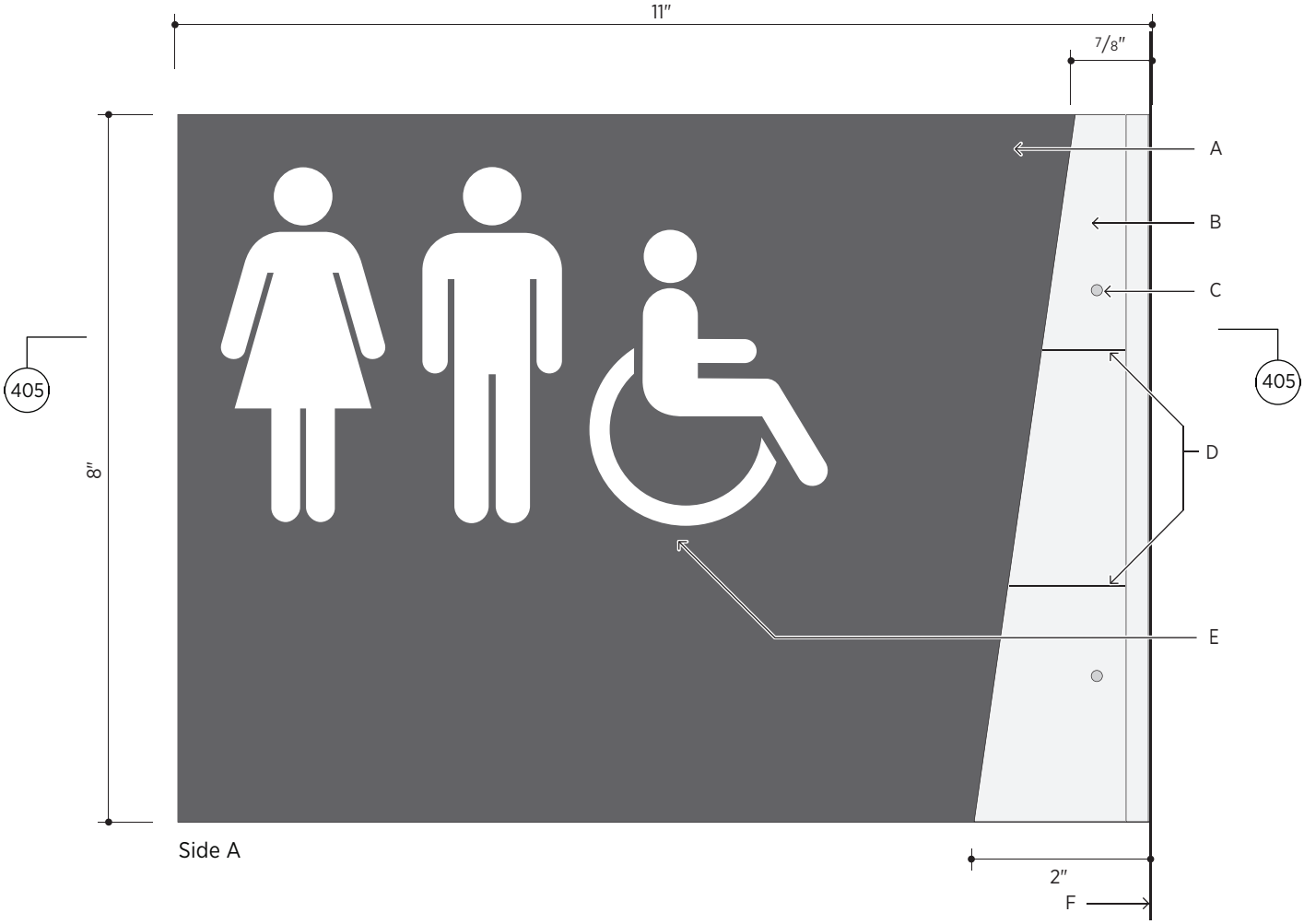
Sign Type 35
Flag Mounted ID
Academic

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1:2	Rev.:
Drawn:	HM/CM	Dwg: 335



Side A

Top view

Notes

A Acrylic plaque, painted COL-04, all exposed surfaces
B Aluminum bracket, painted COL-03 all exposed surfaces; mechanically fastened to wall
C Stainless steel set screw 7/8″ long
D 1/16″ thick x 1/32″ deep machine routed line, painted COL-03
E Digitally printed symbol, on sides A and B
F Mounting surface

100% Construction Documents

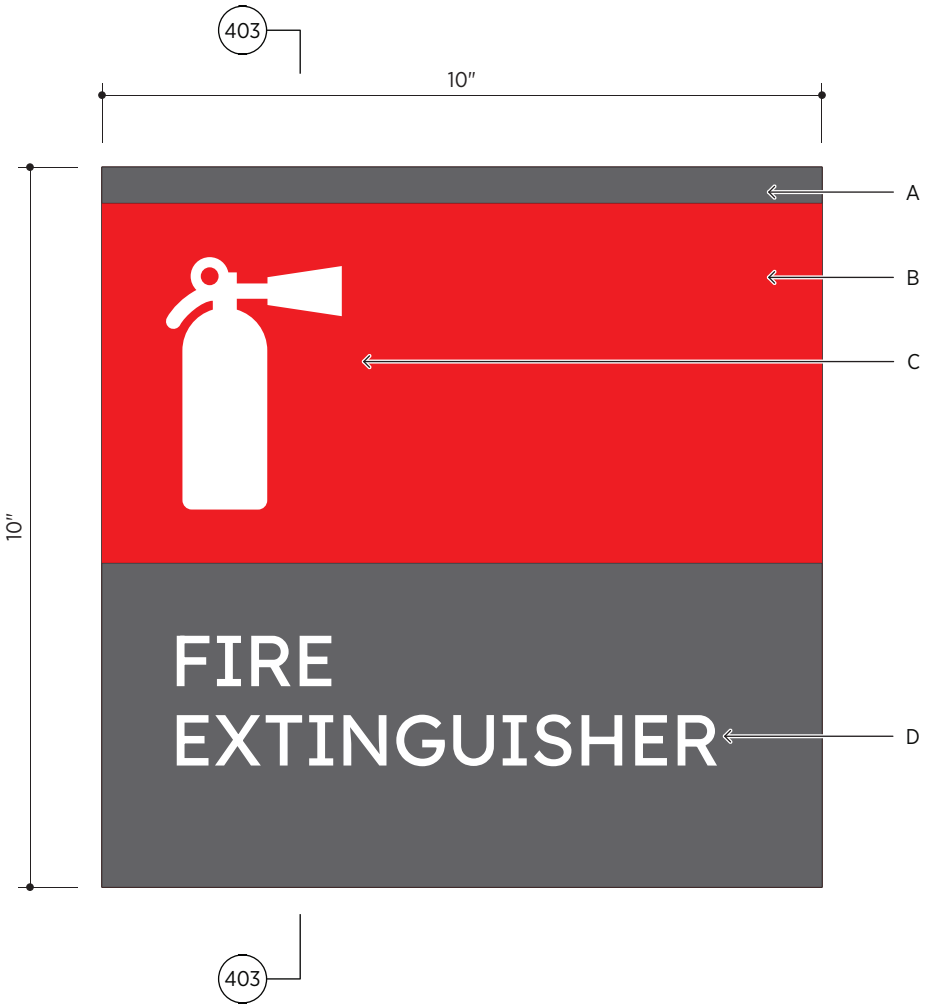
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 35A
Flag Mounted ID
General

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1:2	Rev.:
Drawn:	HM/CM	Dwg: 335A



Notes

A Acrylic plaque, painted COL-04 face and returns
B Masked and painted COL-07 face and returns
C Digitally printed symbol, COL-05
D Digitally printed text, Lexend Light, COL-05
E Mounted at 7'- 0" to top of sign

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 37A
Safety,
Fire Extinguisher

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3/8"= 1"	Rev.:	
Drawn:	HM/CM	Dwg:	337A

Notes

A	Acrylic plaque, painted COL-04 face and returns
B	Masked and painted COL-09 face and returns
C	Digitally printed symbol, COL-05
D	Digitally printed text, Lexend Light, COL-05
E	Mounted at 7′- 0″ to top of sign

100% Construction Documents

Ai3 Architects
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Framingham, MA 01701

508-358-0790
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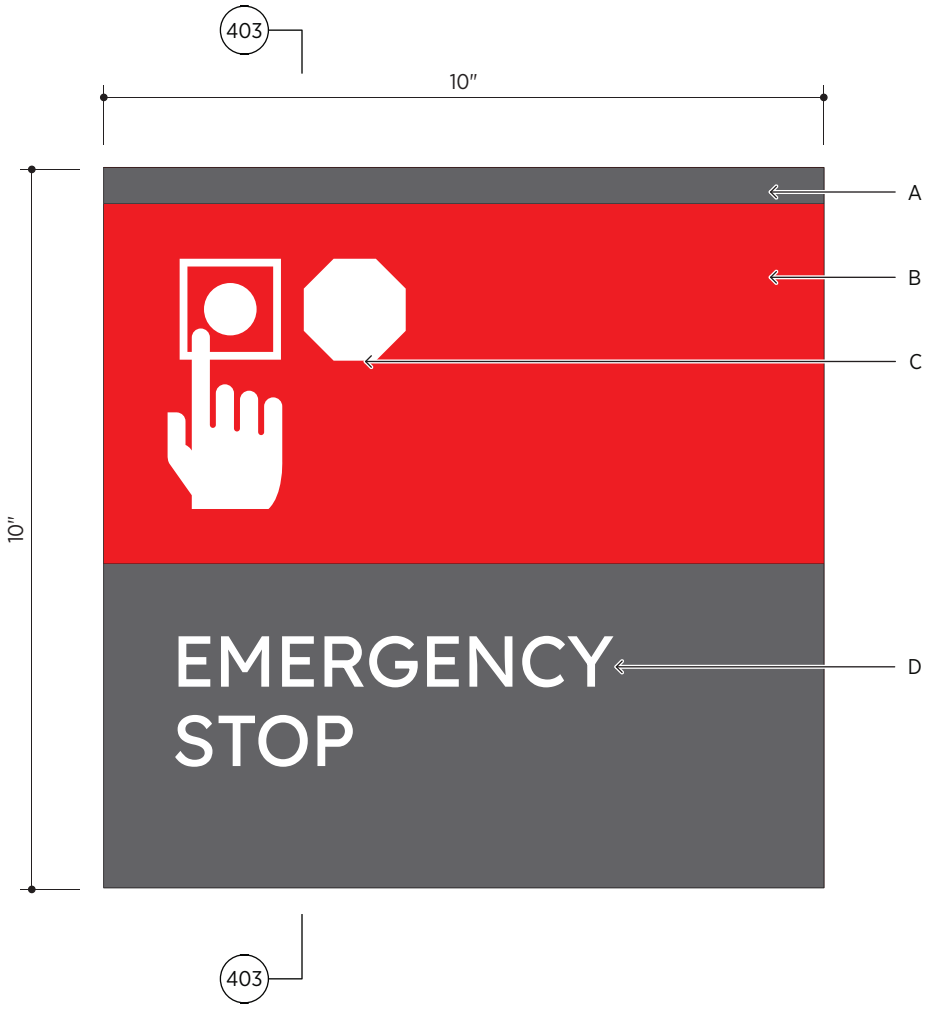
Sign Type 37B
Safety,
Goggles Must Be Worn

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3/8″= 1″	Rev.:	
Drawn:	HM/CM	Dwg:	337B



Notes

A Acrylic plaque, painted COL-04 face and returns
B Masked and painted COL-07 face and returns
C Digitally printed symbol, COL-05
D Digitally printed text, Lexend Light, COL-05
E Mounted at 7′- 0″ to top of sign

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

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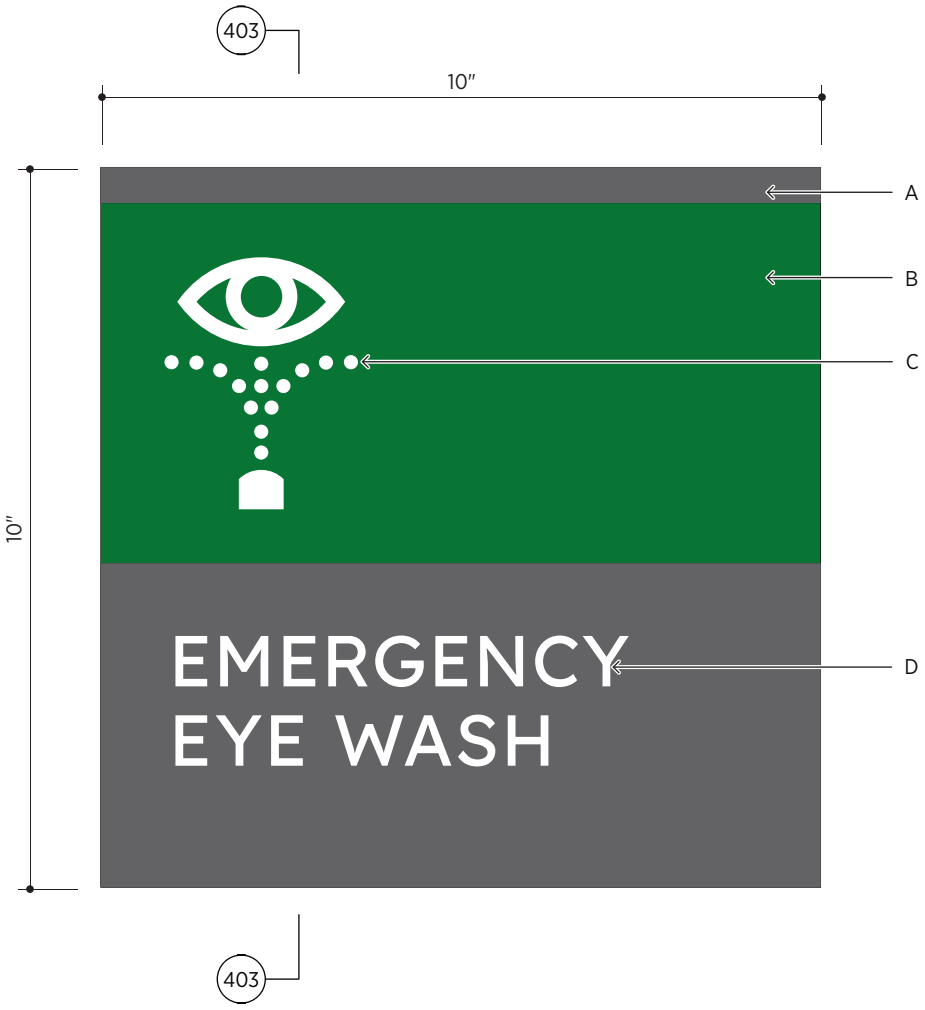
Sign Type 37C
Safety,
Emergency Stop

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3/8″= 1″	Rev.:	
Drawn:	HM/CM	Dwg:	337C



Notes

A Acrylic plaque, painted COL-04 face and returns
B Masked and painted COL-08 face and returns
C Digitally printed symbol, COL-05
D Digitally printed text, Lexend Light, COL-05
E Mounted at 7'- 0" to top of sign

100% Construction Documents

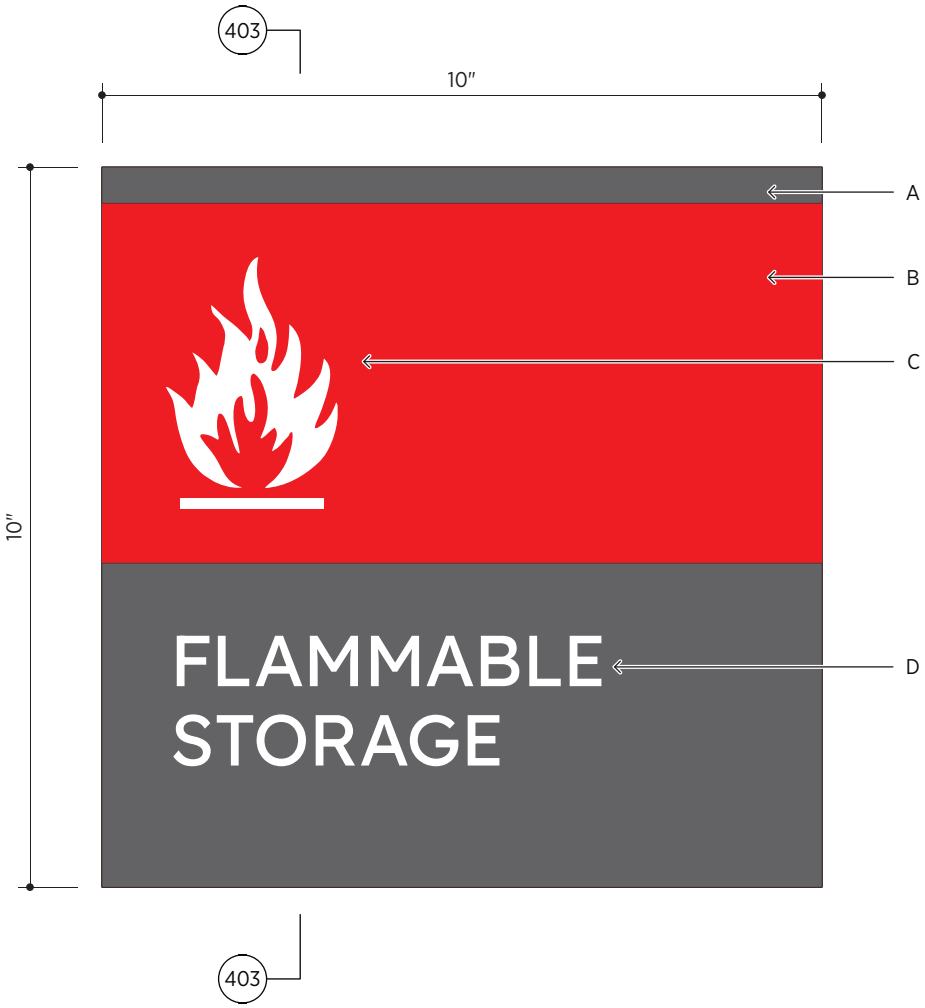
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 37D
Safety,
Eye Wash

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3/8"= 1"	Rev.:	
Drawn:	HM/CM	Dwg:	337D



Notes

A Acrylic plaque, painted COL-04 face and returns
B Masked and painted COL-07 face and returns
C Digitally printed symbol, COL-05
D Digitally printed text, Lexend Light, COL-05
E Mounted at 7'- 0" to top of sign

100% Construction Documents

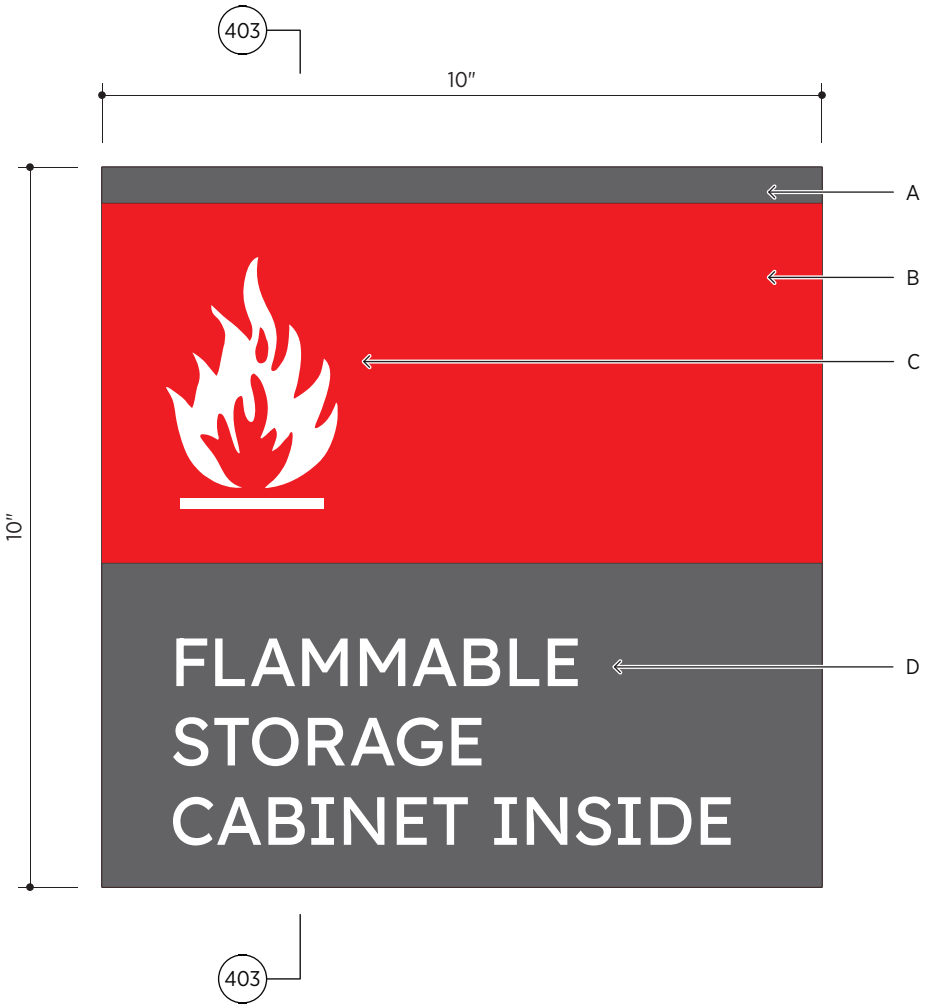
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 37E
Safety,
Flammable Storage

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	3/8"= 1"	Rev.:	
Drawn:	HM/CM	Dwg:	337E



Notes

A Acrylic plaque, painted COL-04 face and returns
B Masked and painted COL-07 face and returns
C Digitally printed symbol, COL-05
D Digitally printed text, Lexend Light, COL-05
E Mounted at 7'- 0" to top of sign

100% Construction Documents

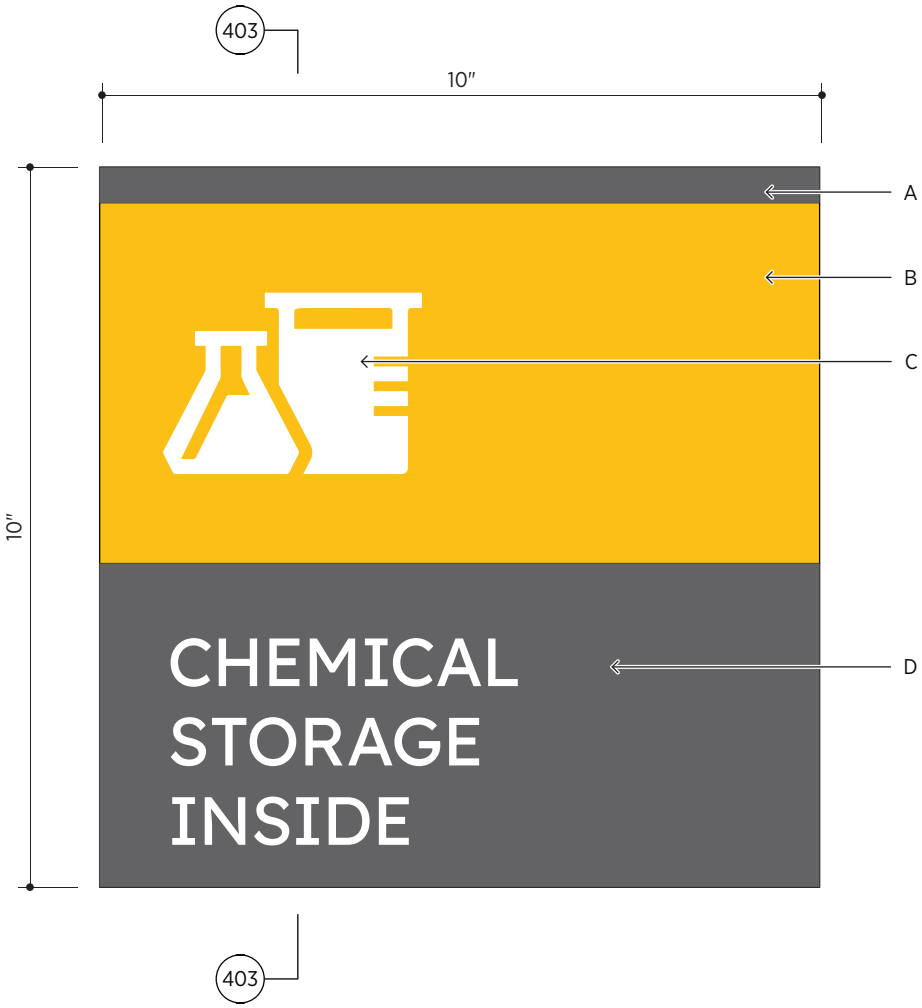
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 37F
Lab Safety,
Flammable Storage Inside

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 3/8"= 1" Rev.:
Drawn: HM/CM Dwg: 337F



Notes

A Acrylic plaque, painted COL-04 face and returns
B Masked and painted COL-10 face and returns
C Digitally printed symbol, COL-05
D Digitally printed text, Lexend Light, COL-05
E Mounted at 7′- 0″ to top of sign

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

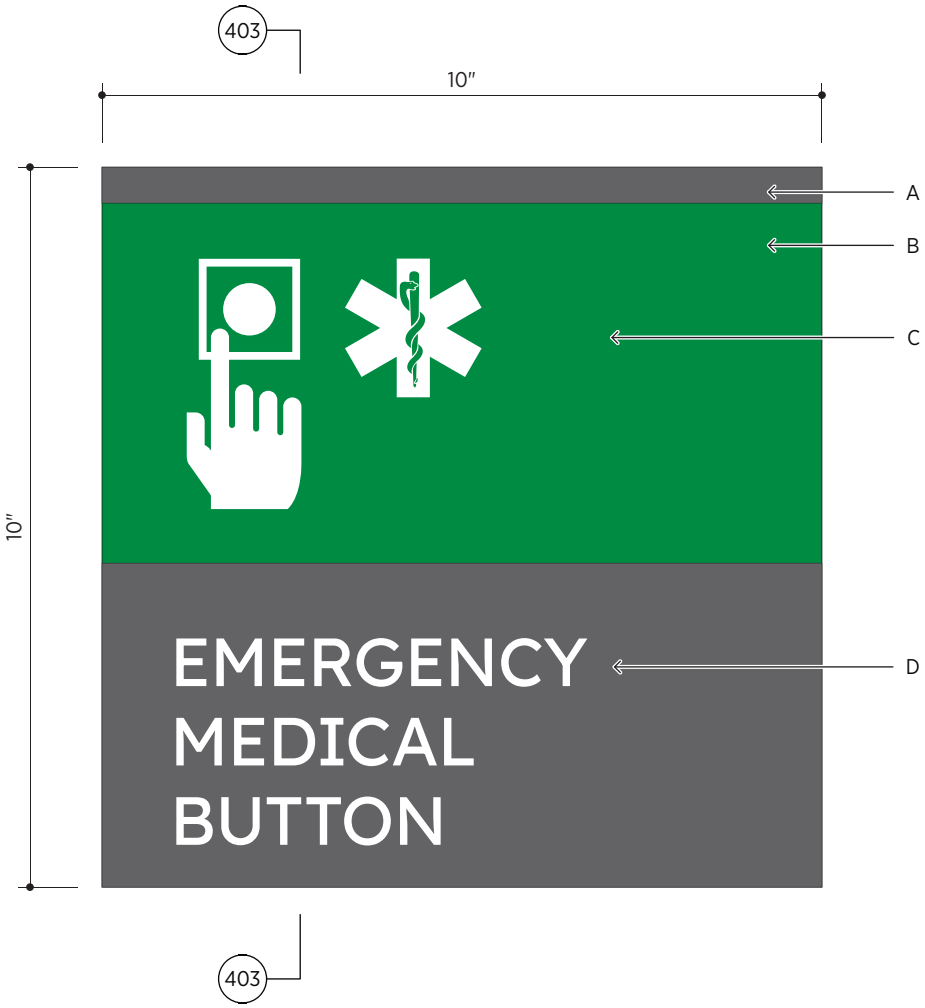
Sign Type 37G
Safety,
Chemical Storage Inside

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 3/8″= 1″ Rev.:

Drawn: HM/CM Dwg: 337G



Notes

A Acrylic plaque, painted COL-04 face and returns
B Masked and painted COL-08 face and returns
C Digitally printed symbol, COL-05
D Digitally printed text, Lexend Light, COL-05
E Mounted at 7′- 0″ to top of sign

100% Construction Documents

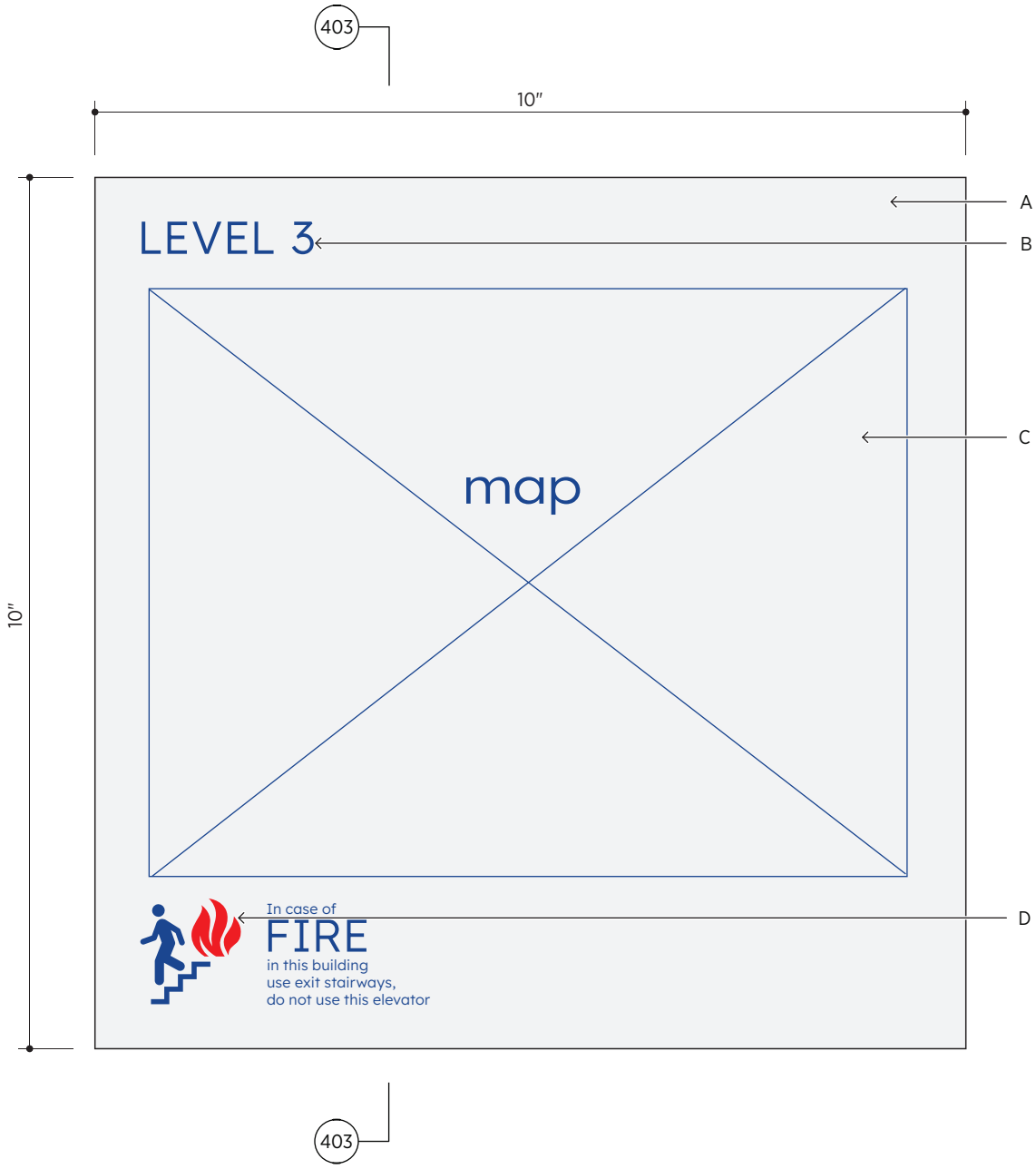
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 37H
Safety,
Emergency Medical Button

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 3/8″= 1″ Rev.:
Drawn: HM/CM Dwg: 337H



Notes

A Acrylic plaque, painted COL-03 face and returns
B Digitally printed text, Lexend Light, COL-01
C Digitally printed map, COL-01, COL-05, COL-06, & COL-07
D Digitally printed symbol, COL-01 & COL-07

100% Construction Documents

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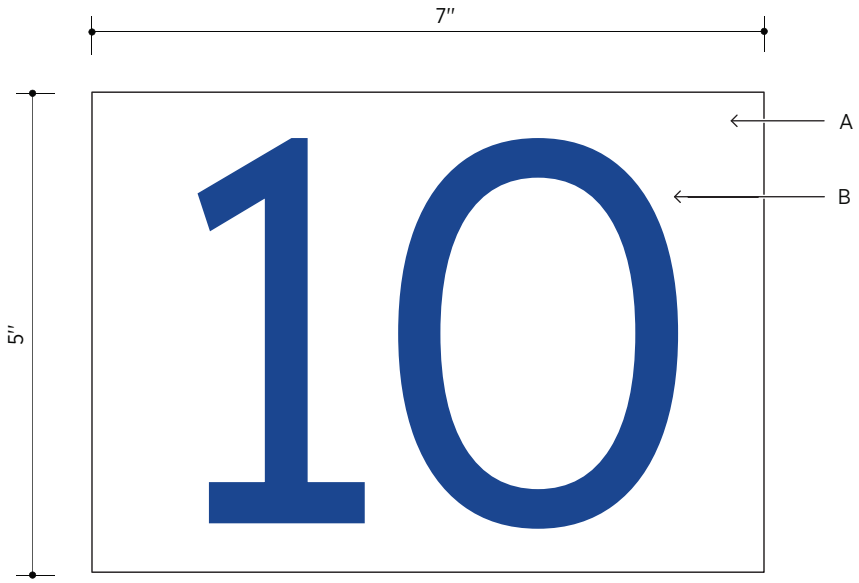
Sign Type 38
Evacuation Map

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/2″= 1′- 0″ Rev.:
Drawn: HM/CM Dwg: 338



Notes

A Vinyl, COL-05
B Cut vinyl text, Lexend Light, COL-01
C When installing on glass door, Install back to back with Exterior Vinyl Door Number (Sign Type 74)

100% Construction Documents

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Framingham, MA 01701

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Sign Type 39
Interior Vinyl Door Number

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/2″= 1″ Rev.:
Drawn: HM/CM Dwg: 339

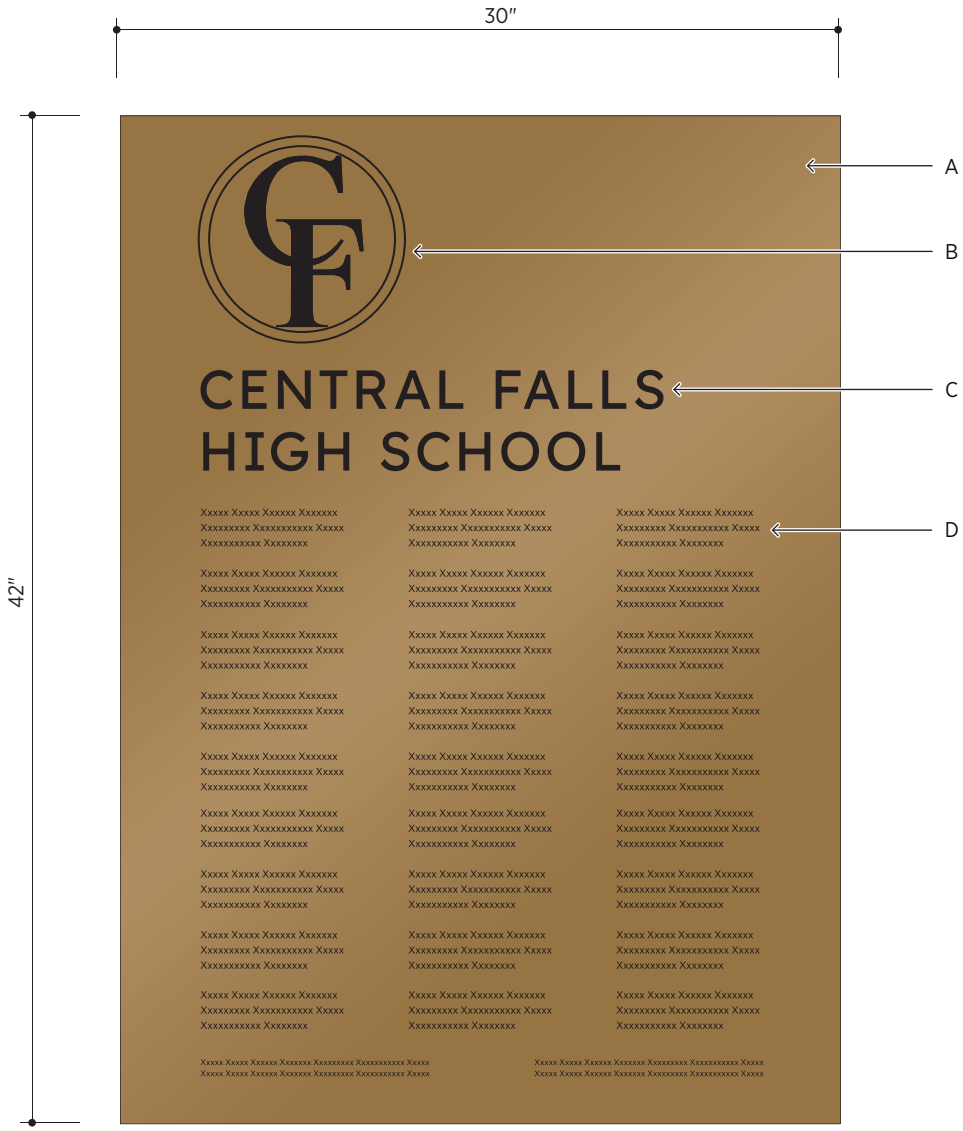

Image shown for
Illustration purpose only

Notes

A Cast Bronze plaque
B Raised logo, COL-06; artwork to be provided by Architect
C Raised text, Lexend Regular, COL-06
D Raised text, Lexend Light, COL-06
E Mounted on wall with concealed studs

100% Construction Documents

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Framingham, MA 01701

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Sign Type 40
Dedication Plaque

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/8″= 1″ Rev.:
Drawn: HM/CM Dwg: 340

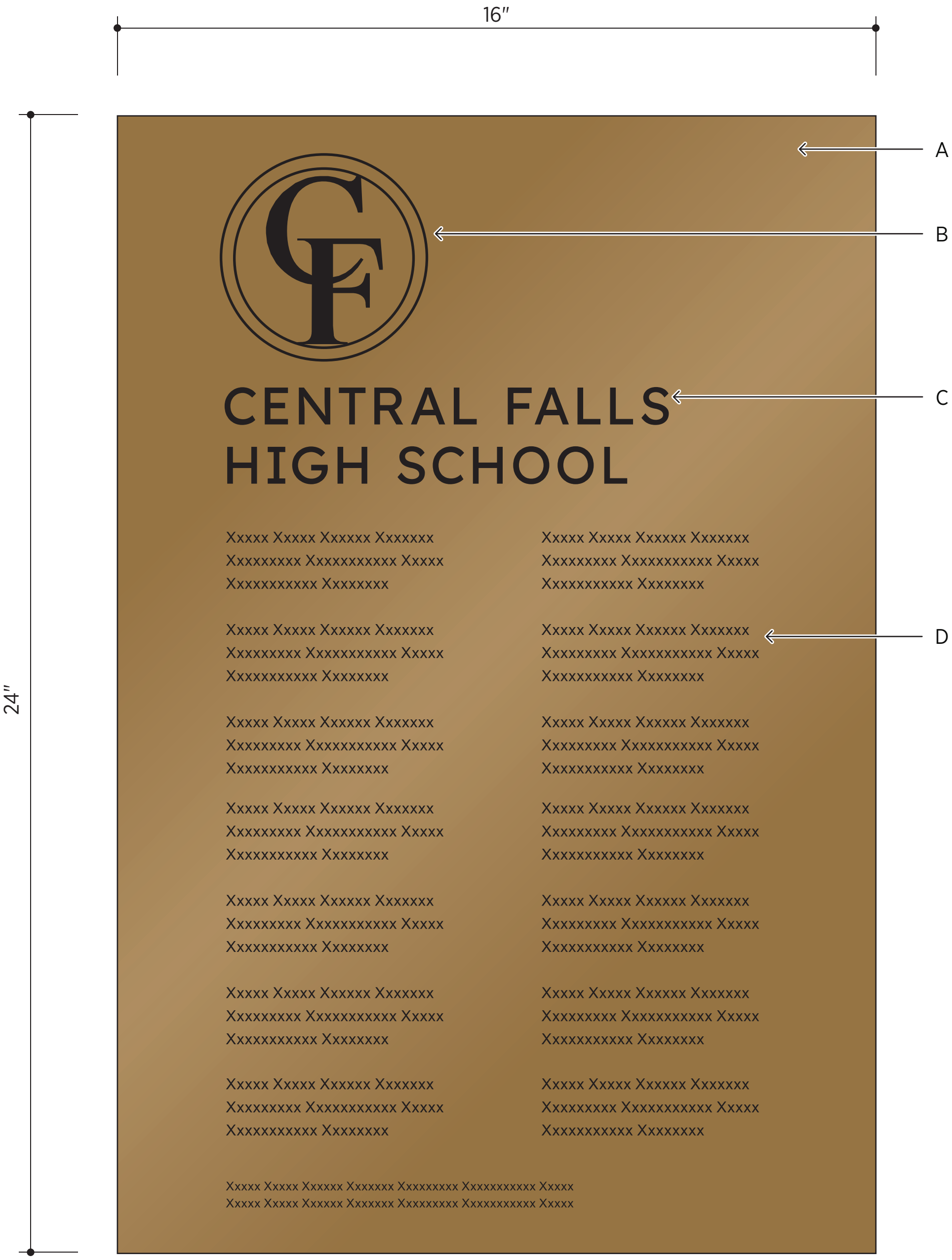


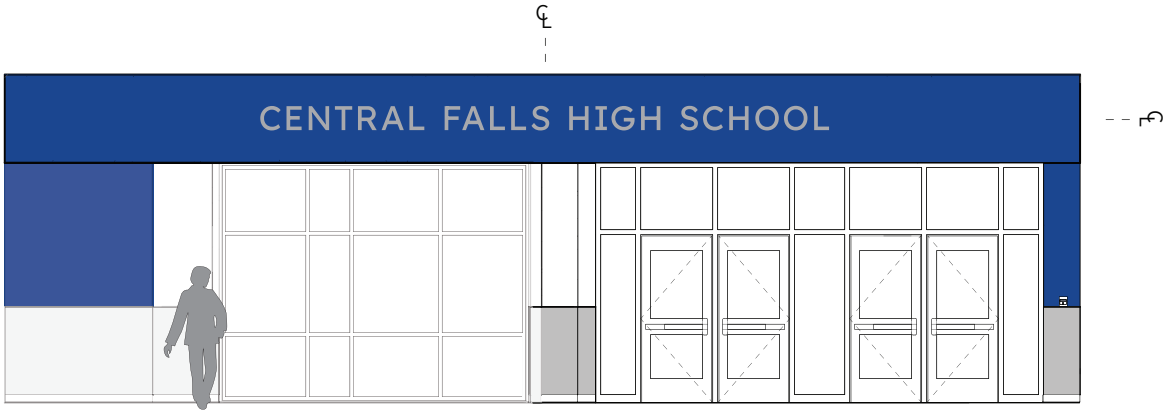
Image shown for Illustration purpose only

Notes

A Cast Bronze plaque
B Raised logo, COL-06; artwork to be provided by Architect
C Raised text, Lexend Regular, COL-06
D Raised text, Lexend Light, COL-06
E Mounted on wall with concealed studs

100% Construction Documents

Ai3 Architects 111 Speen Street, Suite 300 Framingham, MA 01701	Sign Type 41 Donor Plaque	Proj. No.: 2202.02	Date: Oct 13, 2023
		Scale: 1/4"= 1"	Rev.:
508-358-0790 www.ai3architects.com	Central Falls High School Central Falls, RI	Drawn: HM/CM	Dwg: 341



Scale: 1/8"= 1'- 0"

406

23'- 8 3/8"

12"

CENTRAL FALLS HIGH SCHOOL

Scale: 1/4"= 1'- 0"

406

Notes

A 12" cap.ht. x 1" thick, cut-acrylic letters, Lexend Light, letter spaced manually, painted COL-03 face and returns
B Mount with concealed threaded studs

100% Construction Documents

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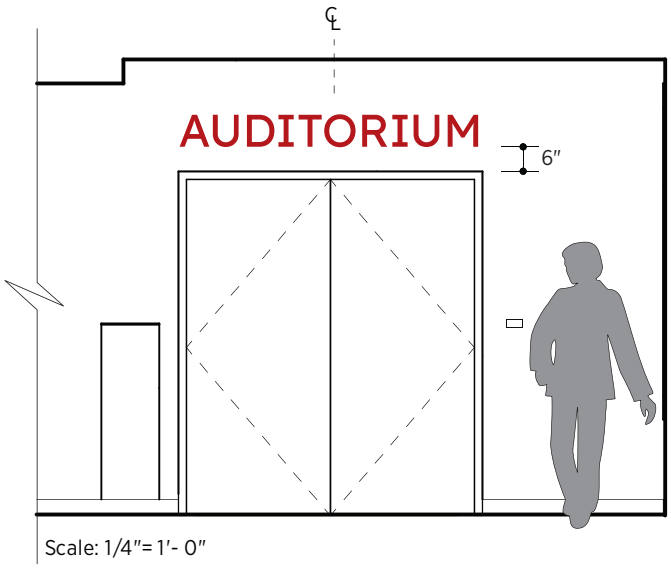
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Sign Type 42A
Interior Letters

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	As noted	Rev.:	
Drawn:	HM/CM	Dwg:	342A



Scale: 1/4″= 1′- 0″

406

6′- 2 5/8″

8″

AUDITORIUM

Scale: 3/4″= 1′- 0″

406

Notes

A 8″ cap.ht. x 3/4″ thick, cut-acrylic letters, Lexend Light, letter spaced manually, painted COL-02 face and returns
B Mount with concealed threaded studs

100% Construction Documents

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111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

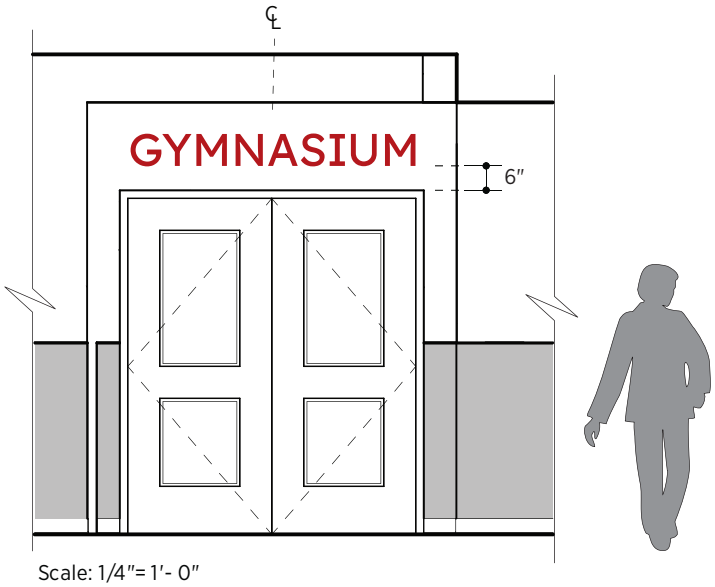
Sign Type 42B
Interior Letters

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: As noted Rev.:

Drawn: HM/CM Dwg: 342B



Scale: 1/4″= 1′- 0″

406

5′- 11 1/4″

8″

GYMNASIUM

Scale: 3/4″= 1′- 0″

406

Notes

A 8″ cap.ht. x 3/4″ thick, cut-acrylic letters, Lexend Light, letter spaced manually, painted COL-02 face and returns
B Mount with concealed threaded studs

100% Construction Documents

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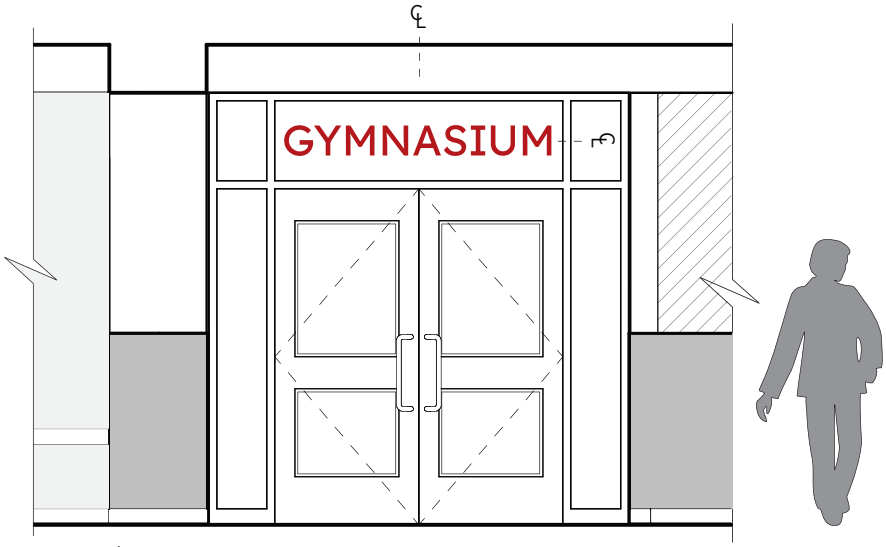
Sign Type 42B
Interior Letters

Central Falls High School
Central Falls, RI

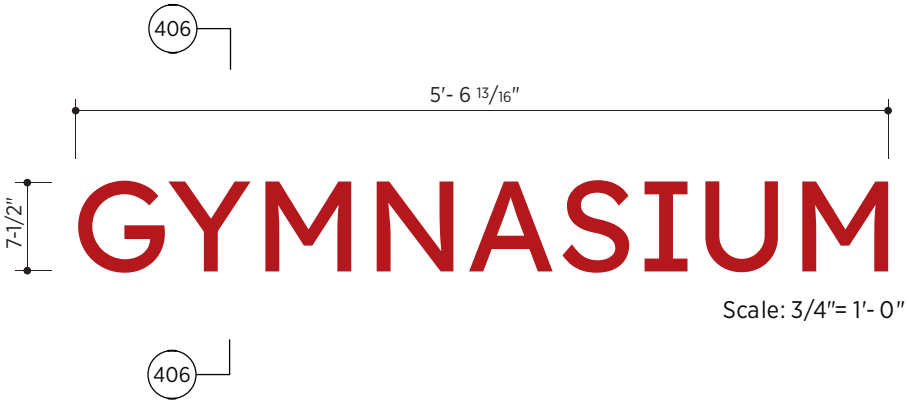
Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: As noted Rev.:

Drawn: HM/CM Dwg: 342B.1



Scale: 1/4"= 1'- 0"



Scale: 3/4"= 1'- 0"

Notes

A 7-1/2" cap.ht. x 3/4" thick, cut-acrylic letters, Lexend Light, letter spaced manually, painted COL-02 face and returns

B Mount on glass panel with full coverage VHB tape; over cut vinyl letters of same size and color, applied on first surface of glass panel

100% Construction Documents

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Framingham, MA 01701

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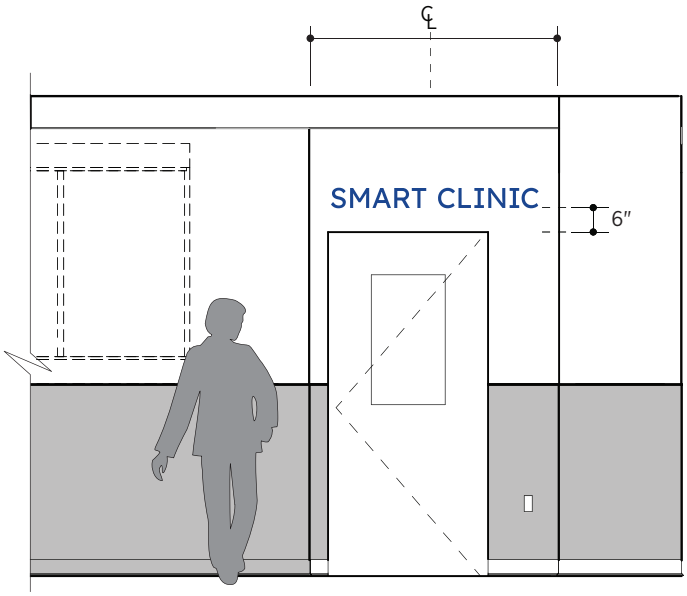
Sign Type 42B
Interior Letters

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	As noted	Rev.:
Drawn:	HM/CM	Dwg: 342B.2



Scale: 1/4″= 1′- 0″

406

4′- 3 7/8″

5″

SMART CLINIC

Scale: 3/4″= 1′- 0″

406

Notes

A 5″ cap.ht. x 3/4″ thick, cut-acrylic letters, Lexend Light, letter spaced manually, painted COL-01 face and returns
B Mount with concealed threaded studs

100% Construction Documents

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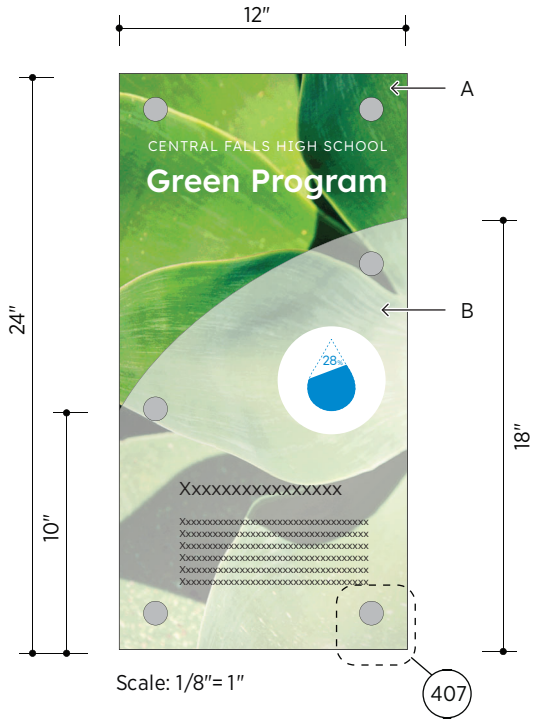
Sign Type 42C
Interior Letters

Central Falls High School
Central Falls, RI

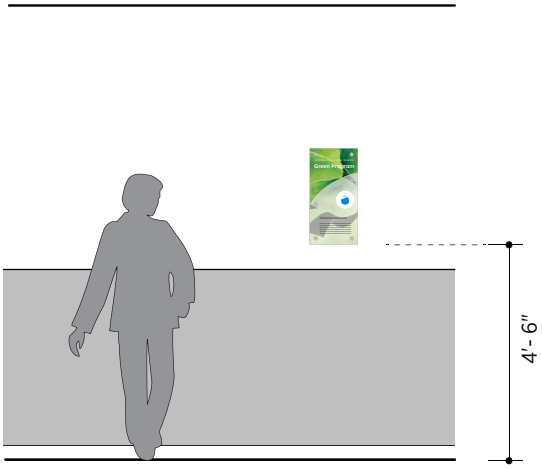
Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: As noted Rev.:

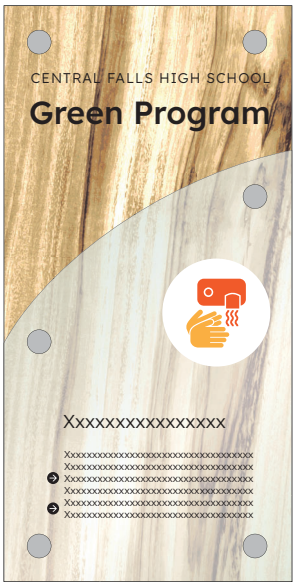
Drawn: HM/CM Dwg: 342C



Scale: 1/8″= 1″



Scale: 1/4″= 1′-0″



Artwork shown here is for illustration purposes only

Notes

A 1/4″ thick clear acrylic panel with polished edges; digitally printed image on second surface, and digitally printed text, Lexend Light and Medium and graphics, on first surface; mounted flash on wall with 1″ diameter Gifford mounting caps with concealed hardware

B 3/8″ thick P95 frosted acrylic panel with polished edges; digitally printed image and text, Lexend Light and Medium, on first surface; mounted with 1″ diameter Gyford mounting caps and 1″ deep spacers with concealed hardware

100 Construction Documents

Ai3 Architects
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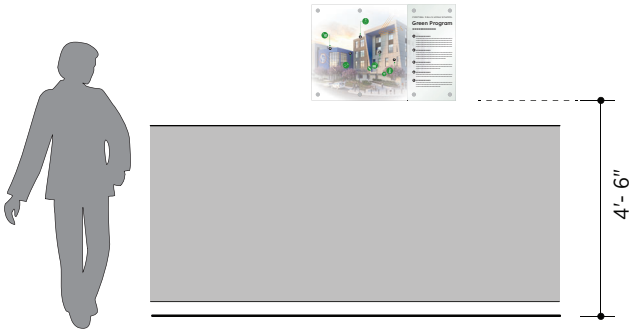
Framingham, MA 01701

508-358-0790
www.ai3architects.com

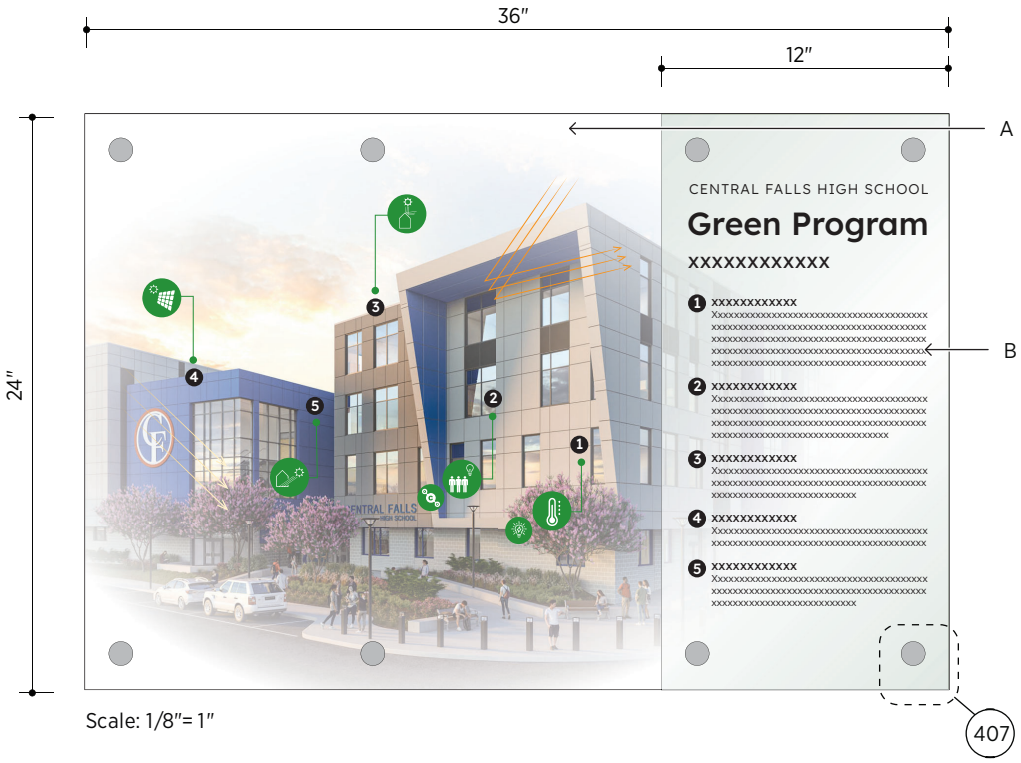
Sign Type 48
Sustainable Graphics Panel

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	As noted	Rev.:	
Drawn:	HM/CM	Dwg:	348



Scale: 1/4 "= 1'-0"



Scale: 1/8"= 1"

Artwork shown here is for illustration purposes only

Notes

A 1/4" thick clear acrylic panel with polished edges; digitally printed image on second surface, and digitally printed text, Lexend Light and Medium and graphics, on first surface; mounted flash on wall with 1" diameter Gifford mounting caps with concealed hardware

B 3/8" thick P95 frosted acrylic panel with polished edges; digitally printed image and text, Lexend Light and Medium, on first surface; mounted with 1" diameter Gyford mounting caps and 1" deep spacers with concealed hardware

100 Construction Documents

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Framingham, MA 01701

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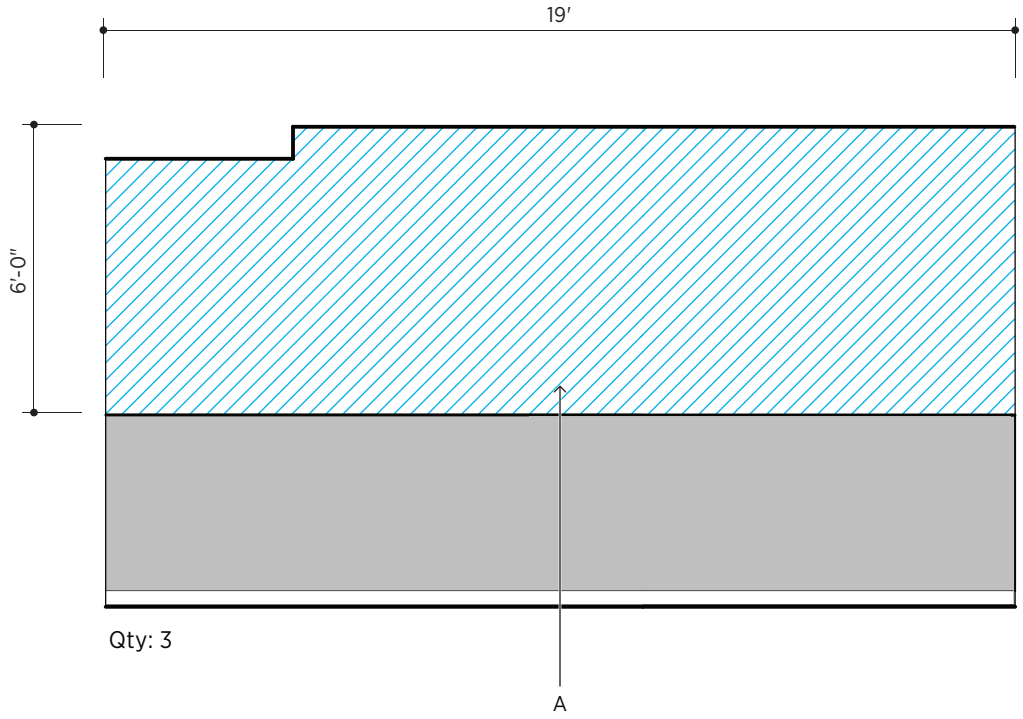
Sign Type 48A
Sustainable Graphics Panel, Large

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	As noted	Rev.:	
Drawn:	HM/CM	Dwg:	348A



Corridors
Floors 2-4, Room 2/408 - 2/410
A9.01D

Notes

A Wall covering; DreamScape Type II (20 oz.) vinyl wall covering white textures matte finish, with digitally printed graphics, multiple colors; require for new drywall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints; install per manufactures recommendation
B All dimensions, VIF
C Final digital artwork to be provided by Architect
D Total qty. 3; each will have unique artwork

100% Construction Documents

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Framingham, MA 01701

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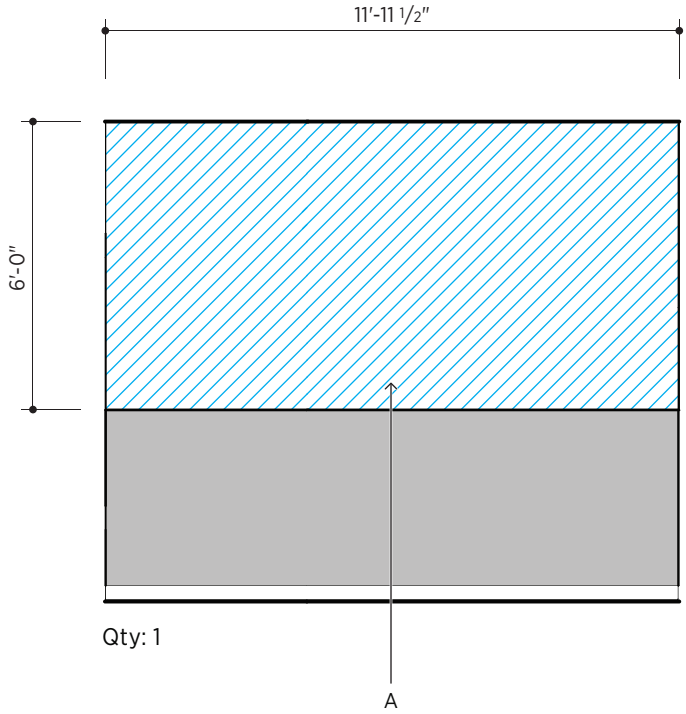
Sign Type 50
Wall Graphics

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/4"= 1'-0" Rev.:
Drawn: HM/CM Dwg: 350



Corridors
Floor 1, Room 108-110
A9.01D

Notes

A Wall covering; DreamScape Type II (20 oz.) vinyl wall covering white textures matte finish, with digitally printed graphics, multiple colors; require for new drywall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints; install per manufactures recommendation
B All dimensions, VIF
C Final digital artwork to be provided by Architect

100% Construction Documents

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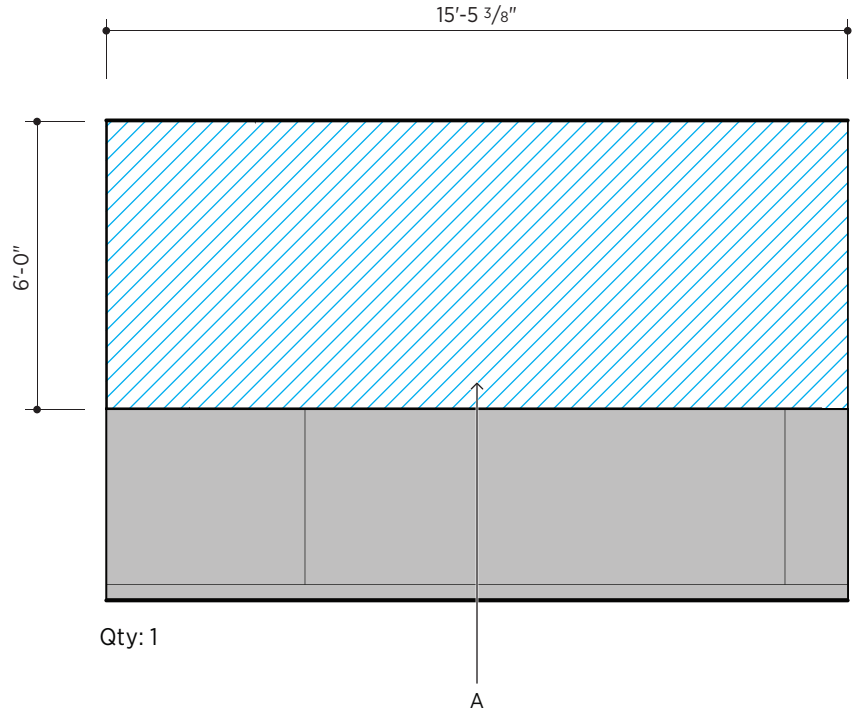
Sign Type 50
Wall Graphics

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02
Date: Oct 13, 2023
Scale: 1/4"= 1'-0"
Rev.:
Drawn: HM/CM
Dwg: 350.1



Corridors
Floor 1, Room 112
A9.01D

Notes

A Wall covering; DreamScape Type II (20 oz.) vinyl wall covering white textures matte finish, with digitally printed graphics, multiple colors; require for new drywall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints; install per manufactures recommendation
B All dimensions, VIF
C Final digital artwork to be provided by Architect

100% Construction Documents

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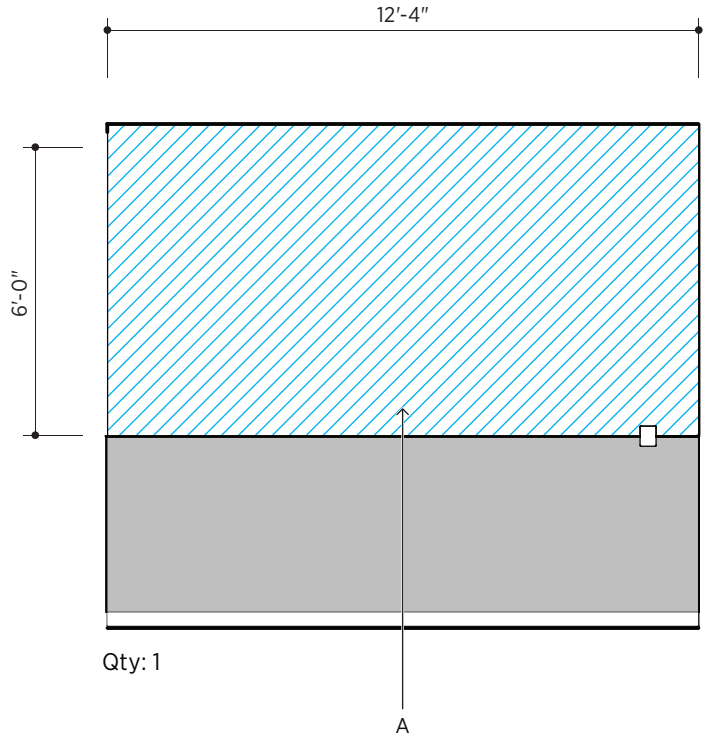
Sign Type 50
Wall Graphics

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/4"= 1'-0" Rev.:
Drawn: HM/CM Dwg: 350.2



Media Commons
Floor 1
A10.20B

Notes

A Wall covering; DreamScape Type II (20 oz.) vinyl wall covering white textures matte finish, with digitally printed graphics, multiple colors; require for new drywall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints; install per manufactures recommendation
B All dimensions, VIF
C Final digital artwork to be provided by Architect

100% Construction Documents

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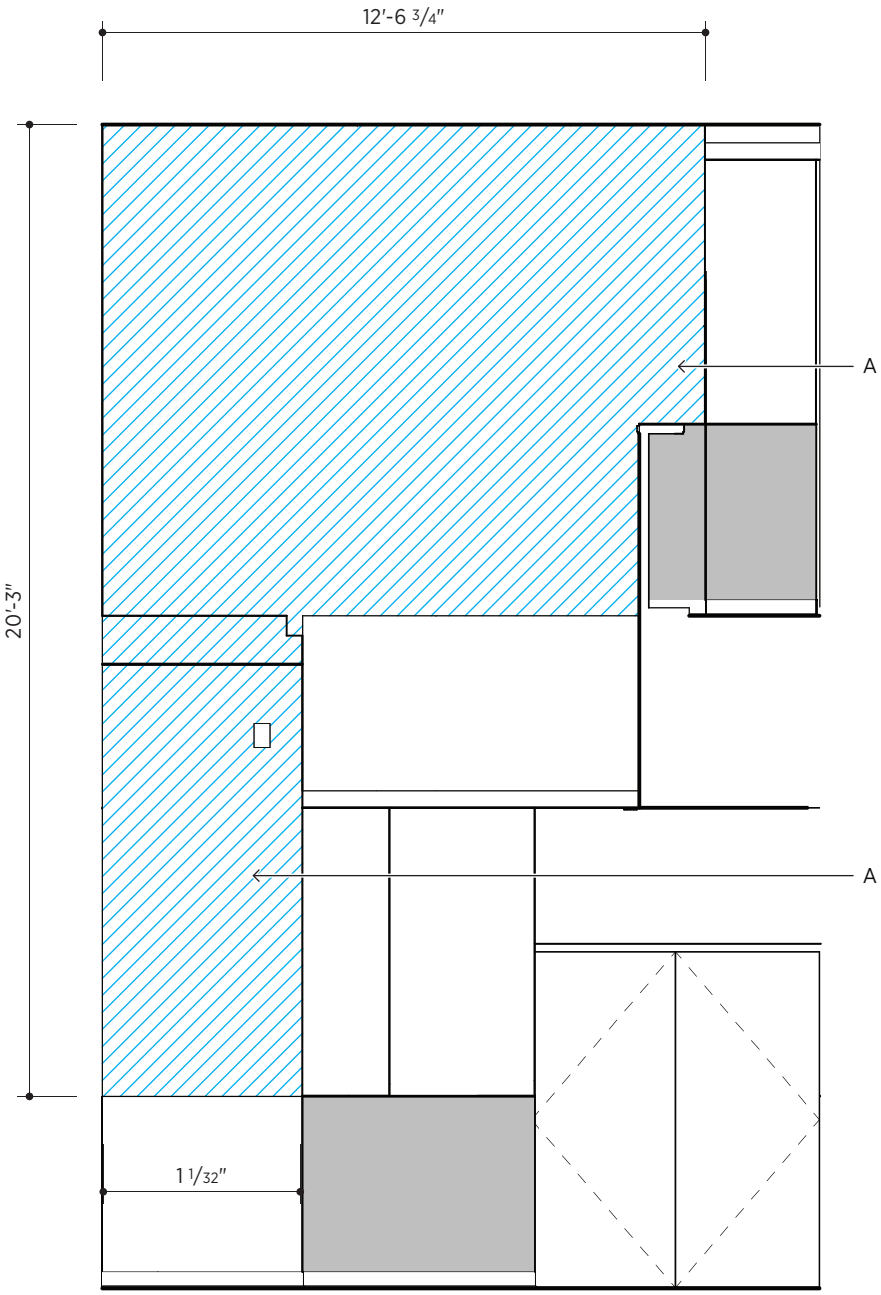
Sign Type 50
Wall Graphics

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/4"= 1'-0" Rev.:
Drawn: HM/CM Dwg: 350.3



Qty: 1 set

Student Commons
Floor 1/2
A10.03

Notes

A Wall covering; DreamScape Type II (20 oz.) vinyl wall covering white textures matte finish, with digitally printed graphics, multiple colors; require for new drywall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints; install per manufactures recommendation
B All dimensions, VIF
C Final digital artwork to be provided by Architect
D Wall covering as shown, per 1 set

100% Construction Documents

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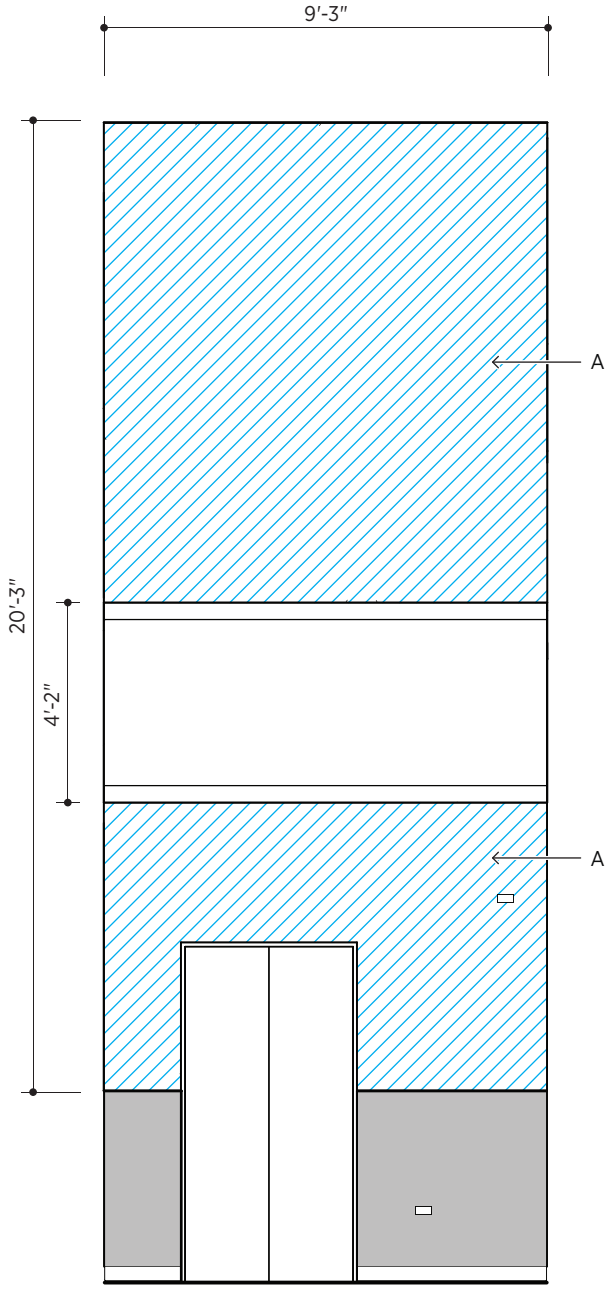
Sign Type 50
Wall Graphics

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023	
Scale:	1/4"= 1'-0"	Rev.:	
Drawn:	HM/CM	Dwg: 350.4	



Qty: 1 set

Student Commons
Floor 1/2
A10.03

Notes

A Wall covering; DreamScape Type II (20 oz.) vinyl wall covering white textures matte finish, with digitally printed graphics, multiple colors; require for new drywall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints; install per manufactures recommendation
B All dimensions, VIF
C Final digital artwork to be provided by Architect
D Wall covering as shown, per 1 set

100% Construction Documents

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Framingham, MA 01701

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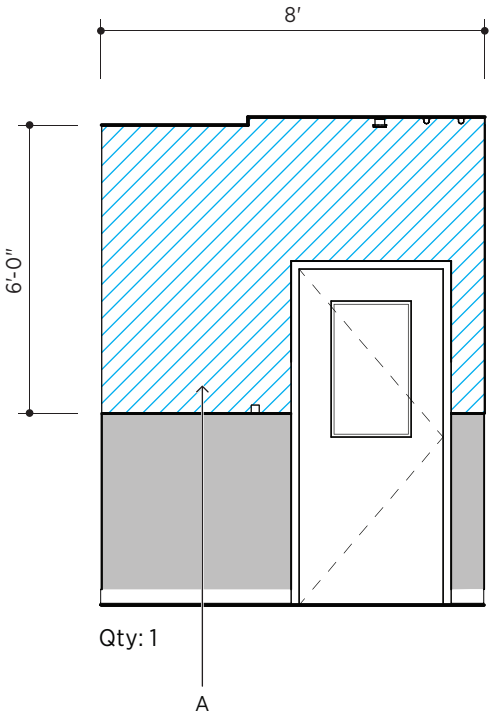
Sign Type 50
Wall Graphics

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/4"= 1'-0" Rev.:
Drawn: HM/CM Dwg: 350.5



Corridor (double height)
Floor 1
A9.01A

Notes

A Wall covering; DreamScape Type II (20 oz.) vinyl wall covering white textures matte finish, with digitally printed graphics, multiple colors; require for new drywall surface to be smooth, properly primed. Use a primer that dries to a solid color to conceal drywall joints; install per manufactures recommendation
B All dimensions, VIF
C Final digital artwork to be provided by Architect

100% Construction Documents

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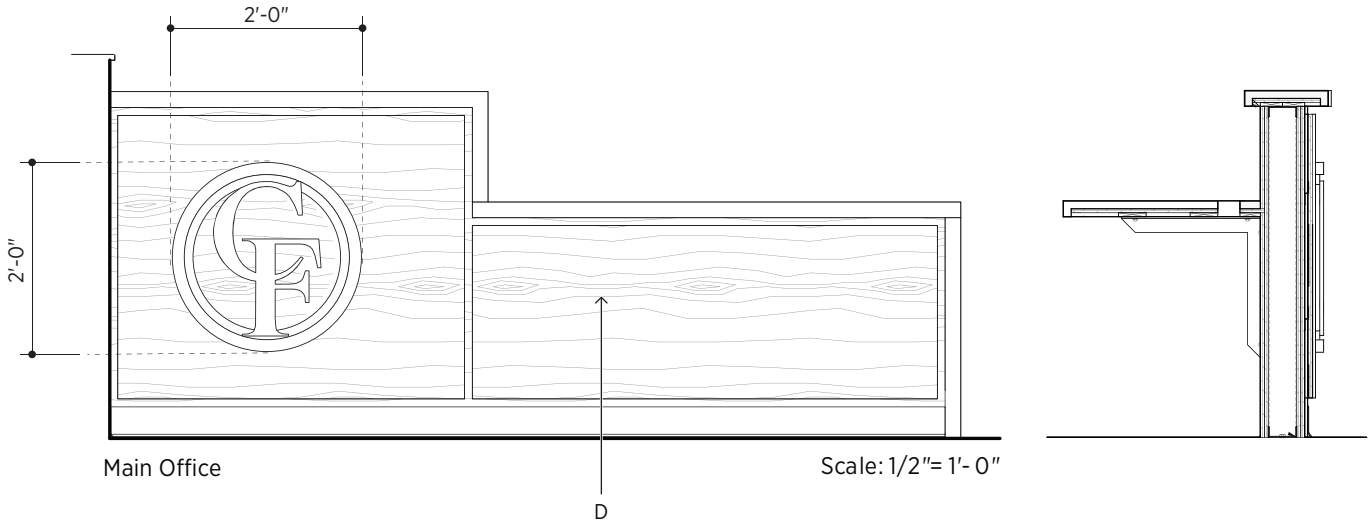
Sign Type 50
Wall Graphics

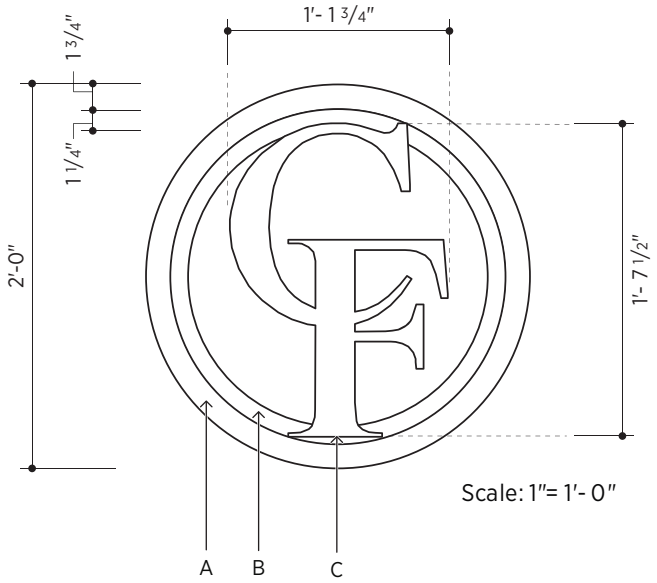
Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/4″= 1′-0″ Rev.:
Drawn: HM/CM Dwg: 350.6



Main Office

Scale: 1/2"= 1'- 0"



Scale: 1"= 1'- 0"

Notes

A 1" deep cut aluminum ring, painted COL-05 all exposed surfaces; mounted on desk with concealed threaded studs
B 1/2" deep cut aluminum ring, painted COL-05 all exposed surfaces; mounted on desk with concealed threaded studs
C 1/2" deep cut aluminum logotype, painted COL-05 all exposed surfaces; mounted on circle with concealed threaded studs
D Desk, by others

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

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www.ai3architects.com

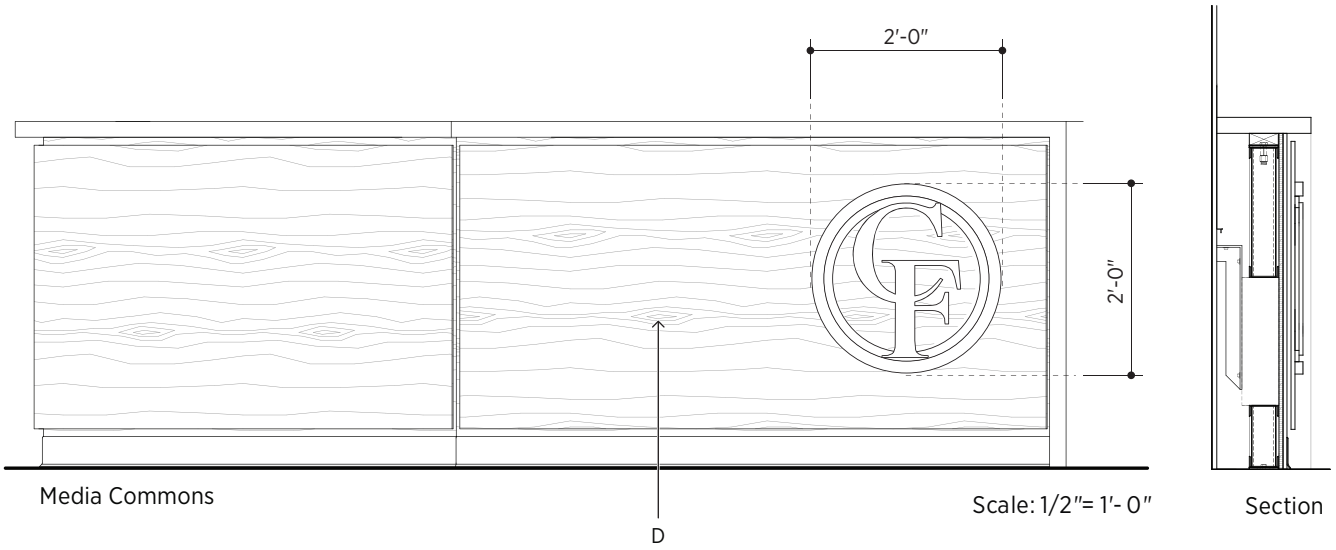
Sign Type 52
School Logo, Desk

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: As noted Rev.:

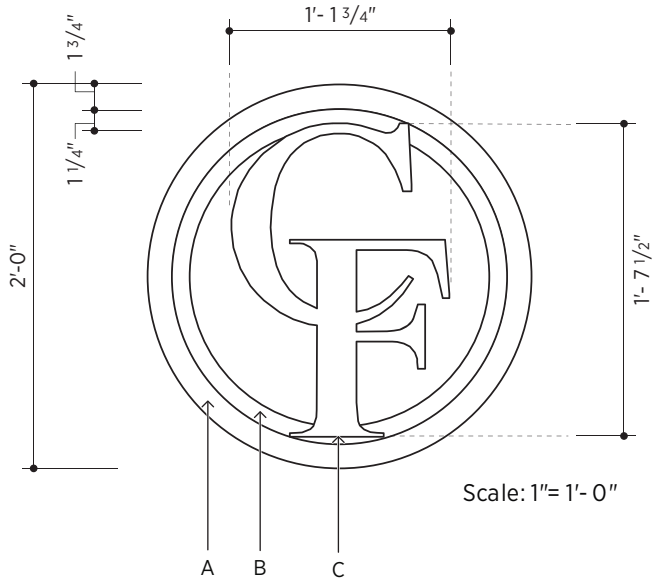
Drawn: HM/CM Dwg: 352



Media Commons

Scale: 1/2"= 1'- 0"

Section



Scale: 1"= 1'- 0"

Notes

A 1" deep cut aluminum ring, painted COL-05 all exposed surfaces; mounted on desk with concealed threaded studs
B 1/2" deep cut aluminum ring, painted COL-05 all exposed surfaces; mounted on desk with concealed threaded studs
C 1/2" deep cut aluminum logotype, painted COL-05 all exposed surfaces; mounted on circle with concealed threaded studs
D Desk, by others

100% Construction Documents

Ai3 Architects
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Framingham, MA 01701

508-358-0790
www.ai3architects.com

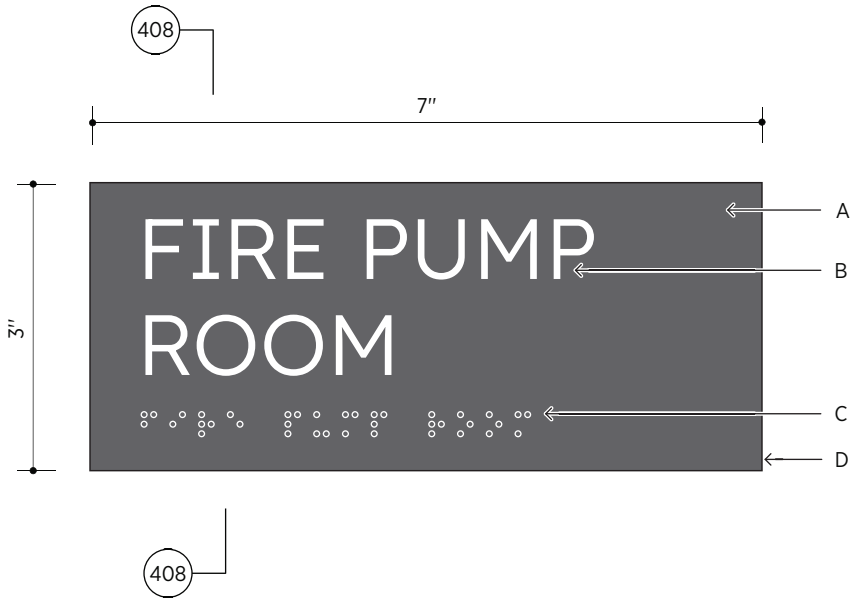
Sign Type 52
School Logo, Desk

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: As noted Rev.:

Drawn: HM/CM Dwg: 352.1



Notes

A Exterior grade thermoformed acrylic plaque, painted COL-04
B Tactile text, Lexend Light COL-05
C Grade II Braille
D Recessed shim plate

100% Construction Documents

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Framingham, MA 01701

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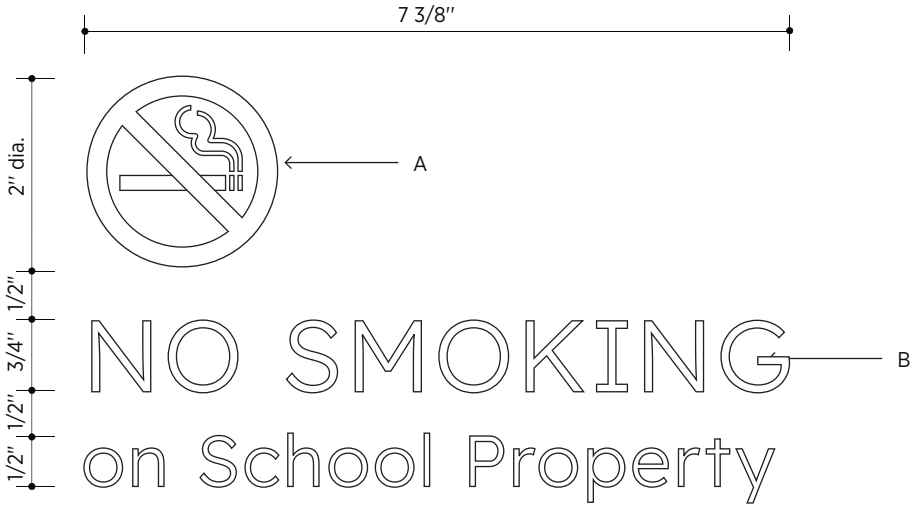
Sign Type 60
Exterior Door ID

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/2" = 1" Rev.:
Drawn: HM/CM Dwg: 360



Notes

A Cut vinyl symbol, COL-05
B Cut vinyl text, Lexend Light, COL-05

100% Construction Documents

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Framingham, MA 01701

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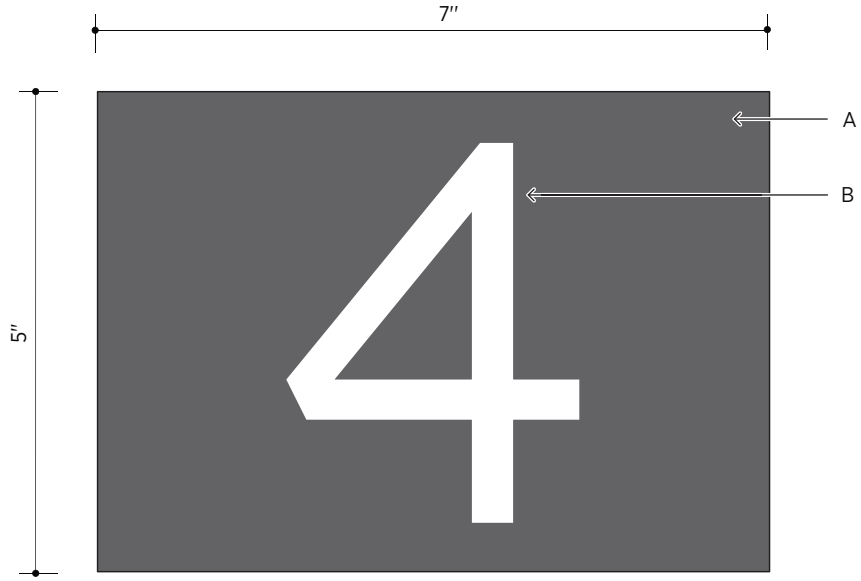
Sign Type 71
No Smoking Vinyl

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	1/2"= 1"	Rev.:	
Drawn:	HM/CM	Dwg:	371



Notes

A Vinyl, COL-04
B Cut vinyl text, Lexend Light, COL-05
C When installing on glass door place back to back with Int Vinyl Door Number (Sign Type 39)

100% Construction Documents

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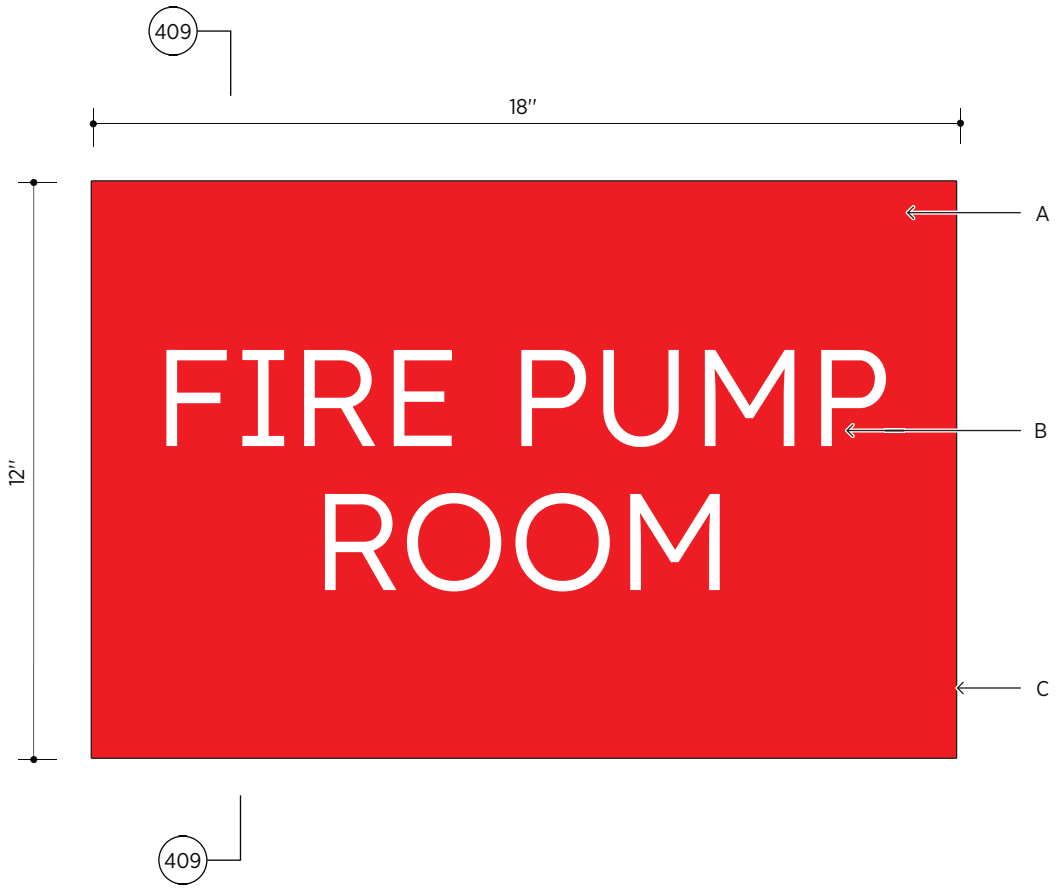
Sign Type 74
Exterior Vinyl Door Number

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023	
Scale:	1/2"= 1"	Rev.:	
Drawn:	HM/CM	Dwg: 374	



Notes

A	Aluminum plaque, painted COL-07
B	Cut vinyl text, Lexend Light, COL-05
C	Recessed shim plate

100% Construction Documents

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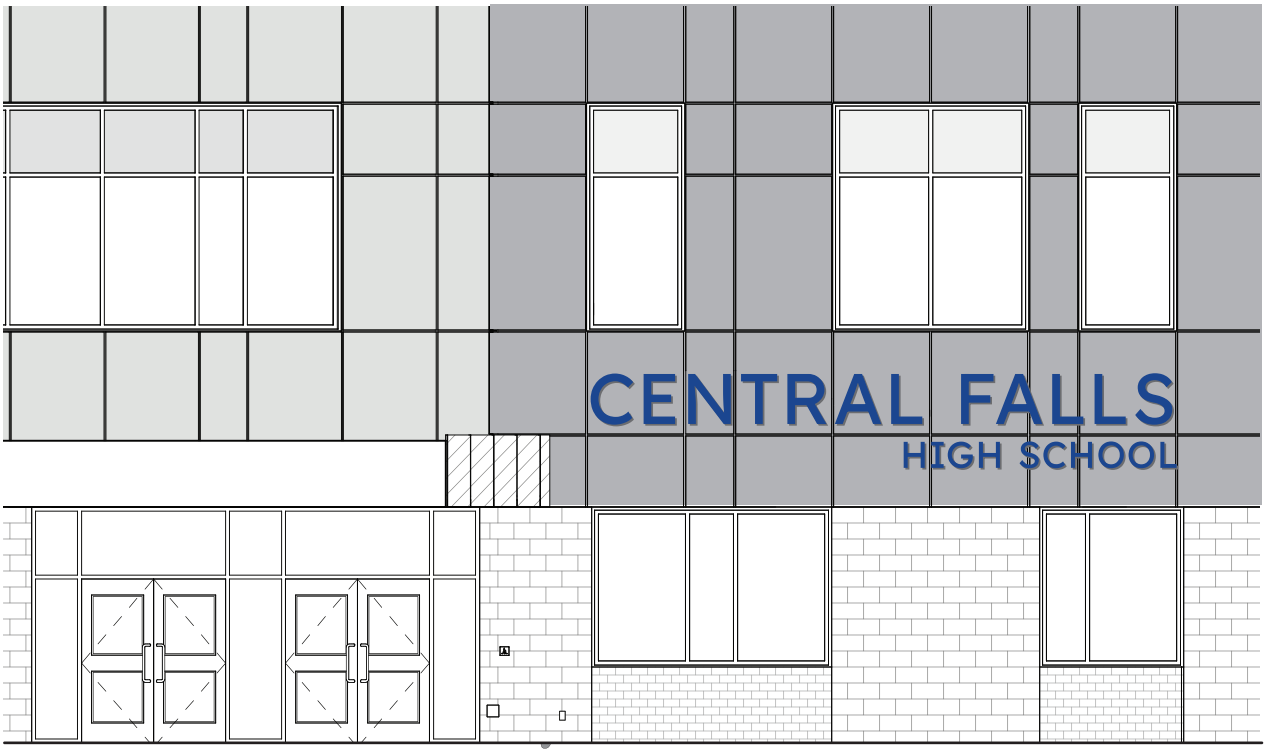
Sign Type 75
Exterior FD Regulatory

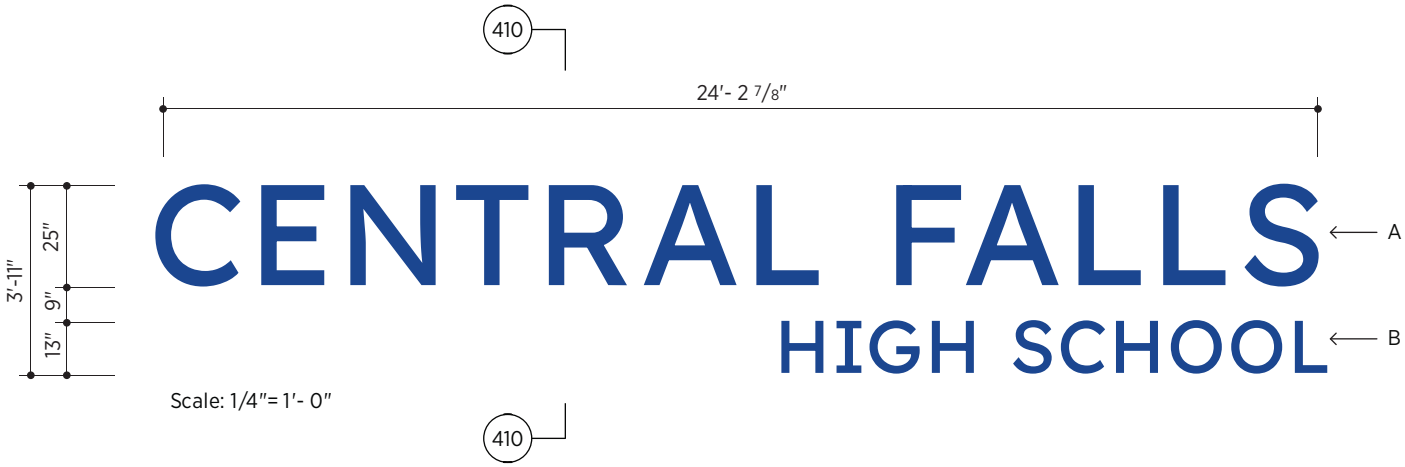
Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	1/4″= 1″	Rev.:
Drawn:	HM/CM	Dwg: 375



Lonsdale Entrance

Scale: 1/8"= 1'- 0"



Scale: 1/4"= 1'- 0"

Notes

A	25" cap.ht. x 3" deep, halo illuminated fabricated aluminum letters; Lexend Regular, letter spaced manually; painted COL-01 face and returns; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga., with clear polycarbonate back panel with LED modules
B	13" cap.ht. x 3" deep, halo illuminated fabricated aluminum letters; Lexend Regular, letter spaced manually; painted COL-01 face and returns; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga., with clear polycarbonate back panel with LED modules
C	Mounted with 3" spacers
D	Blocking required behind wall

100% Construction Documents

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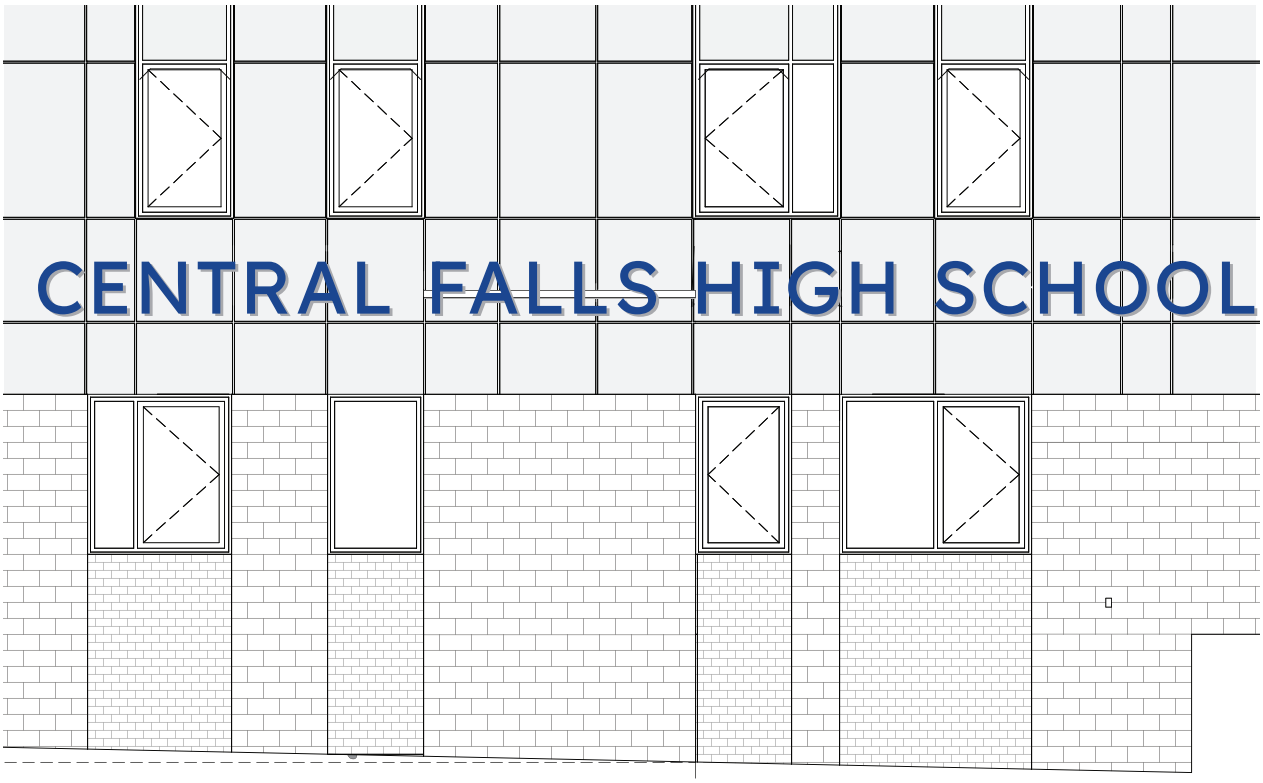
Sign Type 80
Exterior Letters, Illuminated

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	As noted	Rev.:	
Drawn:	HM/CM	Dwg:	380



Higginson Entrance

Notes

A 26" cap.ht. x 3" deep, halo illuminated fabricated aluminum letters; Lexend Regular, letter spaced manually; painted COL-01 face and returns; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga., with clear polycarbonate back panel with LED modules
B Mounted with 3" spacers
C Blocking required behind wall

100% Construction Documents

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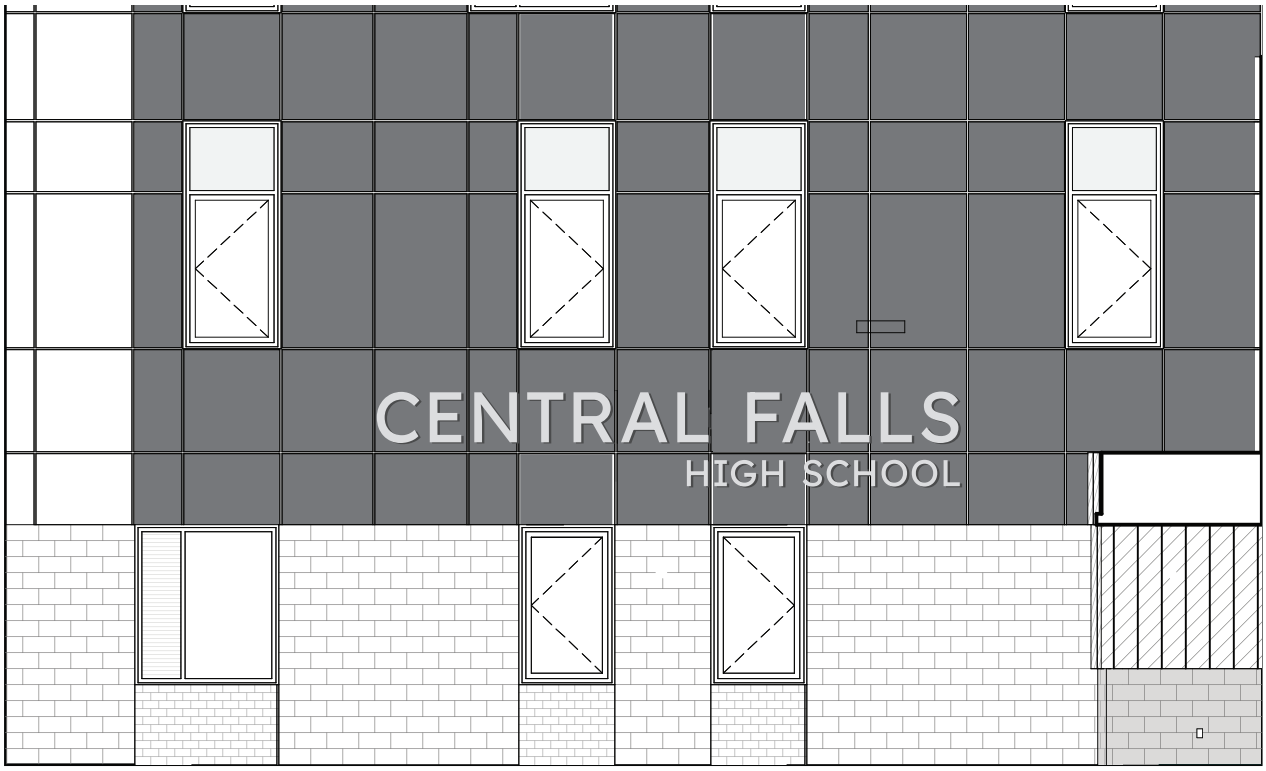
Sign Type 81
Exterior Letters, Illuminated

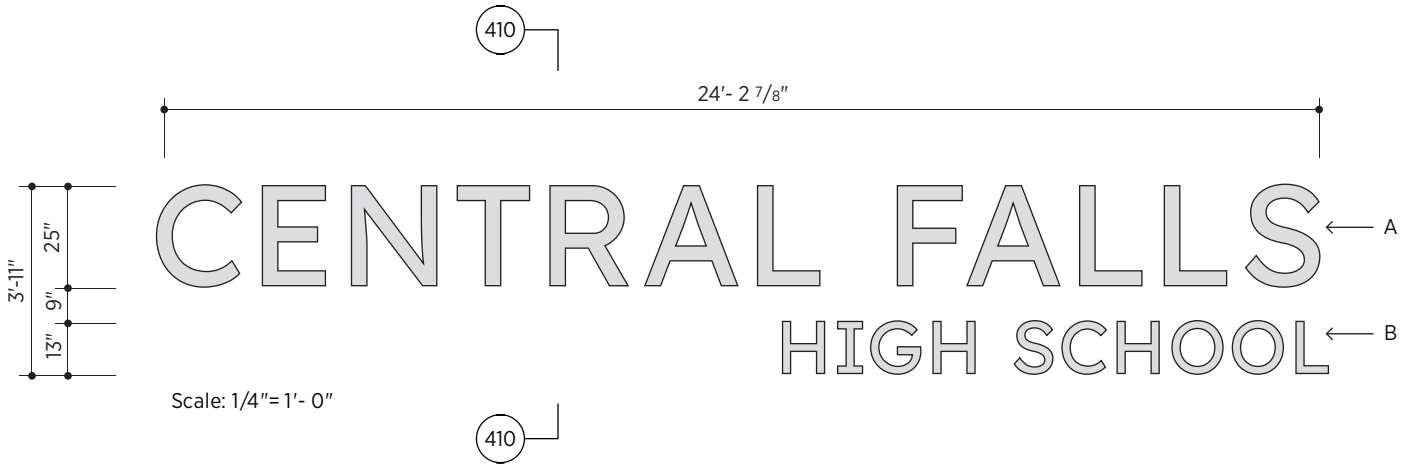
Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/8"= 1'- 0" Rev.:
Drawn: HM/CM Dwg: 381



Bus Stop Entrance

Scale: 1/8"= 1'- 0"



Scale: 1/4"= 1'- 0"

Notes

A 25" cap.ht. x 3" deep, halo illuminated fabricated aluminum letters; Lexend Regular, letter spaced manually; painted COL-03 face and returns; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga., with clear polycarbonate back panel with LED modules

B 13" cap.ht. x 3" deep, halo illuminated fabricated aluminum letters; Lexend Regular, letter spaced manually; painted COL-03 face and returns; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga., with clear polycarbonate back panel with LED modules

C Mounted with 3" spacers

D Blocking required behind wall

100% Construction Documents

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Framingham, MA 01701

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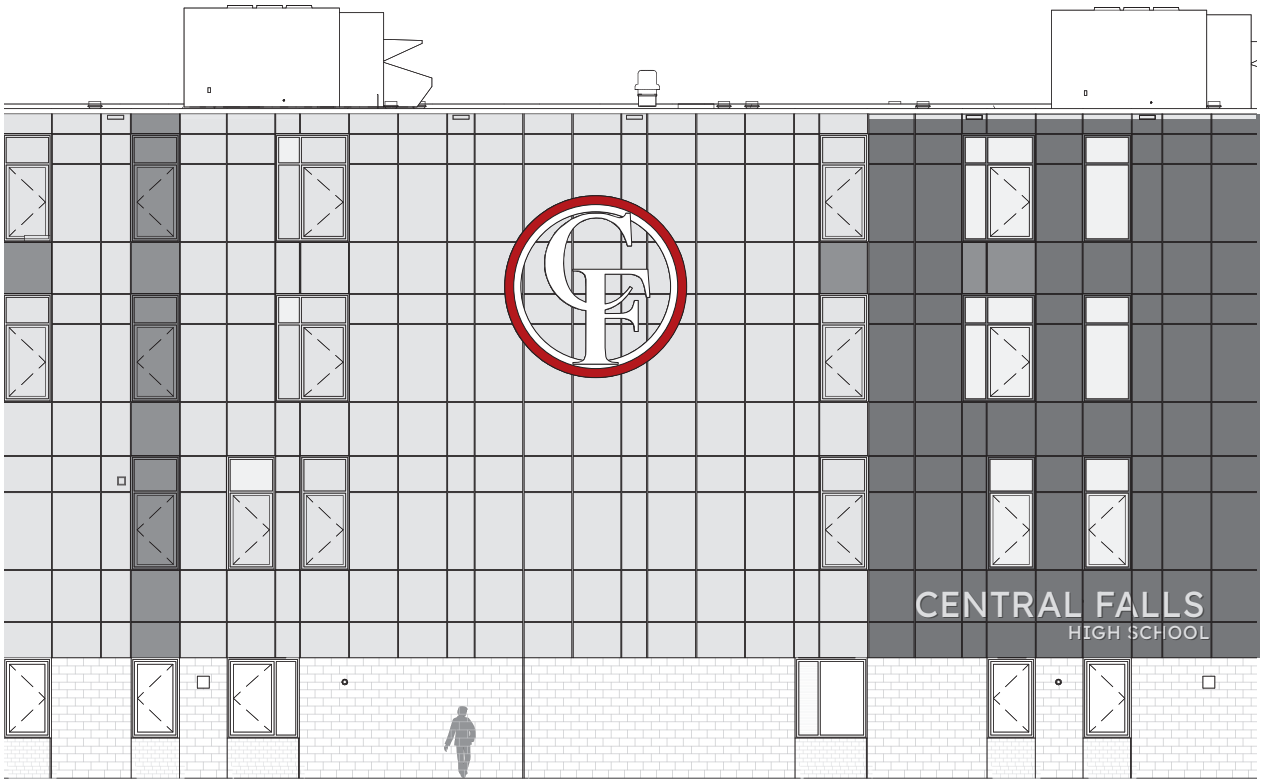
Sign Type 82
Exterior Letters, Illuminated

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

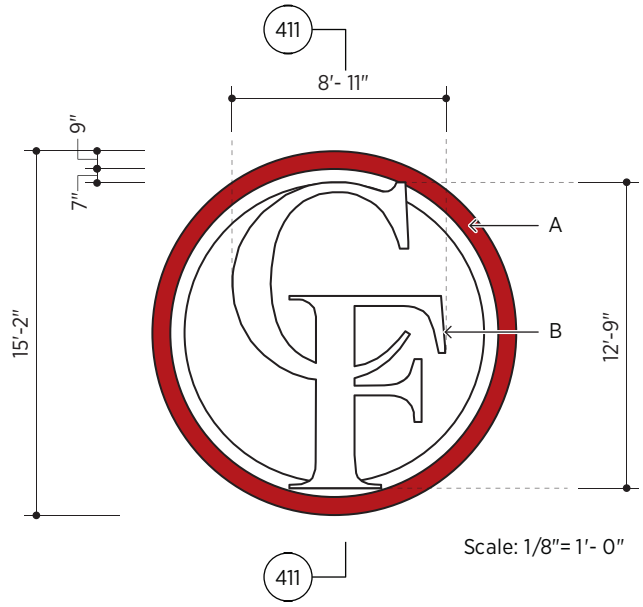
Scale: As noted Rev.:

Drawn: HM/CM Dwg: 382



South Elevation

Scale: 1/16″= 1′- 0″



Scale: 1/8″= 1′- 0″

Notes

A 4″ deep halo illuminated aluminum ring-shaped graphics; masked and painted COL-02 and COL-05 face and returns; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga., with clear polycarbonate back panel with LED modules

A 8″ deep halo illuminated aluminum logotype; painted face and returns COL-05; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga.; set into ring-shaped graphics to be one continuous piece; with clear polycarbonate back panel with LED modules

B Mounted on wall with 4″ spacers

C All dimensions, VIF

D Blocking required behind wall

100% Construction Documents

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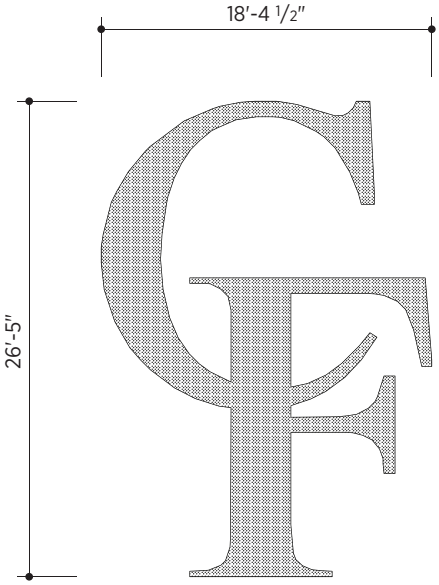
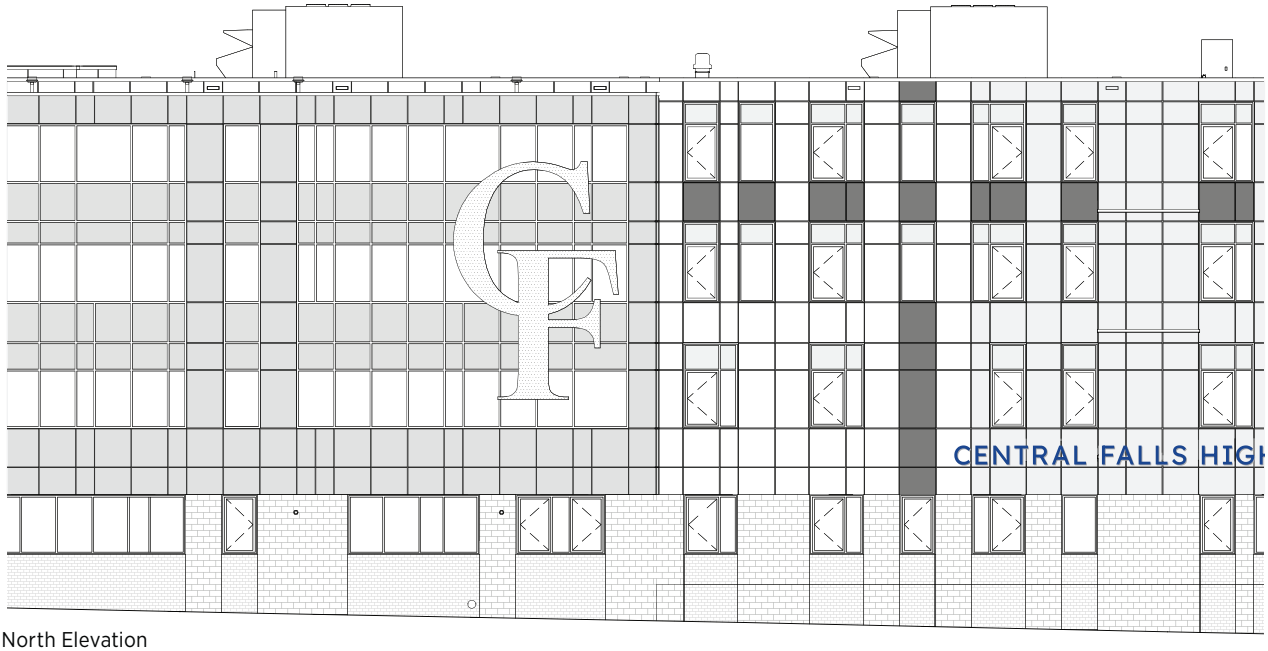
Sign Type 83
Ext School Logo, Illuminated

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	As noted	Rev.:	
Drawn:	HM/CM	Dwg:	383



Scale: 3/32"= 1'- 0"



North Elevation

Scale: 3/64"= 1'- 0"

Notes

A Cut vinyl logotype, optically clear vinyl film, IJ8150 or equivalent; with digitally printed white dot pattern, and exterior grade clear over laminate, 3M 8150 or equivalent; following application of the overlaminate, the graphics will be contour cut to the shape of logotype; applied on first surface on glass panels

B All dimensions, VIF

100% Construction Documents

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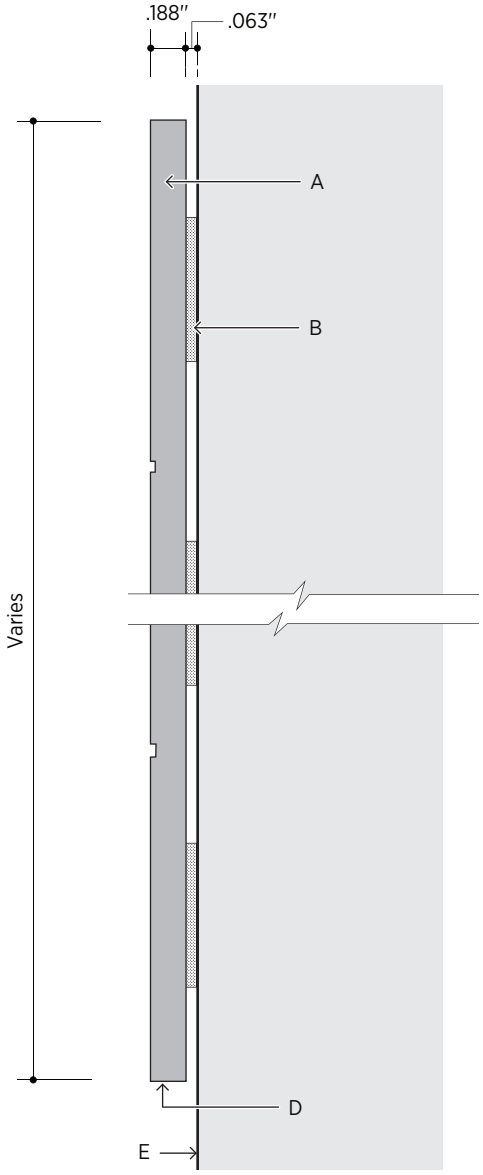
Sign Type 84
Exterior Media Center
Window Graphics

Central Falls High School
Central Falls, RI

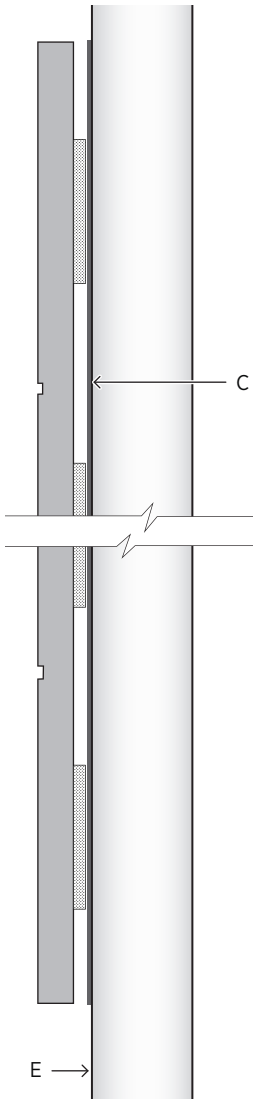
Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1/16"= 1'- 0" Rev.:

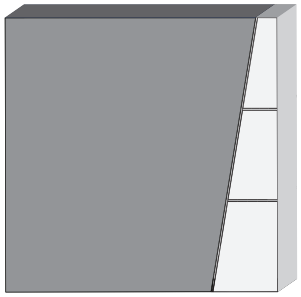
Drawn: HM/CM Dwg: 384



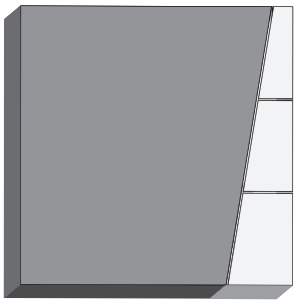
Mounted on wall



Mounted on glass



Top/right view (scale: NTS)



Bottom/left view

Notes

A	Thermoformed acrylic plaque, or acrylic plaque, with 1/16" thick x 1/32" deep machine routed line; masked and painted face and returns
B	VHB foam tape, 3M 4655
C	Vinyl backer, same dimensions as face plaque, first surface application, color match to face plaque
D	Sand and paint all edges
E	Mounting surface

100% Construction Documents

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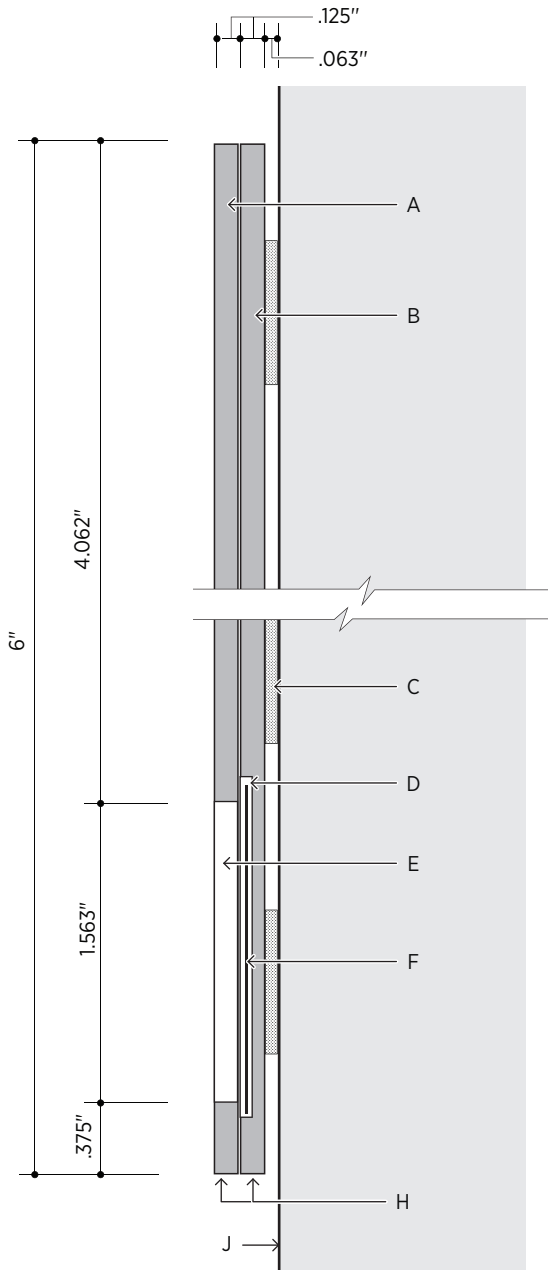
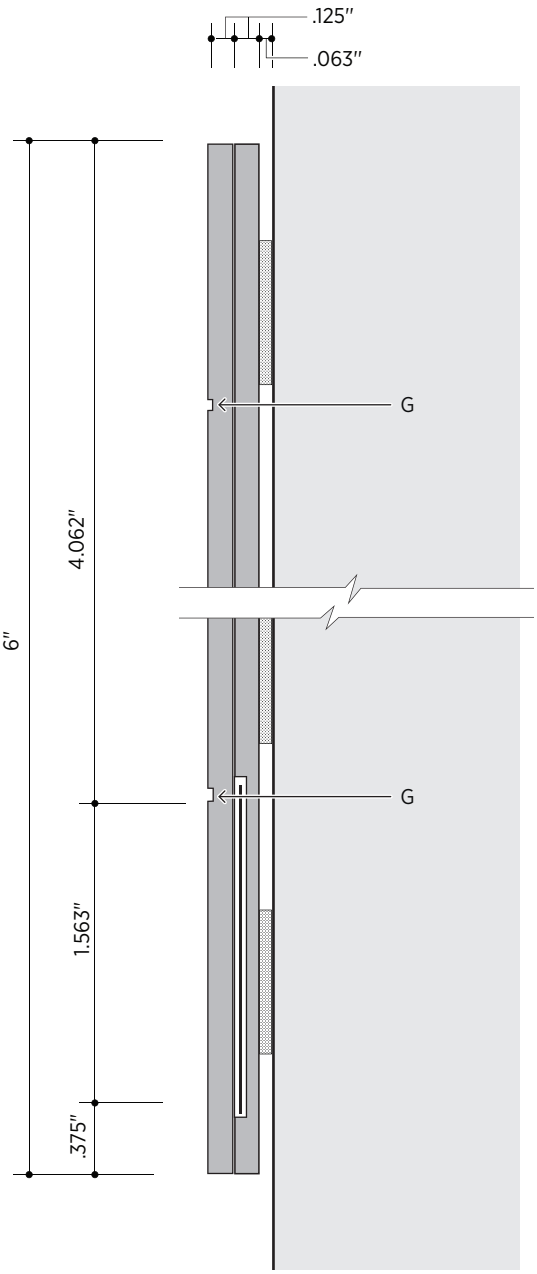
Detail 401

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	FULL	Rev.:	
Drawn:	HM/CM	Dwg:	401



402A



402B

Notes

A Thermoformed acrylic plaque, painted face and returns
B Acrylic panel, painted; laminated to thermoformed acrylic plaque
C VHB foam tape, 3M 4655
D Machine-cut recess for insert
E Insert window, face and returns masked and left clear
F Paper insert, 24lb. text
G 16″ thick x 1/32″ deep machine routed line, painted
H Sand and paint all edges
J Mounting surface

100% Construction Documents

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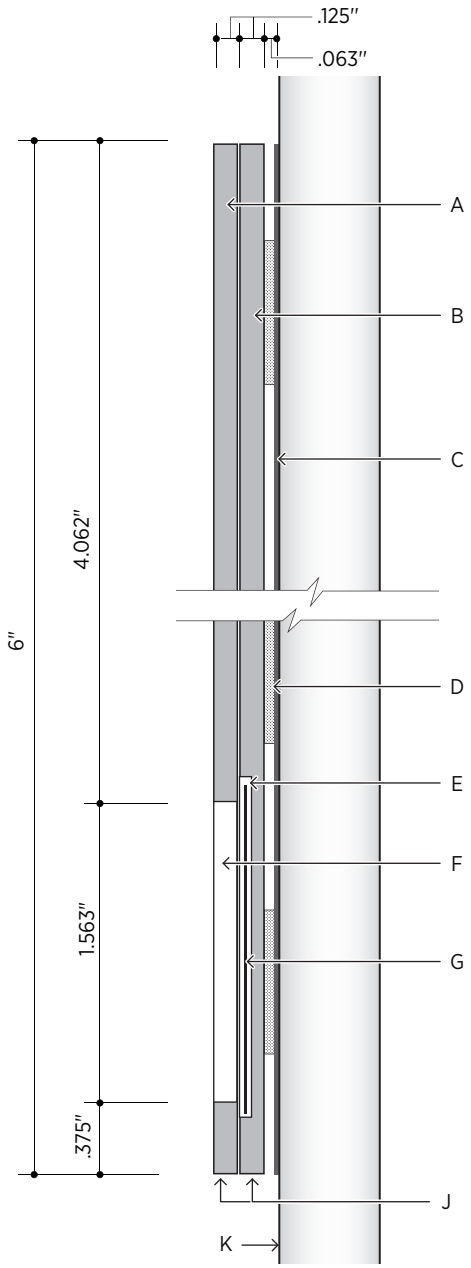
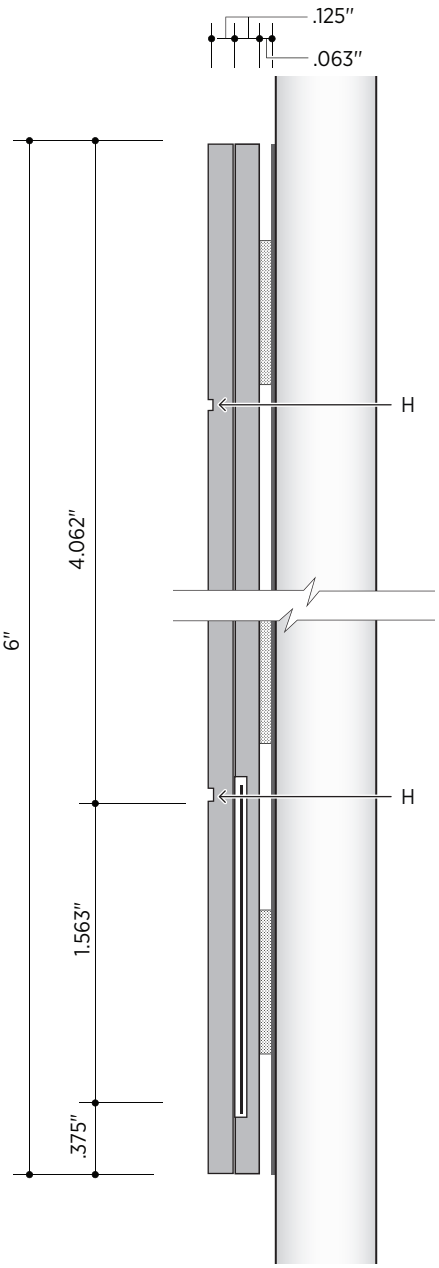
Detail 402

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: FULL Rev.:
Drawn: HM/CM Dwg: 402



402A



402B

Notes

A Thermoformed acrylic plaque, painted face and returns
B Acrylic panel, painted; laminated to thermoformed acrylic plaque
C Vinyl backer, same dimensions as face plaque, first surface application, color match to face plaque
D VHB foam tape, 3M 4655
E Machine-cut recess for insert
F Insert window, face and returns masked and left clear
G Paper insert, 24lb. text
H 16" thick x 1/32" deep machine routed line, painted
J Sand and paint all edges
K Mounting surface

100% Construction Documents

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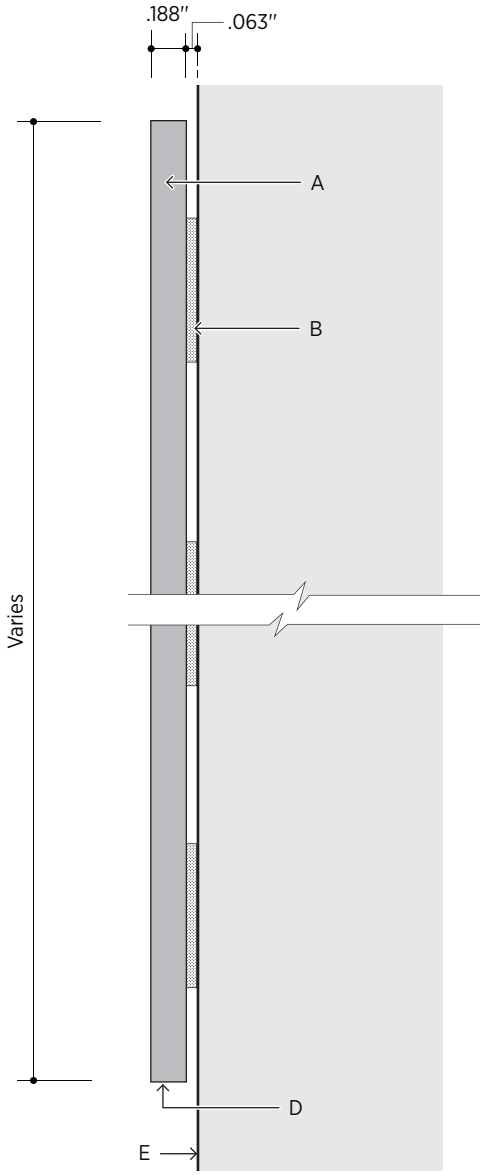
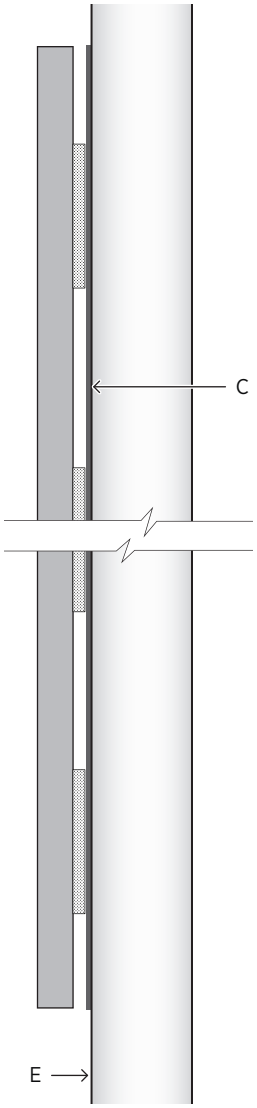
Detail 402

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: FULL Rev.:
Drawn: HM/CM Dwg: 402.1



Mounted on wall



Mounted on glass

Notes

A Thermoformed acrylic plaque, or acrylic plaque, painted face and returns
B VHB foam tape, 3M 4655
C Vinyl backer, same dimensions as face plaque, first surface application, color match to face plaque
D Sand and paint all edges
E Mounting surface

100% Construction Documents

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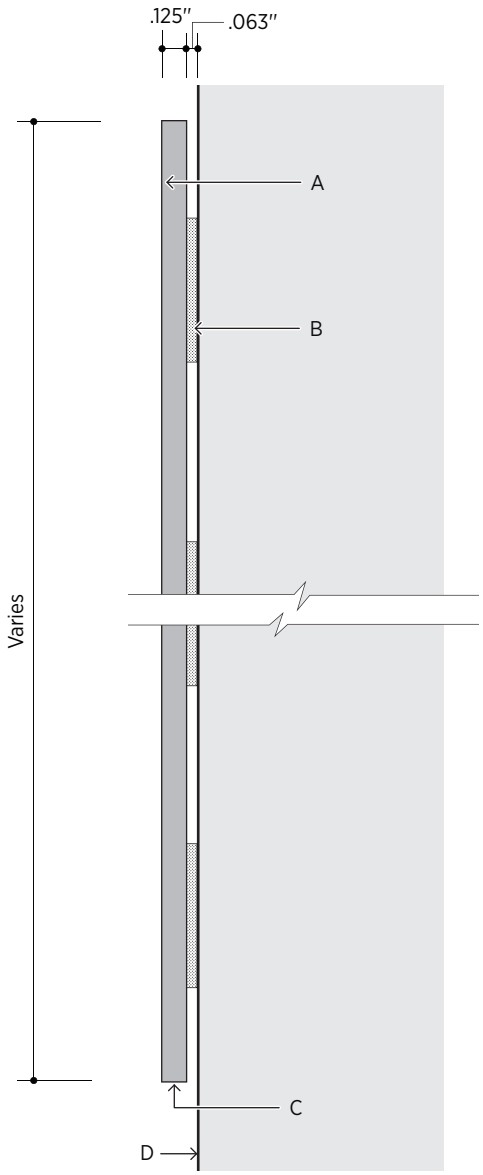
Detail 403

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	FULL	Rev.:
Drawn:	HM/CM	Dwg: 403



Notes

A Acrylic plaque, painted face and returns
B VHB foam tape, 3M 4655
C Sand and paint all edges
D Mounting surface

100% Construction Documents

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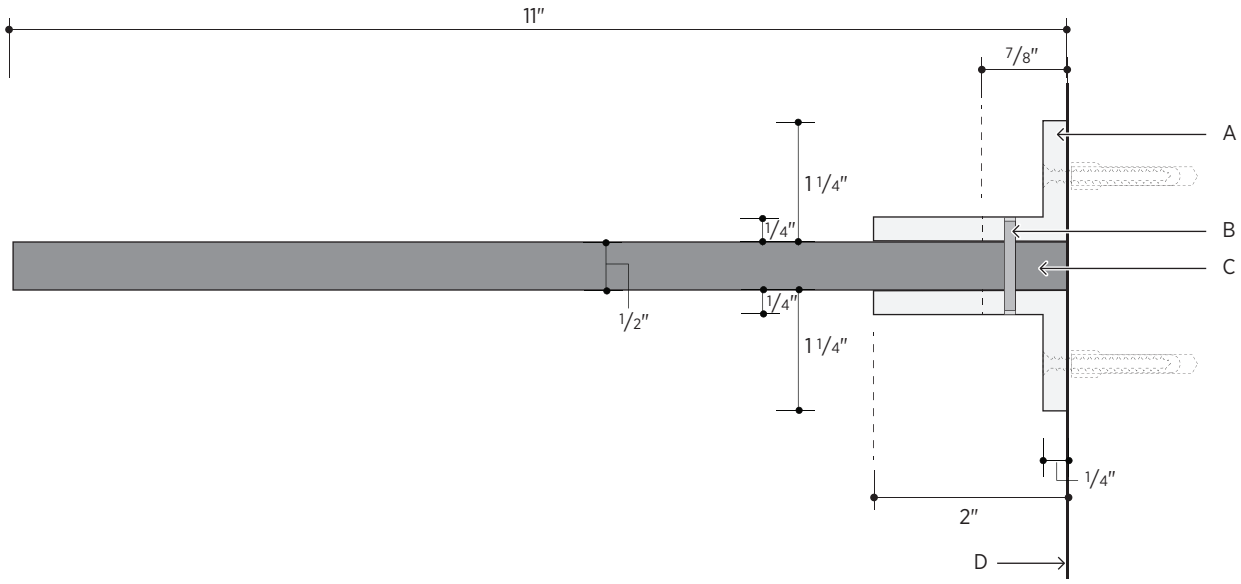
Detail 404

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	FULL	Rev.:
Drawn:	HM/CM	Dwg: 404



Notes

A Aluminum bracket, with 1/16″ thick x 1/32″ deep machine routed line, painted all exposed surfaces; mechanically fastened to wall
B Stainless steel set screw 7/8″ long
C Acrylic plaque, painted all exposed surfaces; digitally printed graphics on side A and B
D Mounting surface

100% Construction Documents

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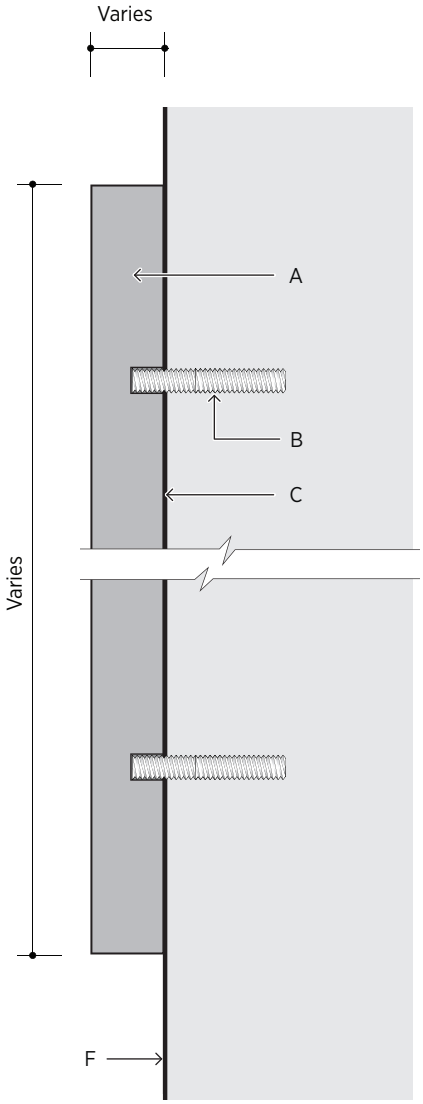
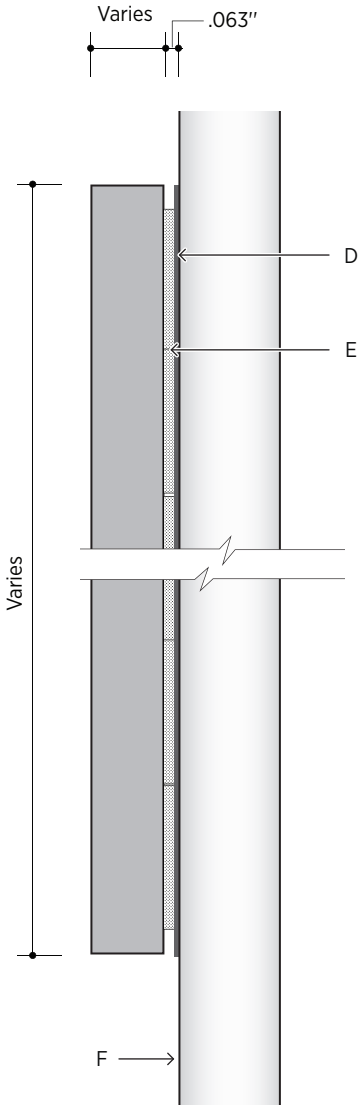
Detail 405	Proj. No.:	2202.02	Date: Oct 13, 2023
	Scale:	FULL	Rev.:
Central Falls High School Central Falls, RI	Drawn:	HM/CM	Dwg: 405



Mounted on wall



Mounted on glass

Notes

A Precision cut acrylic letters, painted face and returns
B Threaded stud
C Silicone adhesive
D Cut vinyl letters, same size as acrylic letters, first surface application, color match to acrylic letters
E VHB foam tape, 3M 4655
F Mounting surface

100% Construction Documents

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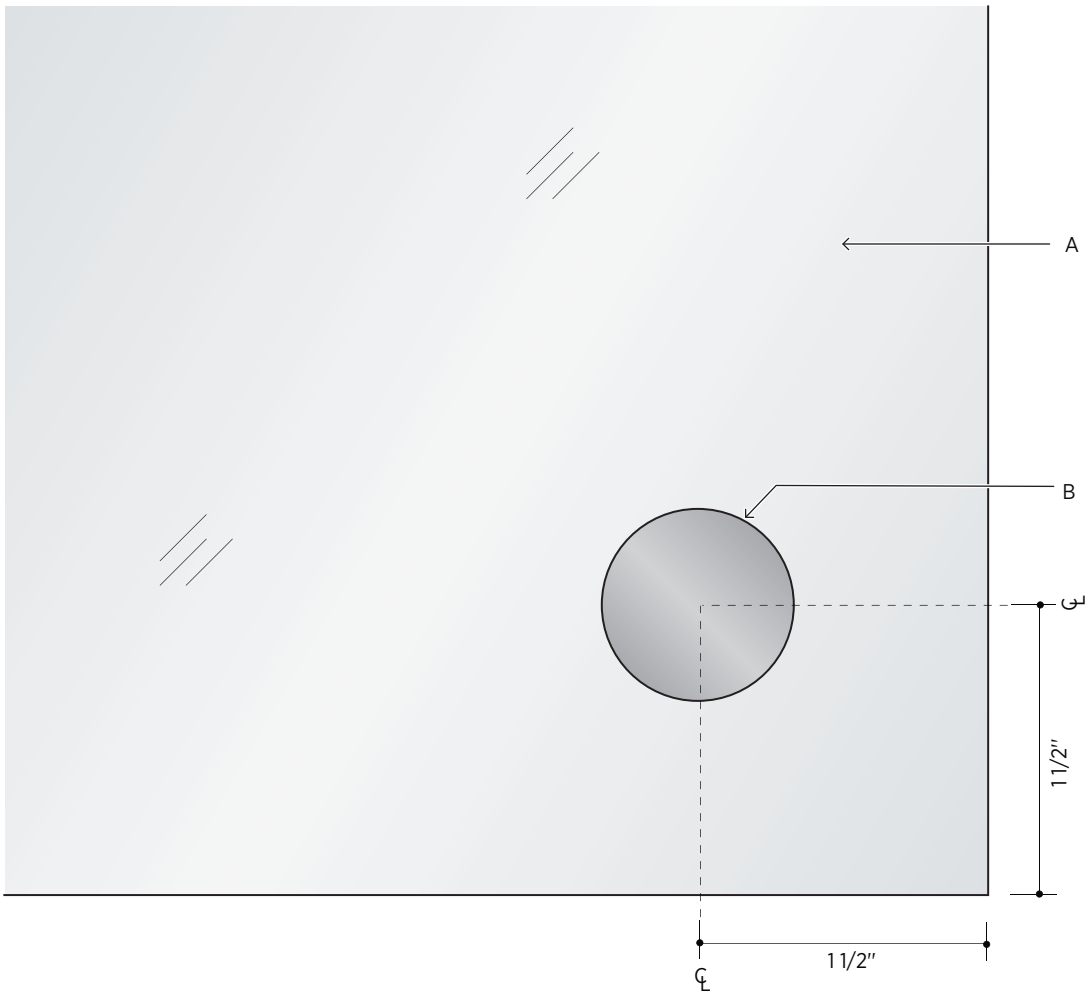
Detail 406

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date:	Oct 13, 2023
Scale:	FULL	Rev.:	
Drawn:	HM/CM	Dwg:	406



Notes

A 1" diameter Gyford security cap
B Acrylic panel with polished edges

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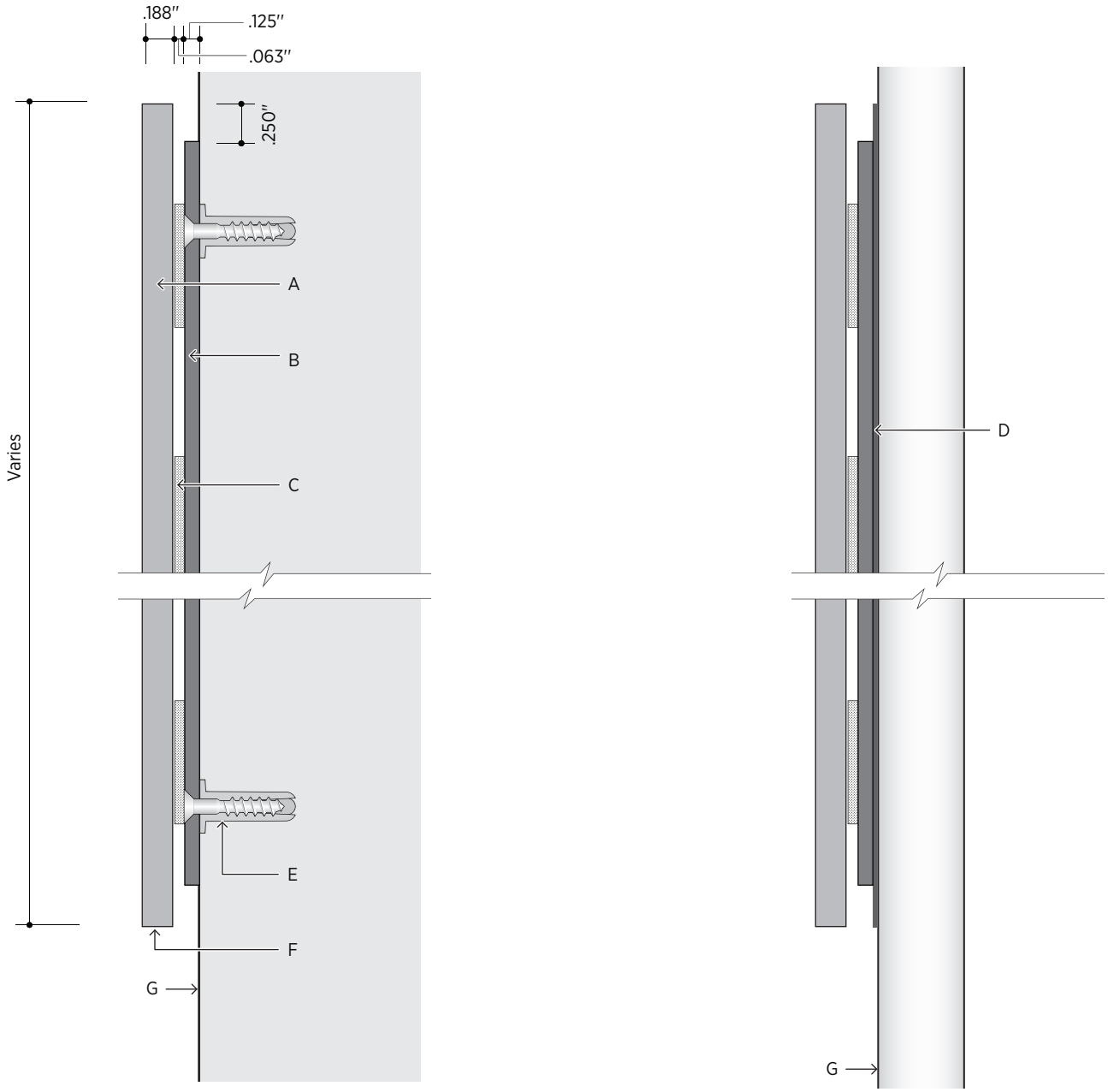
Detail 407

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: FULL Rev.:

Drawn: HM/CM Dwg: 407



Mounted on wall

Mounted on glass

Notes

A Thermoformed acrylic plaque, or acrylic plaque, painted face and returns
B Aluminum shim mechanically fastened to wall
C VHB foam tape, 3M 4655
D Vinyl backer, same dimensions as face plaque, first surface application, color match to face plaque
E #8 screw with anchor
F Sand and paint all edges
G Mounting surface

100% Construction Documents

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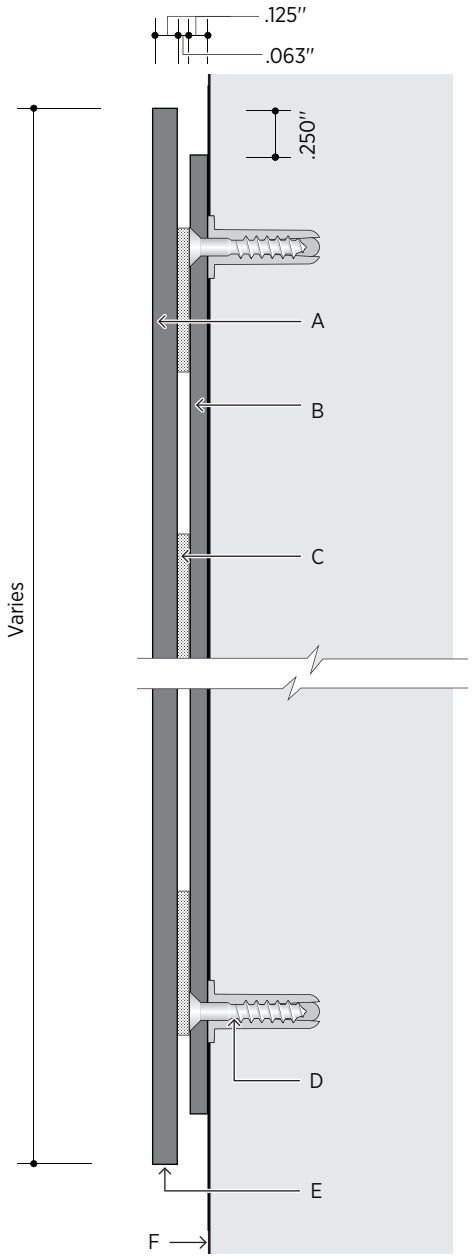
Detail 408

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023
Scale:	FULL	Rev.:
Drawn:	HM/CM	Dwg: 408



Notes

A Aluminum plaque, painted face and returns
B Aluminum shim mechanically fastened to wall
C VHB foam tape, 3M 4655
D #8 screw with anchor
E Sand and paint all edges
F Mounting surface

100% Construction Documents

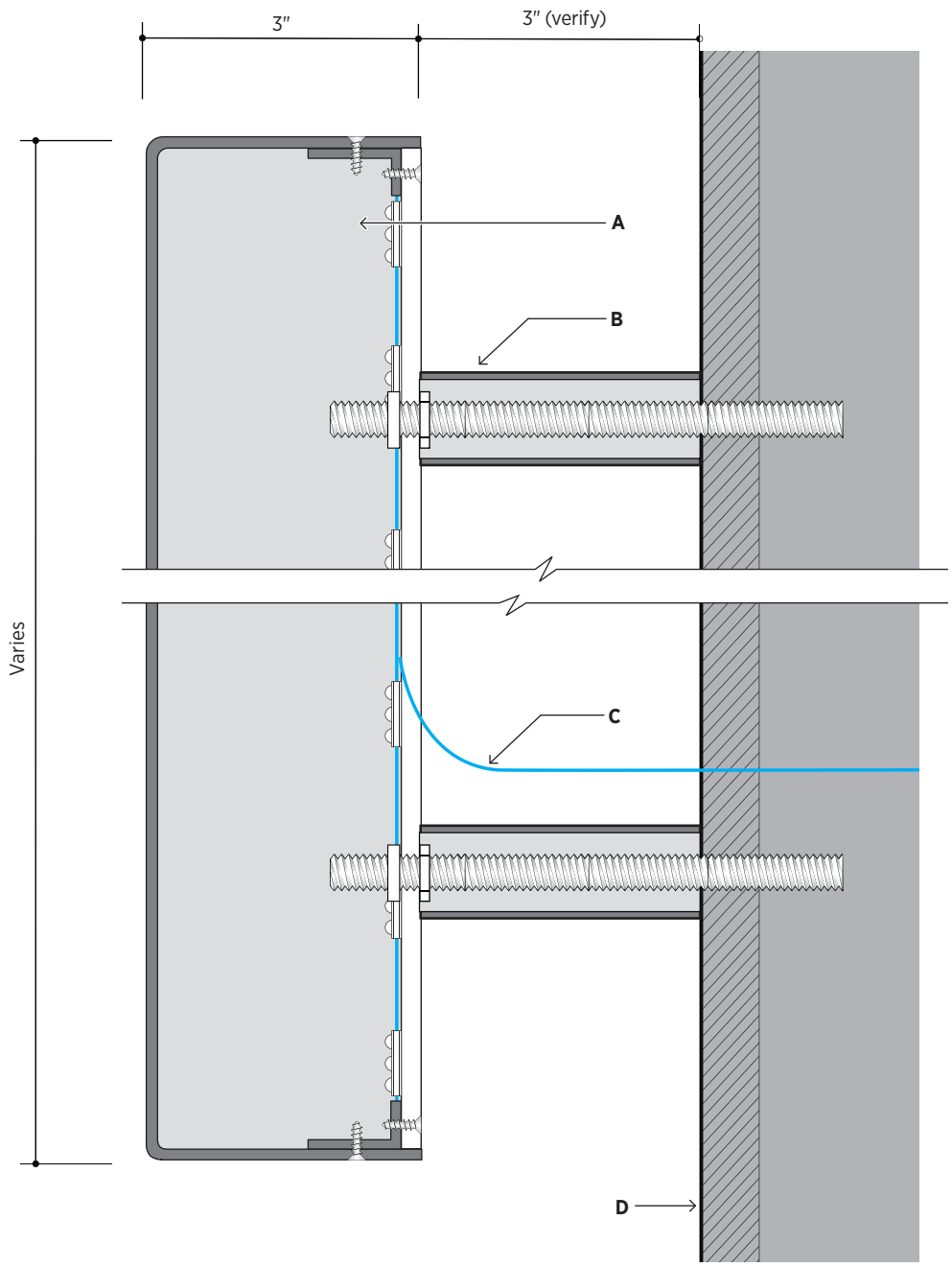
Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Detail 409

Central Falls High School
Central Falls, RI

Proj. No.:	2202.02	Date: Oct 13, 2023	
Scale:	FULL	Rev.:	
Drawn:	HM/CM	Dwg: 409	



Notes

A Halo illuminated fabricated aluminum letters, painted; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga.l; with clear polycarbonate back panel with LED modules
B Threaded studs with mounting hardware and spacer sleeve
C DC power to transformer mounted behind sign
D Mounting surface with blocking by General Contractor

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

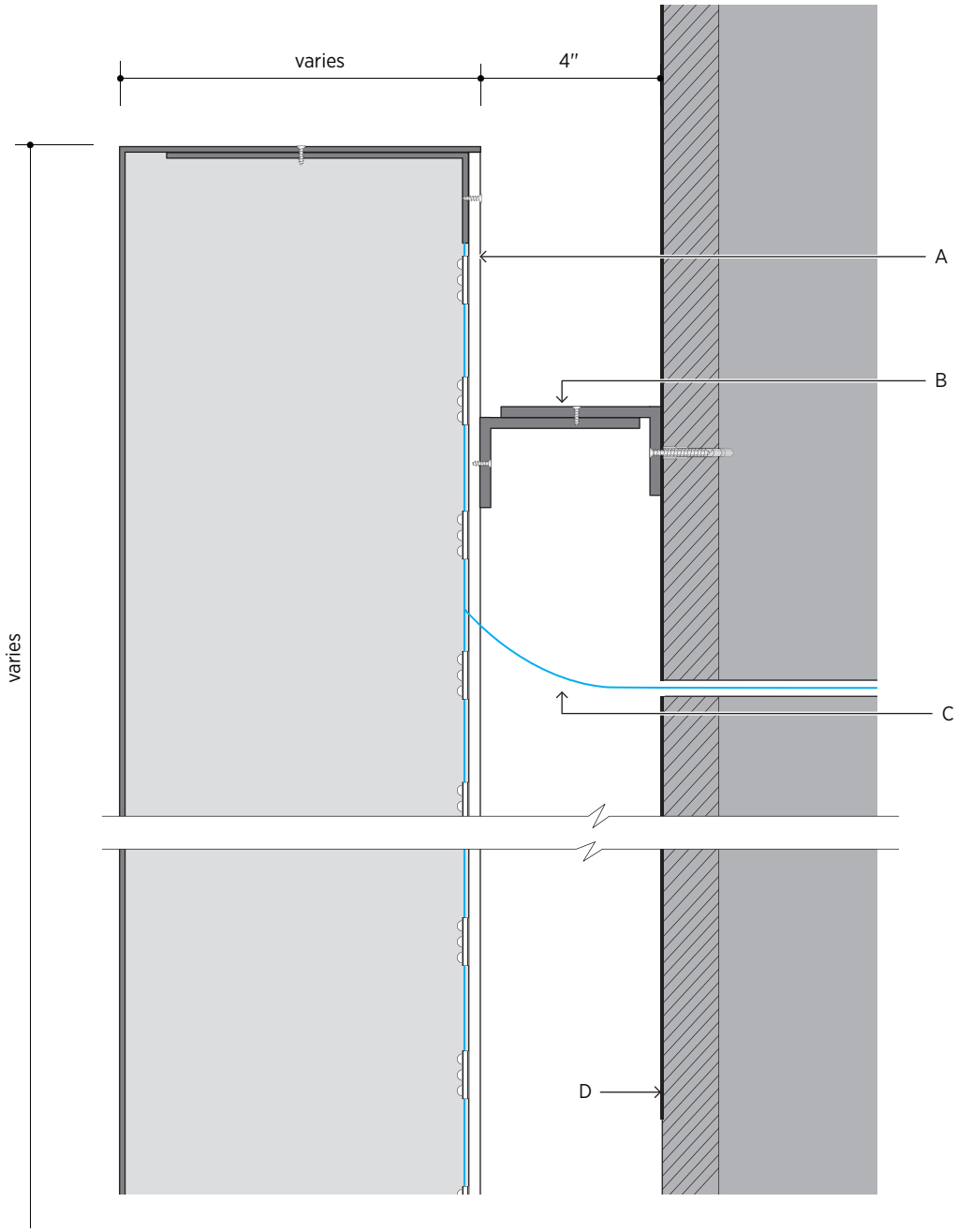
Detail 410

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023

Scale: 1/2"= 1" Rev.:

Drawn: HM/CM Dwg: 410



Notes

A Fabricated aluminum logotype and ring-shaped graphics; faces to be minimum 18 ga, fabricated returns to be minimum 20 ga.l; with clear polycarbonate back panel with LED modules; painted face and returns
B 3-1/2"x 2"x 1/4" aluminum angle
C DC power to remote transformer
D Mounting surface with blocking by General Contractor

100% Construction Documents

Ai3 Architects
111 Speen Street, Suite 300
Framingham, MA 01701

508-358-0790
www.ai3architects.com

Detail 411
Exterior Directional

Central Falls High School
Central Falls, RI

Proj. No.: 2202.02 Date: Oct 13, 2023
Scale: 1/4"= 1" Rev.:
Drawn: HM/CM Dwg: 411

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Section 10 21 13

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install:

1. Floor-ceiling/wall mounted phenolic toilet partitions.
2. Urinal screens, matching toilet partition design and finish.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction recycling.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 05 50 00 – METAL FABRICATIONS: Furnishing and installing metal angles securing work of this Section.

D. Section 06 10 00 - ROUGH CARPENTRY: In wall blocking for partition panel support.

E. Section 10 28 13 - TOILET ACCESSORIES: Furnishing templates, providing and installing toilet accessories surface mounted to toilet compartments, and integral with compartments.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. ASTM A 167 - Stainless and Heat Resisting Chrominum-Nickel Steel Plate, Sheet and strip.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, and manufacturer's warranty for each item furnished hereunder. Include information panel construction, hardware, and accessories.

2. Shop drawings:

a. 1/2 inch scale dimensioned plans and elevations of each toilet room condition showing toilet compartment and urinal screen layout.

b. Large scale design details of showing attachment clips and brackets; and complete installation details.

3. Samples:

a. Selection samples: Manufacturer's full range of color chips, for selection by the Architect; up to two-color combinations for doors and partitions may be selected in each area.

b. Verification samples: 6 inch square samples of each color and finish on same substrate to be used in Work, for color verification after selections have been made.

4. Sustainable Design Submittals: As required by NE CHPS.

1.5 FIELD MEASUREMENTS

A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.6 REGULATORY REQUIRMENTS

A. Partition Fire Resistance Rating: NFPA, Class “A”.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.

1.8 WARRANTY

A. Furnish the following manufacturer’s warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Manufacturer's warranties are in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1. Manufacturer's written warranty, for a minimum period of 10 years from date of Substantial Completion. Warranty shall cover panel, pilaster and door material and manufacturing workmanship against defects, including delamination of surfacing, corrosion and breakage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND MODELS

A. Toilet compartments: Flush type, floor mounted, with floor to ceiling pilasters of standard height and depth, except for sizes of handicapped compartments, which shall be as indicated on the Drawings. Acceptable models include the following, or approved equal:

1. Accurate Partition Corp., Lyons IL, Series “Black-Core Phenolic”.
2. Bobrick Washroom Equipment, Inc., Clifton Park NY, Series “1186”.
3. General Partitions Manufacturing Corp., Deer Park NY, Series “60”.

B. Urinal screens: Flush type, 42 inch high, 18 inches deep matching construction and finish of toilet partitions, with wall attachment and floor to ceiling post support. Acceptable models include the following, or approved equal:

1. Accurate Partition, Series “Post-to-Ceiling Black-Core Phenolic”.
2. Bobrick Washroom Equipment, Inc., Clifton Park NY, Series “1183”.
3. General Partitions Series “60-6 SPC F-C”.

2.2 FABRICATION

A. Pilasters and doors: 3/4 inch [19 mm] thick, solid phenolic core, color matched with integrally bonded decorative “matte finish” melamine surface, in color(s) selected by Architect from available range. Laminated surfaces are not acceptable.

1. Door widths; except as otherwise indicated, provide the following widths:
   a. Handicapped accessible stalls, 36 inches [914 mm] door width having a minimum 32 inch [813 mm] clear opening, or greater.
   b. Standard stalls, 28 inches [610 mm]
2. Pilasters (stiles) shall run full height, floor to ceiling with secure attachment at both ends.
   a. Pilasters that are adjacent to doors shall be rabbeted on the vertical edge next to the door to provide for a sightless condition between the door and the pilaster.

B. Panels: 1/2 inch [13 mm] thick, of same material and finish as pilasters and doors.

C. Head rails: Hollow extruded aluminum tube with anti-grip top having wall thickness of not less than 0.125 inches; with cast aluminum or stainless socket brackets. Provide corner brackets, wall brackets and end caps as required.

D. Pilaster floor and ceiling shoes: 4 inches high formed stainless steel with satin finish.

E. Hardware and fittings: Type 302/304 stainless steel, except as specified otherwise.

1. Door hinges: Gravity type self-closing hinge fabricated from 14 gage type 302/304 cast stainless steel with a satin finish. Hinge shall be fully adjustable up to 360 degrees, with a type 302/304 stainless steel pivot pin.
2. Door latch with nylon slides. Door keeper, one piece 14 gage stainless steel.
3. Door stop: 14 gage stainless steel. Plated Zamac door stops are not acceptable.
4. Panel to stile connection: Full panel height “U” shape stainless steel channel.
5. Panel to wall connection: Full panel height “U” shape stainless steel channel or “Double T” shape extruded aluminum channel, clear anodized.

F. Colors: As selected by the Architect from the manufacturer’s full range of available colors.

1. Toilet rooms shall be two separate colors by gender as selected.

2.3 ACCESSORIES

A. Equip all doors with combination coat hook and bumper.

B. Anchorages and Fasteners: Through-bolted stainless steel with theft-resistant heads. Chrome plated steel or brass are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify correct spacing of plumbing fixtures.

C. Ensure wall blocking is coordinated with location of anchors before commencing with installation.

D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - GENERAL

A. Comply with manufacturer's recommended procedures and installation sequence, and as specified herein.

B. Install pilasters, partitions, urinal screens, and doors rigid, straight, plumb and level. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Set pilaster units with anchorages having minimum 2 inches penetration into structural floor, unless otherwise recommended by partition manufacturer.

D. Attach panel brackets securely to walls using anchor devices.

E. Anchor urinal screen panels to walls with two panel brackets and tube vertical upright anchored to floor.

F. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.

G. Hang door and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

H. Ensure that all holes in partitions, for attachment of related items, are accurately located and drilled, in accordance with the templates furnished by the accessory manufacturer. Conceal all evidence of drilling, cutting, and fitting in the finished work.

I. No permanent exposed to view labels of any kind will be permitted to remain on the partitions, urinal screens, or doors.

3.3 FIELD QUALITY CONTROL

A. Ensure that all work is free from dents, tool marks, warpage, buckle, open joints, or other defects. Protect compartments during erection, and after erection, and until final approval of the entire project by the Architect.

3.4 ADJUSTMENT

A. Adjust and align hardware to provide a uniform clearance at vertical edges of doors not to exceed 3/16 inch.

B. Adjust hinges to locate doors in partial-open position (approximately 30 degrees open) when unlatched. Return outswing doors to closed position.

C. Test operation of movable parts, and make all adjustments necessary to ensure proper operation.

3.5 CLEANING

A. Upon completion of the installation, remove all evidence of tapes and other packing materials; touch-up all scratches and surface defects and thoroughly clean and polish all exposed to view surfaces.

B. Provide protection as necessary to prevent damage during remainder of construction period.

End of Section

Section 10 21 23

CUBICLES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:
   1. Surface-mounted cubicle curtain track and guides.
   2. Track accessories.
   3. Curtains.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 06 10 00 - ROUGH CARPENTRY: Above ceiling wood blocking and curbing.

D. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling system to support track.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
   1. NFPA 701 - Fire Tests for Flame Resistant Textiles and Films.
   2. UL Flammability Test Nº 214.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:
   1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS.

1.4 PERFORMANCE REQUIREMENTS

A. Track: To support vertical test load of 50 pounds without visible deflection of track or damage to supports. Size track to support moving loads.

B. Size track to support moving loads, sufficiently rigid to resist visible deflection and without permanent set.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Shop drawings:
   a. 1/4 inch scale reflected ceiling plans indicating view of curtain track, hangers and suspension points.
   b. Large scale details of track showing suspension system, attachment clips and brackets; and complete installation details.
3. Selection samples:
   a. Sample fabric swatches minimum 3 by 5 inch size, indicating manufacturer's full range of colors and textures available for selection by Architect.
   b. Provide additional samples requested by Architect for initial selection of colors and finishes.
4. Verification samples:
   a. 12 inch long section of track.
   b. Track splice, wall and ceiling hanger and escutcheon.
   c. 12 by 12 sample patch of selected [specified] curtain cloth with representative hem stitch detail, heading with reinforcement, and carrier attachment to curtain header.
5. Sustainable Design Submittals: As required by NE CHPS.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:

1. Maintenance data: Include recommended cleaning methods and materials and stain removal methods.
2. Manufacturer’s warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable codes for flame/spread rating of 25 for curtains when tested in accordance with ASTM E 84. Provide certificate of compliance from authority having jurisdiction.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, and store products in manufacturer’s original sealed cartons.

B. Accept curtain materials on site and inspect for damage. Store curtain materials and deliver to the Owner to installation at Substantial Completion.

C. Store products in protected, elevated location. Store to prevent twist or warp of track sections.

1.8 FIELD MEASUREMENTS

A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with trades responsible for installation of suspended ceilings.

1.10 EXTRA MATERIALS

A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, provide:
   1. Two of each curtain size.
   2. Ten extra carriers.

B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. A.R. Nelson Company (Arnco), St. Louis, MO.
   2. Construction Specialties/General Cubicle, Cranford, PA.
   3. Imperial Fastener Company, Pompano Beach, FL.
   4. Salsbury Industries, Los Angeles CA.
   5. InPro Corporation (ClickEZE), Muskego WI.

2.2 CURTAIN TRACK AND CURTAIN

A. Track:
   1. Acceptable products include the following, or approved equal:
      a. A.R. Nelson (Arnco), product: “1200” track. Provide Arnco “1100” track for suspended locations.
      b. General Cubicle, product: “6062”. Provide General Cubicle, product: “6663” for suspended locations.
      c. Imperial, product: “IFC-98”.
      d. Salsbury Industries, product: “19100”.
      e. InPro (ClickEZE), product: “CE6000 Royal Generic Plus” for both direct mount and suspended locations.
   2. Track shall be extruded aluminum having over-all dimensions of 1-3/8" x 3/4" x 0.062 inch minimum wall thickness. . Design for surface application with side

projections to overcome ceiling irregularities and affording a method for scribing a tight, neat line to the ceiling..

3. Track bends with minimum 12 inch radius, without deforming track section, or impeding movement of carriers. Fabricate in one continuous "L" shape where-ever practical.
4. Provide extruded slip-on connectors and nylon end stops and gates.
5. Provide switch for tracks in rooms shown with side by side beds, so that one cubicle can service two beds.
6. Finish for track and fittings: Clear anodized finish

B. Roller carriers: Wheeled nylon carrier with self-lubricating nylon wheels and nylon axle, to accurately fit track, designed with “break-a-way” post or hook which will separate from axle assembly when 22 pounds of downward pressure is applied.

1. Install sufficient quantity of carriers for each curtain, minimum of one carrier for every 6 inches of track.

C. Track ends: Positive stop to fit track extrusion.

D. Suspension rods: Tubular aluminum sections, sized to support specified design loads and designed to receive attachment from track and either above ceiling or ceiling support as field conditions require.

E. Curtain: Close woven nylon or cotton, anti-bacterial, self-deodorizing, sanitized, preshrunk, flame proofed to UL Flammability Test 214.

1. Manufacture curtains of one piece, sized 10 percent wider than track length. Terminate curtain 20 inches above finished floor. Provide widths required for locations shown, fabricate curtains from actual field measurements.
2. Include open nylon mesh at top 14 inches of curtain for room air circulation.
3. Curtain heading of triple thickness 2 inches wide, with grommeted holes for carriers at 6 inches on center, double fold bottom hem 2 inches wide, included lead weights. Lockstitch seams in two rows. Turn seam edges and lockstitch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and above ceiling supports and verify that they are in proper condition to receive the work of this Section. Verify field measurements are as shown on shop drawings.

1. Beginning of installation means acceptance of existing surfaces, supports and project conditions.

3.2 INSTALLATION

A. Install track rigid, and true to ceiling line, secured to ceiling system or to track hangers where suspended systems are required.

B. Install end cap and stop devices as indicated on approved shop drawings.

C. Install curtains on carriers ensuring smooth operation.

3.3 PROTECTION

A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 10 22 13

WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install wire mesh partition system for walls (floor to ceiling installation) complete with access doors, all accessories and related hardware.

B. Furnish the following products to be installed under the designated Sections:

1. Embedded anchors for placement into concrete by Section 03 30 00 - CAST-IN-PLACE CONCRETE.
2. Embedded anchors for placement into masonry by Section 04 20 00 - UNIT MASONRY.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slab substrate.

D. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit partitions.

E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, edgings, nailers curbs, cants, cants grounds, furring, and sheathing.

F. Section 08 71 00 - DOOR HARDWARE: Cylinders for locksets.

G. Section 09 29 00 - GYPSUM BOARD: Gypsum board construction partitions and metal framing.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A240/A240M – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
5. ASTM A500/A500M – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
6. ASTM A501/A501M – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
7. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.
8. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
9. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
10. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
11. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
12. ASTM B211 - Standard Specification for Aluminum-Alloy Bars, Rods, and Wire.
13. ASTM B221 - Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
14. AWS D1.1 - Structural Welding Code.
15. FS QQ-W-461 - Wire, Steel, Carbon, (Round, Bare, and Coated).
16. FS TT-P-645 - Primer Paint, Zinc Oxide, Alkyd Type.
17. SSPC - Painting Manual.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner or designated representative, Architect, General Contractor, Partition Installer's Project Superintendent, and representatives of other related trades as directed by the Architect or Contractor.
2. Agenda:
    a. Scheduling of partition delivery and installation.
    b. Review of staging and material storage locations.
    c. Coordination of work by other trades.
    d. Installation procedures for ancillary equipment.
    e. Protection of completed Work.
    f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
    g. Emergency rain protection procedure.
    h. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

C. Sequencing:
1. Field Measurements
    a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for wire mesh partitions and related components, including, but not limited to: partition framing, supports and bracing, wire mesh, and hardware.
2. Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention
3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
4. Shop drawings:
    a. 1/4 inch scale elevations and plans of each wire mesh partitions.
    b. Large scale design details showing attachment clips and brackets; and complete installation details. All details bearing dimensions of actual measurements taken at the project.
5. Selection samples:

a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.

6. Verification samples:
   a. 12 x 12 inch samples of wire mesh illustrating construction and selected finish.
   b. 12 inch long samples of framing components.
   c. Samples of hinge, latch set,
7. Sustainable Design Submittals: As required by NE CHPS.
8. Qualification Submittals.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
   1. Bonds and Warranty Documentation:
      a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

A. Obtain partition components and hardware from a single manufacturer.

B. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the specified products with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable elevator code for screen mesh opening size.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Storage and Handling Requirements:
   1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
   2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.10 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

B. Provide manufacturer's standard 5 year performance and finish warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Wirecrafters, LLC, Louisville, KY.
2. Alabama Metal Industries Corporation, Birmingham, AL.
3. Banker Wire, Inc., Mukwonago, WI.
4. Central Wire and Iron Works, Des Moines IA.
5. Major Partitions, Tampa FL.
6. Newark Wire Works, Edison NJ.

2.2 DESIGN REQUIREMENTS

A. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.

B. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.3 COMPONENTS

A. Wire Mesh Partitions: Factory-assembled, full-mesh style, modular interchangeable units that allow expansion without waste of components, complete with all components, accessories, hardware, and fasteners.
1. Provide fixed sections unless otherwise indicated.
2. Section Width: 60 inches (1830 mm).
3. Provide special width panels to achieve partition dimensions indicated.
4. Panel frames bolted together and to posts at 18 inches (457 mm) on center vertically.
5. Height: 96 inches (2438 mm).
6. Finish: Electrostatic sprayed enamel, in manufacturer's standard color.

B. Wire Mesh Panels: Steel channel frames with wire mesh securely clinched through holes in channels; frame joints mortise and tenoned.
   1. Wire Mesh: 6 gauge steel wire woven into 2 inch (50 mm) diamond mesh.
   2. Frame Members: Steel channels 1-1/2 inch (38 mm) by 3/4 inch (19 mm); extended below bottom horizontal to form post feet.
   3. Provide intermediate horizontal stiffener channels of same dimension as frame members at approximately 36 inches (915 mm) above floor level and at not more than 60 inches (1830 mm) apart vertically; wires woven through stiffener channels.

C. Hinged Door Sections: Matching wire mesh panels.
   1. Hinge Side, Top and Bottom Frame Members: 1-1/2 inch (38 mm) by 3/4 inch (19 mm) channel with 1-1/2 inch (38 mm) by 1/8 inch (3 mm) flat bar cover.
   2. Lock Side Frame Members: 1-5/8 inch (41 mm) by 7/8 inch (22 mm) by 1/8 inch (3 mm) angle, riveted.
   3. Width: 36 inches (915 mm).
   4. Door Opening Height: 84 inches (2134 mm), minimum.
   5. Hinges: 3 heavy duty butt hinges riveted to door panel and frame.
   6. Lock: Mortise cylinder lock operated by key outside, recessed knob inside.

D. Corners and Intersections:
   1. 90 Degree Corner: Full height 1-3/4 inch (44 mm) by 1-3/4 inch (44 mm) steel angle.
   2. 3- and 4-Way Intersections: Clips.
   3. Other Corners: Full height 2-3/8 inch (60 mm) outside diameter pipe post.

E. Straight Run Posts: 5/16 inch (8 mm) thick flat steel bars; provide between each section of partition.
   1. Panels Over 16 feet (4884 mm) High: 3-1/2 inches (89 mm) wide posts.
   2. Panels 12 feet (3657 mm) to 16 feet (4884 mm) High: 3 inches (76 mm) wide posts.
   3. Panels 7 feet (2134 mm) to 12 feet (3657 mm) High: 2-1/2 inches (63 mm) wide posts.

F. Floor Sockets: Aluminum; 2-1/2 inches (63 mm) high; set screws to secure posts at adjustable height.

G. Top Bar: Continuous steel channel stiffening length of partition run.
   1. Size: 3 inches (76 mm) by 4.1 pounds per ft (6 kg/m).
   2. Anchored to panel frames with 5/16 inch (8 mm) U-bolts at 28 inches (710 mm) on center.
   3. Anchored to adjacent structure as indicated on drawings.

2.4 ACCESSORIES

A. Bolts, Nuts and Washers: Hot-dip galvanized.

B. Anchorage devices: Drilled expansion bolts.

C. Exposed mechanical fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of structure.

2.5 FABRICATION

A. Fabricate assemblies of framed sections; to sizes and profiles required; with framing members fitted, reinforced and braced, to suite design requirements.

B. Fit and assemble in largest practical sections for deliver to site, ready for installation.

C. Fabricate items with joints tightly fitted and secured. Make exposed joints flush and hairline.

D. Grind exposed welds flush and smooth with adjacent finish surface. Ease exposed edges to small uniform radius.

E. Provide components required for anchorage to adjoining construction. Fabricate anchorage and related components of same material and finish as framing members.

F. Fabricate openings made for penetrating mechanical and electrical components.

2.6 FACTORY FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. All members shall shop-applied electrostatic sprayed enamel finish, in color selected by Architect from Manufacturer's standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify that field measurements are as shown on the Shop Drawings.

C. Beginning of installation means acceptance of existing project conditions.

3.2 ERECTION

A. Erect and install in accordance with manufacturer's instructions. Install level and plumb, accurately fitted, free from distortion or defects.

B. Adjust doors to achieve free movement.

3.3 TOLERANCES

A. Maximum variation from plumb or level: 1/4 inch.

B. Maximum misalignment from true position: 1/4 inch.

3.4 CLEANING

A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 10 22 39

FOLDING PANEL PARTITIONS

PART 1 – GENERAL

1.1 SUMMARY

A. General: The work of this Section consists of providing folding panel partitions where shown on the Drawings, as specified herein, and as required for a complete and proper installation.

B. Furnish and install the following:

1. Folding panel acoustical partition, paired hinged panels, manual operation.
2. Ceiling track, ceiling guards, and operating hardware.
3. Tackable surfaces.
4. Markerboards.
5. Pass doors, frames, and hardware.
6. Shop applied surface finish.

C. Furnish overhead track attachment brackets to be installed under Section 05 50 00 – METAL FABRICATIONS. Provide an accurate template to Section 05 50 00 for bracket installation to support the folding panel partition track at Auditorium.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Floor recess for floor track.

D. Section 05 50 00 - METAL FABRICATIONS: Overhead track structural support framing.

E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and track support shimming.

F. Section 06 20 00 - FINISH CARPENTRY: Wood trim.

G. Section 08 71 00 - DOOR HARDWARE: Lock cylinders.

H. Section 09 29 00 - GYPSUM BOARD: Adjacent ceiling finish.

I. Section 09 51 00 - ACOUSTICAL CEILINGS: Adjacent ceiling finish.

J. Section 09 72 00 - WALL COVERINGS: Furnishing vinyl coated wall fabric for application to panels.

K. Division 26 - ELECTRICAL: Electric service and empty conduit from partition motor controller to disconnect.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
3. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.
4. ASTM E413 - Classification for Rating Sound Insulation.
5. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions.
6. ASTM E596 – Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
7. FS CCC-W-408 - Wall Covering, Vinyl-Coated.
8. PEI - Performance Specifications for Porcelain Enamel Chalkboards.
9. All applicable federal, state and municipal codes, laws and regulations for exits.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner or designated representative, Architect, General Contractor, folding panel partition Installer's Project Superintendent, folding panel partition manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work.
2. Agenda:
    a. Scheduling of folding panel partitions..
    b. Review of staging and material storage locations.
    c. Coordination of work by other trades.
    d. Installation procedures for ancillary equipment.
    e. Protection of completed Work.
    f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
    g. Emergency rain protection procedure.
    h. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

C. Sequencing:
1. Field Measurements
    a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

D. Scheduling:
1. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, sound transmission performance data, physical properties and installation instructions for panel system.
    a. Provide written test report by test facility for acoustical performance.
    b. Provide written test report by approved test facility for field tests of acoustical performance of completed partitions.
2. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage.
3. Shop drawings: Fully describe partition fabrication, layout and installation.

a. 1/4 inch scale elevations and plans of each unique folding partition.

b. Large scale design details of ceiling track trolleys and hardware; show attachment to framing; and complete installation details. Indicate tolerances required for framing members.

4. Selection Samples:

a. Sample card indicating Manufacturer's full range of colors available for selection by Architect for vinyl fabric, chalkboards and tack surfaces.

b. Provide 24 by 24 inch samples if requested by Architect to assist the initial selection of colors and finishes.

5. Verification Samples:

a. 12 by 12 inch record samples of selected colors and finishes for vinyl fabric, chalkboards and tack surfaces.

b. 12 inch long samples of trim in finish specified.

6. Sustainable Design Submittals: As required by NE CHPS.

7. Qualification Submittals.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Operation and Maintenance Data: Maintenance instructions for Owner’s routine maintenance procedures including inspection, adjustments, lubrication and cleaning.

a. Include troubleshooting guide and instructions for field repairs.

b. Include service manual and parts list

c. Identify parts recommended by manufacturer to be replaced following manufacturer’s suggested years of service for identified components.

2. Bonds and Warranty Documentation:

a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

A. General: Notify the Architect where conflicts apply between referenced standards, specified materials, and methods of construction.

B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of folding panel partitions.

C. Qualifications:

1. Installer: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, **and approved by product manufacturer**.

2. Professional Engineer Qualifications: Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Rhode Island

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Do not deliver folding panel components to the project until all concrete, masonry, plaster and other wet work has been completed and dry.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Packaging Waste Management: Comply with disposal and recycling requirements specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable an recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.8 SITE CONDITIONS

A. Maintain ambient temperature above 50 degrees Fahrenheit for 24 hours before, during, and 48 hours after installation of folding panel partitions

1.9 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

1. Manufacturer’s Warranty: Effective from completion date of installation for a period of two years. Warranty shall include the work of this Section and agreement to promptly repair defects and malfunction folding panel partitions. Warranty includes replacement of defective materials, and labor for repairs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Modernfold Inc., New Castle IN, Product: “ Acousti-Seal Encore.”

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Modernfold Inc., New Castle IN.

2. Hufcor Americas Inc., Janesville, WI.
3. Moderco, Inc., Boucherville, Quebec.
4. Kwik Wall Co., Movable Partitions, Springfield, IL.

2.2 DESCRIPTION

A. General Description:
1. Partition Type: Folding panel acoustical partition(s) with paired hinged panels, manual operation.

2.3 PERFORMANCE/DESIGN CRITERIA

A. Sound Transmission Coefficient (STC): Standard panel construction (per ASTM E90), STC as tested on panel size of 100 square feet (9.3 square meters),
1. Minimum STC ratings are as follows:
a. Type 1 Partitions STC: 52, NIC 46.
2. Acoustical performance shall have been tested at an NIST-accredited, independent laboratory in accordance with ASTM E90-99 or more recent Test Standards.
3. Acoustical performance: NSSEA “Class ratings” are not acceptable in lieu of tested performance.

B. Noise Isolation Class (NIC): ASTM E336 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings, NIC of 42.
1. Contractor shall arrange for NIC testing of the installed operable walls. If the NIC test results do not the specified NIC rating the Contractor shall repair or replace the walls and re-test until the walls meet the NIC specification at no additional cost to the Owner.

C. Regulatory Requirements: Conform to applicable code for combustibility requirements for materials.
1. Surface Burning of panel finish: ASTM E 84; flame/fuel/smoke rating of 25/35/50.

D. Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

E. Work of this section shall be field tested under Section 01 45 29 - TESTING LABORATORY SERVICES using applicable ASTM standard test methods to confirm integrity of specified acoustical performance. All partitions failing to achieve specified acoustical performance shall be re-installed or replaced and re-tested until compliance is achieved at no additional cost to the Owner.

2.4 PARTITIONS – MANUALLY OPERATED, PAIRED PANEL

A. Manually operated, paired-panel type, with the following features:
1. Panel Construction: Nominal 4-1/4-inch (108 mm) thick panels in manufacturer’s standard 51-inch (1295 mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with

overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

a. Hinges: “SOSS” brand Invisible laminated hinge with antifriction segments mounted between each heat-treated link. Hinge to be attached directly to panel frame. Welded internal hinge bracket shall support the hinge and allow for adjustment of hinge plates.

2. Panel Skins: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction.

3. Panel Finishes: Acoustical, non-woven needle punch carpet, with fused fibers to prevent unraveling or fray of material.

4. Panel trim: No exposed panel trim required or allowed, hardware to be of one consistent color

a. Smoke Gray.

5. Stacking: Center stacked.

6. Acoustic Seals:

a. Panel to panel seals: Grooved and gasketed astragals, continuous flexible vinyl, fitted to panel edge construction; color to match panel finish.

b. Panel to panel jambs: Flexible acoustic seals at jambs and meeting mullions, ceilings, and floor. Provide retractable seals at floor and ceiling.

c. Bottom seals: Automatic operable drop seal, activated when panel is in position.

d. Top seals: Continuous contact multi-finger vinyl sweep seals.

B. Suspension System:

1. Suspension Tracks: Minimum 11-gage, 0.12-inch roll-formed steel track, supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 3/8-inch diameter threaded rods. Aluminum track is not acceptable.

a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.

2. Carriers: Two all-steel trolleys with steel-tired ball bearing wheels. Non-steel tires are not acceptable. Suspension system shall provide automatic indexing of panels into stack area using preprogrammed switches and trolleys without electrical, pneumatic, or mechanical activation.

C. Hardware: Latching door handles of cast steel, satin chrome finish.

2.5 FABRICATION

A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.

2.6 POCKET DOORS

A. Pocket Doors: Acoustically sealed Pocket Doors by folding panel partition manufacturer.

1. Configuration shall be manually operated of the following types, provide as indicated on Drawings:

a. Type I single door hinged to a jamb on one side as required.

b. Type II double door hinged to a jamb on each side and closing in the center.

c. Type III double doors hinged to a jamb on each side and closing in the center. One of the door panels is equipped with a smaller hinged panel that folds back when the operable partition is extended into the pocket.

B. Panels shall be nominal 3-inch (76mm) thick in manufacturer's standard width. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of panel skin.

C. Panel skin: Roll-formed 21-gage steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction.

1. Acoustical ratings of panels with this construction: 50 STC.

D. Panel hinges: SOSS® invisible laminated hinge with antifriction segments mounted between each heat-treated link. Hinge to be attached directly to panel frame. Welded internal hinge bracket shall support the hinge and allow for adjustment of hinge plates. Concealed hinges or hinges mounted into panel edge or vertical astragal are not acceptable.

E. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.

F. Panel face finish: Match operable partition, except as otherwise indicated on Drawings

G. Pocket Door jambs shall be continuous channels anchored to a fixed wall. Welded hinge anchor plates shall support pocket door hinges and permit a full 180-degree swing.

H. Pocket Door framing and acoustical baffles as required shall be by others.

2.7 ACCESSORIES

A. Pass Doors:

1. Single Pass Doors: Matching pass door same thickness and appearance as the panels. ADA-compliant pass door equipped with non-locking lever latch. No threshold will be permitted.

2. Hardware:

a. Locking lever latch.

b. Self-Illuminated exit signs.

c. Panic hardware.

d. Door closer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Inspect partition and envelope for compliance with ASTM E557.

C. Examine flooring, structural support, and opening, with installer present, for compliance with installation tolerance requirements and other conditions affecting operable partition performance. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Confirm track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

E. Confirm floor flatness of 1/8 in 10 feet, non-cumulative.

F. Verify that required utilities are available, in proper location, and ready for use.

G. Beginning of installation means acceptance of project conditions

3.2 PREPARATION

A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all in situ surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

B. General: Comply with ASTM E557, operable partition manufacturer’s written installation instructions, Drawings and approved Shop Drawings.

C. Install operable partitions and accessories after other finishing operations, including painting have been completed.

D. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

E. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

F. Fit and align partition assembly level and plumb.

3.3 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

E. Fit and align partition assembly level and plumb.

3.4 TOLERANCES

A. Maximum variation from plumb or level: 1/4 inch.

B. Maximum offset from true dimensional alignment: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. General: Field inspection will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.

B. Light leakage testing: Conduct visual field test for light leakage with all room lights turned on in space on opposite side of partition, and dark on side where being viewed from. Adjust partition or replace gasketing as required to correct light leakage observed.

C. Operation Test: In the presence of the Owner's designated representative, demonstrate that partition is capable of being moved from the stored position to the fully extended position smoothly and quietly. Demonstrate proper operation of the partition in manual mode. Adjust partitions which do not operate properly and retest.

D. Field Sound Performance: Provide partition testing by an independent certified acoustical consultant in accordance with ASTM E336, and achieve a Noise Isolation Clast (NIC) of 42, plus or minus two. Adjust or modify partitions which do not comply and retest. Submit test reports.

3.6 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

B. Visually inspect partition in closed position for light leaks to identify a potential acoustic leak. Adjust to achieve tight seal.

3.7 CLEANING

A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

B. Clean work under provisions of Section 01 70 00 – EXECUTION.

C. Waste Management:

1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.8 DEMONSTRATION

A. Engage a factory-authorized servie reprsentative to train Owner’s maintenance personnel for adjustment, operation and maintenance of operable panel partitions.

3.9 PROTECTION

A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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BULLET RESISTANT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:

1. Bullet resistant (UL 752 Level 5), fiberglass panels and related accessories.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 06 10 00 – ROUGH CARPENTRY: Wood blocking.

D. Section 09 22 16 – NON –STRUCTURAL METAL FRAMING: Metal stud framing to receive cementitious backer board installed under this Section.

E. Section 09 29 00 - GYPSUM BOARD: Gypsum board, applied over metal framing installed by this Section 09 22 16 including: gypsum board, and related trim components.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM E119 - Standard Test Methods for Fire-Rating of Building Construction and Materials.
2. UL 752 10th Edition, Standard for Bullet Resisting Equipment.
3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements
    a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
    b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
2. Shop Drawings:
    a. 1/4 inch scale elevations and plans of each condition where bullet resistant panels are required.
    b. Large scale design details showing method of attachment; and complete installation details.
3. Verification Samples: 12 x 12 inch samples.
4. Certificates:
    a. Fire Resistant Requirements Manufacturer's written certification stating that bullet resistant panels and all related items to be furnished hereunder, meet or exceed the requirements all U.L. fire-resistive requirements for the indicated Labels have been met.
5. Test and Evaluation Reports: UL Listing Verification and UL752 Current Test Results as provided by Underwriters Laboratories, and printed data in sufficient detail to indicate compliance with the contract documents.
6. Manufacturer’s Instructions: Manufacturer’s written installation instructions indicating special procedures, and perimeter conditions requiring special attention.
7. Sustainable Design Submittals: As required by NE CHPS.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Bonds and Warranty Documentation:
    a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

A. General: Notify the Architect where conflicts apply between referenced standards, specified materials, and methods of construction.

B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer.

1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

a. Deliver materials to the project with the manufacturer’s UL Listed Labels intact and legible.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 WARRANTY

A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

B. Manufacturer Warranty:

1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner’s name the standard written manufacturer’s 2 year guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer’s published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Armortex, Schertz, Texas.

B. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

1. Armortex, Schertz, Texas
2. Waco Composites (ArmorCore brand), Waco, TX.
3. Total Security Solutions, Fowlerville, MI.
4. Bullet Guard Corporation, West Sacramento, CA.

2.2 DESCRIPTION

A. General Description: Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets. The production technique and materials used shall provide the controlled internal delamination to capture a projectile.

B. Bullet Resistant Fiberglass panels: 1-7/16 inch minimum thickness, and 14.8 pounds per square foot.

2.3 PERFORMANCE/DESIGN CRITERIA

A. Capacities: General: Bullet resistant tested in accordance with UL 752 and in compliance with the following tests:
1. Level 1: 9mm full metal copper jacket with lead core.
2. Level 2: .357 Magnum, jacketed lead soft point.
3. Level 3: .44 Magnum lead semi-wadcutter gas checked.
4. Level 4: .30 Caliber rifle lead core soft point.
5. Level 5: 7.62 mm rifle lead core full metal copper jacket, military ball.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Prior to installing the bullet resistive material the contractor shall verify that all supports have been installed required by the contract documents and the architectural drawings.
2. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

3.3 INSTALLATION

A. All joints shall be reinforced by a back-up layer of bullet resistive material. The bullet resistance of the joint, as reinforced, shall be at least equal to that of the panel. Minimum width of reinforcing layer at joint shall be 4-inches(2” on each panel or a 2” minimum overlap).

B. Armor shall be installed in accordance with the manufacturer’s printed recommendations. Armor panels shall be adhered using an industrial adhesive, mastic, screws or bolts. Method of application shall maintain the bullet resistive rating at junctures with the concrete floor slab, the concrete roof slab, the bullet resistive door frames, the bullet resistive window frames, and all required penetrations.

3.4 TOLERANCES

A. Maximum variation from plumb or level: 1/8 inch.

B. Maximum offset from true dimensional alignment: 1/8 inch.

3.5 FIELD QUALITY CONTROL

A. Field inspection will be performed under the provisions of Section 01 45 29 – TESTING LABORATORY SERVICES.

3.6 CLEANING

A. Daily clean work areas by sweeping and disposing of debris, and scraps.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

C. Clean work under provisions of Section 01 73 00 – EXECUTION.

End of Section

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Section 10 28 13

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install toilet, bath and custodial accessories.

B. Furnish and install protection padding for exposed piping.

C. Install Owner-furnished (OFCI) toilet accessories.

D. Furnish concealed anchorage devices for handicap handrails for installation under Section 06 10 00 - ROUGH CARPENTRY.

E. Furnish toilet and bath accessory templates, to locate anchorage reinforcement, to trades responsible.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - SUMMARY: Toilet accessories furnished and installed by Owner.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 06 10 00 - ROUGH CARPENTRY:

1. Wood blocking.
2. Installation of concealed anchorage devices for grab bars in toilet rooms: Section 10 28 13 - TOILET ACCESSORIES.

E. Section 09 22 16 – NON-STRUCTURAL METAL FRAMING: metal framing and reinforcing plate blocking.

F. Section 09 29 00 - GYPSUM BOARD: Gypsum board partitions and metal framing.

G. Section 09 77 33 - SANITARY WALL PANELS: Glass fiber wall panels.

H. Section 10 21 13 - TOILET COMPARTMENTS.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A240/A240M – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
5. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
7. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
8. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
9. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use.
12. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
13. ASTM G222 - Standard Practice for Estimation of UV Irradiance Received by Field-Exposed Products as a Function of Location.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work

B. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under **Section 00 00 00 - TITLE**

C. Sequencing:

1. Field Measurements

a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, for each item furnished hereunder.

2. Schedule: Complete schedule, indicating types, quantity, and model numbers of accessories for each location in which the accessories will be installed.

3. Selection samples: Sample color chips indicating each manufacturer's full range of colors available for selection by Architect.

4. Verification samples: Complete units, as requested by Architect.

5. Sustainable Design Submittals: As required by NE CHPS.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier and item identification number corresponding with approved schedule.

B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, surface contamination, corrosion and damage from construction traffic and other causes.

C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.

2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

B. Coordinate the work of this Section with placement of internal wall reinforcement.

1.8 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

1. Warranties shall be effective starting from Date of Project Substantial Completion and are effective for specified term lengths.

B. Manufacturer Warranty: In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet steel: Cold rolled, commercial quality, ANSI/ASTM A 366.

B. Stainless steel sheet: ASTM A 167, Type 302/304.

C. Tubing: ASTM A 269 stainless steel.

2.2 TOILET ACCESSORIES

A. Manufacturer: To establish a standard of quality, design, function desired, and appearance, Drawings and specifications have been based on manufacturers and model numbers specified herein below. Manufacturers offering products which may be considered as equal include the following:

1. American Specialties, Inc. (ASI), Yonkers, NY.
2. Bobrick Washroom Equipment, Inc. (Bobrick), Clifton Park, NY.
3. Bradley Corporation / Washroom Accessories Division, (Bradley) Menomonee Falls, WI.
4. VonDrehle Corporation, Hickory, NC.

B. Coat/robe hook: Surface mounted satin finish stainless steel double robe hook, fabricated from 22 gage type 304 stainless steel, protrudes from wall nominally 1-7/8 inches.

1. ASI model Nº. 7345-S.
2. Bobrick model Nº. B-76727.
3. Bradley model Nº. 9124.

C. Electric dryer: High speed, low energy consumption surface-mounted hand dryer with no-touch infrared-sensor operation. Automatic shut-off after 90 seconds of non-use. GreenSpec™ Listed.

1. Electrical requirements, 115 volt AC, 9 amp, 60hz. 900-1500 watts.
2. Cover: One piece aluminum housing or die-cast zinc alloy, with brushed stainless steel finish.
3. Acceptable models:
   a. Dyson Airblade V Hand Dryer, HU02 Sprayed nickel.
   b. ASI 'Turbo-Dry High Speed Dryer', model Nº. 0197-1.
   c. Excel Dryer model Nº. XL-SB
   d. World Dryer 'Airforce' series, model Nº. J974.
4. Accessories: Approved manufacturers accessories equal to Speed and Sound Control Kit part #40112 and Noise Reduction Nozzle part #62.2. Unit to have a Max dB level rating of 70-72dB. Accessories ADA recess kit; In single toilet rooms "Xlerator Part ID 40502", In gang toilet rooms "Xlerator Part ID 40551".

D. Grab bars (of lengths and configurations as indicated on Drawings): Stainless steel, minimum wall thickness 18 gage (Stub's gage), with non-slip knurled, peened or striated surface.

1. Grab bars (Child): 1 inch diameter with satin finished ends, concealed mounting and snap flange with cover secured by 4 set-screws, equal to:
   a. ASI series 3700.
   b. Bobrick series: B-530-X18.
   c. Bradley series (n/a). 852
2. Grab bars (Adult): 1-1/4 inch diameter with satin finished ends, concealed 1/8 inch thick mounting flange with snap-on cover, equal to:
   a. ASI series 3700.
   b. Bobrick series B-5806.99.
   c. Bradley series 832.

E. Grab bars at accessible showers: Stainless steel, minimum wall thickness 18 gage (Stub's gage), with non-slip knurled, peened or striated surface. 1-1/4 inch diameter with satin finished ends, concealed 1/8 inch thick mounting flange with snap-on cover. (Provide configuration as indicated on Drawings).

1. “L” shape grab bar with 42 inch and 24 inch leg lengths:
    a. ASI model 3700-P Series in dimensions indicated.
    b. Bobrick series: B-5806.99 Series in dimensions indicated.
    c. Bradley series: 832 Series, in dimensions indicated.
2. “L” shape grab bar with 30 inch and 30 inch leg lengths:
    a. ASI model 3700-P Series in dimensions indicated.
    b. Bobrick series: B-5806.99 Series in dimensions indicated.
    c. Bradley series: 832 Series in dimensions indicated.

F. Mirrors, framed: Type 1 (Child): 18 inches wide by 30 inches high and Type 2 (Adult): 40 inches wide by 30 inches high having the following:
1. Frame: one piece 3/4/ by 3/4 inch type 304 18 gage stainless steel roll formed frame, with continuous integral stiffener on all sides. Corners shall be heliarc welded, ground and polished smooth. corners
2. Back: 20 gage galvanized steel back attached to frame with concealed screws.
3. Mirror glass: 1/4 inch thick safety glass, ASTM C 1048 FT, fully tempered, complying with Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1, with Class 1, standard commercial quality, electro-copper back-plating protected by a corrosion-resistant zinc-coating.
4. Acceptable models:
    a. ASI model Nº. 0600-
    b. Bobrick model Nº. B-2908-
    c. Meek model Nº. M1210

G. Mop and broom holders: Surface mounted, nominal 44 inch long stainless steel unit with 18 gage 8 inch deep continuous shelf, 5 stainless hooks and 4 mop/broom holders, anti-slip spring loaded, rubber cam mop holders, capable of holding 7/8 to 1-1/4 inch diameter handles.
1. ASI model 1308B.
2. Bobrick model Nº. B-239-44.
3. Bradley model Nº. 9934.

H. Sanitary napkin disposal (Type 1): Surface mounted feminine napkin disposal unit, fabricated of type 304 stainless steel, with one piece cover.
1. A.S.I., model 0852
2. Bobrick model B-270 (“Contura” Series)
3. Bradley model Nº. 4722-15

I. Sanitary napkin disposal (Type 2): Partition mounted feminine napkin disposal unit serving two toilet compartments.

1. A.S.I. 0472
2. Bobrick B-354
3. Bradley model Nº. 4721-15

J. Sanitary napkin/tampon vendor (Type 1): Semi-recessed stainless steel napkin/tampon vendor having a capacity of 30 napkins and 27 tampons. (requires 4 inch wall depth).

1. Mechanism handle turns and shall be operable to comply with ADA Accessibility Guidelines (ADAAG).
2. Coin operation: Equip with single 25 cent coin mechanism.
3. Acceptable models:
   a. ASI model Nº. 0468-2-F. (Basis of Design)
   b. Bobrick model Nº. B-370634C
   c. AJW model Nº. (n/a).
   d. Bradley model Nº. (n/a).
4. Locations: Girls multi-use toilet rooms and gender neutral toilet rooms, SPED/SwD Toilet rooms and Nurse Toilet rooms (T102, T106, 129A (Girls Locker Room), T202, T206, T302, T306, T402, T108, 128A (Gender Neutral Locker Room), T204, T308, 326B (Music Storage), 326A (Music Storage), T404, 101B, 105B, 202A, 204A, 112J, 112K).

K. Sanitary napkin/tampon vendor (Type 2): Semi-recessed stainless steel napkin/tampon vendor having a capacity of 30 napkins and 27 tampons. (requires 4 inch wall depth).

1. Mechanism handle turns and shall be operable to comply with ADA Accessibility Guidelines (ADAAG).
2. Coin operation: Equip with single 25 cent coin mechanism.
3. Acceptable models:
   a. AJW model Nº. U526-25.
   b. ASI model Nº. 6468-25.
   c. Bobrick model Nº. B-3500-25 (pull handle).
   d. Bradley model Nº. (n/a).
4. Locations: Staff Toilet Rooms (T105, 127A, 214B, 314B, T203, T103, T109, T303, T403, T307).

L. Shower curtains and rods:

1. Curtain rods: 1-1/4 inch diameter, Stainless steel, minimum wall thickness 18 gage (Stub's gage), with stainless steel 2-1/2 inch flange and concealed fasteners. Lengths for locations shown on the Drawings.
    a. ASI model 1206
    b. Bobrick model B-6047.
2. Curtain hooks: 18-8, type 304 Stainless steel, 0.09 inch diameter. Provide one hook for every 6 inches, or fraction thereof of each curtain rod.
3. Polyester shower curtain: white, 100 percent polyester mildew resistant, Teflon coated for water repellency and stain resistance. Fabricate curtain with hemmed edges and a fully weighted, anti-fungus, mildew resistant bottom hem and corrosion-resistant grommets along reinforced top edge every 6 inches (152 mm) on center through top hem.

M. Shower seat Type 1: Folding type with cushion shall have a frame constructed of type-304, satin finish stainless steel. Seat cushion shall be 1-1/2 inches thick foam padding mounted on 1/ inch thick plywood and covered in water-resistant reinforced vinyl fabric. Seat shall be able to lock in upright position when not in use and comply with ADA Accessibility Guidelines (ADAAG). Seat supports shall not come into contact with floor. Provide left or right hand seat. *(Addendum No. 6)*
    1. A&J model Nº. U933-1AR or U933-1AL, as indicated.
    2. ASI model Nº. 8205R or 8205L as indicated.
    3. Bobrick model Nº. B517 or B518, as indicated.

N. Shower seat Type 2: Folding seat having a frame constructed of type-304, satin finish stainless steel, 16-gauge (1.6 mm), 1-1/4" (32-mm) square tubing, and 18-gauge (1.2-mm), 1" (102-mm) diameter tubing. Seat 18 inches wide and project nominally 16 inches from wall and have a 2 inch thick foam padded, white vinyl seat with enclosed 1/2 inch thick plywood base. Seat supports shall not come into contact with floor. Seat shall fold against wall when not in use. *(Addendum No. 6)*
    1. ASI model Nº. 8204.
    2. Bobrick model Nº. B-519.

O. Shelving: Custodial shelf, stainless steel, 6 inches deep by 18 inches wide with 3/4 inch edge return. Mounting brackets, 16 gage welded to shelf.
    1. ASI model Nº. 0692.
    2. Bobrick model Nº. B-296.
    3. Bradley model Nº. 756.

P. Soap Dispensers (Child and Adult): Owner Furnished Contractor Installed (OFCI). Coordinate and provide blocking as required to properly mount dispensers where indicated on the Drawings.

Q. Toilet tissue dispenser: Surface-mounted, jumbo-roll, toilet tissue dispenser, constructed of type-304 stainless steel. Dispensing mechanism accommodate two

10" (254-mm) diameter toilet tissue rolls; and be equipped with a sliding access panel that exposes one roll at a time. Spindles shall be convertible in the field to dispense 3" or 2-1/4" (76 or 57 mm) diameter core rolls with use of removable core adapters furnished.

1. ASI model Nº. 0040.
2. Bobrick model Nº. B-2892.
3. Bradley model Nº. 5425.

2.3 LOCKS

A. General: All locks shall be keyed alike. Provide four (4) keys, for lockable accessories, to the Owner.

2.4 INSTALLATION ACCESSORIES

A. Fasteners, screws, and bolts: Type 304 stainless, tamperproof.

B. Expansion shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.

2.5 FABRICATION

A. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion, scratches or dents. Weld and grind smooth joints of fabricated components.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

C. Shop assemble components and package complete with anchors and fittings. Hot dip galvanize exposed and painted ferrous metal and fastening devices. Provide steel anchor plates, adapters, and anchor components for installation.

2.6 FACTORY FINISHING

A. Ferrous metals: Clean and treat, spray apply one coat of baked-on rust and moisture-resistant primer, followed by two coats of baked-on synthetic enamel, in selected colors. Ensure that finish coating is uniform in color intensity and degree of gloss, throughout.

B. Chrome/Nickel Plating: ASTM 456, Type SC2, satin finish.

C. Stainless steel: Number 4 satin finish, except as otherwise specified above under manufacturer’s available colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide templates and rough-in measurements as required. Deliver inserts and rough-in frames to site at appropriate times for building-in by other trades

B. Coordinate with trades responsible for providing receiving surfaces on which accessories will be installed.

C. Exact locations of accessories within each room or area shall be as directed by the Architect.

3.2 INSTALLATION

A. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.

B. Install toilet accessories absolutely level and in true line, securely and rigidly anchored with theft proof fasteners of the size and type most appropriate for the specific receiving surface, concealing the fasteners as far as practicable.

3.3 ADJUSTING

A. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.4 CLEANING

A. Remove all protective films and coverings from accessories, and clean and polish each piece. Remove all rubbish, packing materials, and debris, caused by the work of this Section.

End of Section

Section 10 40 00

SAFETY SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:

1. Fire extinguisher cabinets (rated and non-rated types).
2. Provide fire extinguishers at Type C valve cabinets furnished and installed under Section 21 00 00 – FIRE SUPPRESSION.
3. Fire Extinguishers: Provide 20 pound capacity extinguishers at locations called out on the Fire Safety Plan (refer to general notes on Drawing). Provide 5 pound capacity extinguishers at all other locations indicated.
4. Fire blanket cabinets with blankets.
5. Fire Department valve cabinet
6. Defibrillators and cabinets.
7. First aid kits.
8. Emergency key cabinets.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit partitions.

E. Section 06 10 00 - ROUGH CARPENTRY: Wood rough-in framing and blocking.

F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Framed wall openings at gypsum board partitions.

G. Section 09 91 00 - PAINTING: Field finishing.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. NFPA 10 – Standard for Portable Fire Extinguishers, 2007 Edition.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, indicating: fabrication specifications, finishes, dimensions of cabinet and rough opening, and installation instructions.
2. Shop drawings: Details showing unit dimensions, methods of construction, attachment clips and brackets; and complete installation details.
3. Sustainable Design Submittals: As required by NE CHPS.

1.5 REGULATORY REQUIREMENTS

A. Obtain certificate of compliance from authority having jurisdiction indicating approval of fire extinguisher cabinets and their installed locations.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not deliver cabinets or extinguishers to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Store cabinets and extinguishers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS AND CABINETS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:

1. J.L. Industries, Bloomington MN.
2. Larsen Manufacturing Co., Minneapolis MN.
3. Potter-Roemer, Union NJ.

B. Recessed fire extinguisher cabinets:

1. Cabinet trim style: Flat trim, fully recessed cabinet.
2. Door and trim: Cold-rolled steel with factory applied white thermally fused polyester coating, acceptable to receive a field applied recoating.
   a. Vertical duo design with clear tempered safety glazing.
   b. Vigilante alarm: Provide 9 volt, battery operated (battery included), plunger activated, vigilante alarm.

c. Handles: Red door handles having raised letters “FIRE”.

d. Lettering: Factory furnished decals for filed application, as directed by Architect.

1) Pattern: Vertical reading.

2) Color: Red

3. Cabinet construction: 18 gage cold-rolled steel with factory applied white baked acrylic enamel finish.

4. Acceptable products (non rated):

a. Cabinets for 5 pound capacity extinguishers:

1) JL Industries “Ambassador Series”, model number 1815.

2) Larsen “Architectural Series”, model number 2409-R1.

3) Potter-Roemer, “Alta Series”, model number 7010.

b. Cabinets for 20 pound capacity extinguishers:

1) JL Industries “Ambassador Series”, model number 2015.

2) Larsen “Architectural Series”, model number 2712-R.

3) Potter-Roemer, “Alta Series”, model number 7025.

5. Acceptable products (2 hour rated):

a. Cabinets for 5 pound capacity extinguishers:

1) JL Industries “Ambassador Series”, model number 1815-FX.

2) Larsen “Architectural Series”, model number FS-2409-R1.

3) Potter-Roemer, “Alta Series”, model number FRC-7010.

b. Cabinets for 20 pound capacity extinguishers:

1) JL Industries “Ambassador Series”, model number 2015-FX.

2) Larson “Architectural Series”, model number FS-2712-R.

3) Potter-Roemer, “Alta Series”, model number FRC-7025.

C. Wall mounting bracket: 16 gage steel surface mounted bracket, with red glossy polyester thermo-set coating, equal to the following. Provide with red letter decals spelling “FIRE EXTINGUISHER” applied to wall surface, letter size, style as required by code, location as selected by Architect.

1. JL Industries, model number “MB-810”.

2. Larsen model number 864.

3. Potter-Roemer, model number 3903.

D. Extinguishers: Multi-purpose dry chemical type (mono amonium phosphate), with metal valves and siphon tubes, replaceable molded valve stem seals, pressure gauges and hose discharge

1. 5 pound capacity extinguishers (typical) multi-purpose rated ‘2A, 10B:C’.

2. 20 pound capacity extinguishers (where designated): multi-purpose rated ‘4A, 60B:C’.

2.2 FIRE DEPARTMENT VALVE CABINETS

A. Fire department valve cabinets:

1. Cabinet trim style: Flat trim, fully recessed cabinet.
2. Door and trim: Cold-rolled steel with factory applied white thermally fused polyester coating, acceptable to receive a field applied recoating.
   a. Full glazed design with clear tempered safety glass.
   b. Handles: Manufacturer's standard.
   c. Lettering: Factory applied, having the words "Fire Department Valve".
      1) Pattern: Horizontal reading.
      2) Color: Red.
3. Cabinet construction: 18 gage cold-rolled steel with factory applied white baked acrylic enamel finish.
   a. Interior dimensions: 18 by 18 inches by 8 inches deep.
4. Acceptable cabinet models:
   a. Two hour fire-resistant-rated cabinets
      1) JL Industries "Crownline 8000" series, model number 8514
      2) Larsen "Architectural Series", model number VC-1818R.
      3) Potter-Roemer, model number FRC1810.

2.3 FIRE BLANKET CABINETS AND BLANKETS

A. Combination fire extinguisher and blanket cabinet: Surface mounted combination fire extinguisher/fire blanket cabinet. Provide solid door labeled with red letters "FIRE EXTINGUISHER" (vertical) and "FIRE BLANKET" (horizontal),. equal to:
   1. JL Industries, not acceptable equal.
   2. Larsen Manufacturing Co., model "FB 3612-SM".
   3. Potter-Roemer, model number 6609.

B. Fire blanket cabinet: Surface mounted blanket cabinet. Fabricate from 18 gage cold-rolled steel with factory applied red baked enamel finish with solid door labeled with white letters "FIRE BLANKET" (horizontal), equal to:
   1. JL Industries, model "2FB".
   2. Larsen Manufacturing Co., model "FB 1016".
   3. Potter-Roemer, model number 6601.

C. Fire blanket: Nominal 62 by 80 inch sized woven wool blanket, treated with fire resistant chemicals meeting FS-CS-191-53.

2.4 EMERGENCY AID SPECIALTIES

A. Defibrillator cabinet: Recessed cabinet, 14 inches by 14 inches by 6 inches equal to Phillips Model No. "AMP180RM".

B. Automated External Defibrillator:
   1. Basis of Design: Philips Heart Start OnSite HS1 Defibrillator.
   2. Defibrillator Model: Automatic external defibrillator with adult defibrillation peak current of 32A (150J nominal) into a 50 ohm load and pediatric defibrillation peak current of 19A (50J nominal) into a 50 ohm load, complying with AAMI

DF80 guidelines and AHA recommendations for adult defibrillation equal to Phillips Model “HeartStart M5066A”.

a. Capacity: Minimum 200 shocks or 4 hours of operating time.

3. Unit includes:
   a. Defibrillator unit.
   b. Battery: 9 Volt DC, 4.2 Ah disposable long-life lithium manganese dioxide primary cells equal to Phillips Model No. M5070A, pre-installed.
   c. Adult pads cartridge equal to Phillips Model M5071A.
   d. Infant/Child pads cartridge equal to Phillips Model M5072A.
   e. Quick reference guide.
   f. Setup and maintenance guide with expiration date tags.
   g. Owner’s Manual.
4. Accessories:
   a. Adult training pads cartridge equal to Phillips Model M5073A.
   b. Infant/Child training pads cartridge equal to Phillips Model M5074A.
   c. Data Recording and Transmission: Infrared IrDA protocol
   d. Alarm: Standard key activated alarm, activated when door is opened to remove the defibrillator; 120db.
5. Required number: Provide 2 cabinets and defibrillators in locations determined by the Owner and Architect.

2.5 EMERGENCY KEY CABINETS

A. Fire department emergency access key cabinet: Model SUPRASAFE 2HSR, UL listed, high security, capacity (13 keys), recessed mounted with optional recessed masonry mounting kit, as manufactured by Kidde Fire Safety, Mebane, NC., or approved equal having the following construction:
   1. Housing: 1/4 inch thick plate steel with joints welded.
   2. Door: 1/2 inch thick steel plate with neoprene weather seal and stainless steel door hinge.
   3. Locking: Double-action rotating tumblers and hardened steel pins accessed by a biased cut key with 1/8 inch thick stainless steel lock cover.
   4. Finish: Black polyester powder coat.

2.6 FIRST AID KITS

A. First aid kit: Wall mounted, ANSI compliant kit with steel cabinet having 3 shelves, for minimum 100 person capacity, as manufactured by Global Industrial, model Nº. WGB2024170 or approved equal.

2.7 SIGNAGE

A. Extinguisher signage: Manufacturer’s standard V-shape blade type signage white background with red text equal to Larsen Model PTD-108. Provide one sign at each extinguisher location.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify that prepared openings are ready to receive extinguisher cabinets.

C. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

A. Install fire extinguisher cabinets in accordance with manufacturer's instructions in locations indicated.

B. Do not commence installation of fire extinguisher cabinets until immediately adjacent surfaces have been completely installed and finished.

C. Install cabinets absolutely level and in true line, with units securely anchored to the surrounding construction. Fit trim pieces accurately and tight to adjacent construction.

1. Maximum variation from plumb and level: 1/8 inch.
2. Maximum offset from true dimensional alignment: 1/4 inch.

3.3 CLEANING AND ADJUSTMENT

A. Upon completion of the work of this Section in any given area, remove tools, and all packaging and debris from the work area; leave area in broom-clean condition.

B. After adjacent work is complete:

1. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
2. Remove all tape and other packing materials from fire extinguisher cabinets .
3. Thoroughly clean and polish all exterior and interior surfaces of extinguisher cabinets, take care to remove dirt from corners. Clean metal and glass surfaces with mild cleaning agents as recommended by manufacturer.
4. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

End of Section

Section 10 51 13

METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section consists of furnishing and installing metal lockers with all required closures, filler pieces and locker room benches where shown on the Drawings, as specified herein, for a complete and proper installation. Work includes, but is not limited to:

1. Locker Type 1 (Gender Neutral, Girls, & Boys Locker Rooms): All welded construction athletic locker, double-tier, flat-top.
2. Locker Type 2 (Boys Locker Rooms): All welded construction athletic locker, double-tier, flat-top.
3. Locker Type 3 (Girls, & Boys Locker Rooms): All welded construction athletic locker, four-tier, flat-top.
4. Locker Type 4 (Custodial & Kitchen): Double tier, flat-top ventilated metal locker.
5. Locker room benches and backrests.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slab curbs.

D. Section 06 10 00 - ROUGH CARPENTRY: Wood sleepers cast into concrete curbs.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ADAAG - Americans with Disabilities Act, Accessibility Guidelines

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements

a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.

2. Warranty: Provide sample copies of manufacturers' actual warranties, clearly defining all terms, conditions, and time periods for the coverage thereof.

3. Shop drawings:

a. 1/4 inch scale (minimum) plans of each area with specified lockers, include layout of all lockers, closures, and filler panels and large scale details of locker construction; and details of accessory items.

b. Large scale details of locker and bench construction, showing filler panels, sloping top components, attachment clips, brackets and complete installation details.

4. Selection samples: Manufacturer's color chips, comprising at least 8 different colors, for selections by the Architect.

5. Verification samples:

a. one full sized locker of each type required.

6. Sustainable Design Submittals: As required by NE CHPS.

7. Qualification Submittals.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Bonds and Warranty Documentation:

a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

2. Sustainable Design Submittals: As required by NE CHPS, version 4.0.

1.6 QUALITY ASSURANCE

A. Obtain locker and benches from a single manufacturer, or from manufacturers recommended by the prime manufacturer of lockers.

B. Qualifications

1. Manufacturer, with a minimum of 3 years' experience demonstrating previously successful work of the type specified herein.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not order or fabricate lockers, until all specified submittals have been submitted to, and approved by, the Architect.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
3. Store lockers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel: Mild cold-rolled and leveled steel, free from buckle, scale, and surface imperfections.

B. Expanded Metal: 3/4 inch mesh flattened carbon steel, 13 gage minimum.

C. Fasteners: Cadmium, zinc, or nickel plated steel; exposed bolt heads, slotless type; self-locking nuts or locker washers for nuts on moving parts.

1. Locker assembly fasteners shall be "pop" type rivets with aluminum bodies and steel mandrels. Rivets shall be backed up by washers to ensure correct rivet expansion and secure fastening.

D. Equipment: Hooks and hang rods of cadmium-plated or zinc-plated steel or cast aluminum.

2.2 LOCKER TYPES

A. Locker Type 1 (Gender Neutral, Girls, & Boys Locker Rooms): All welded construction athletic locker, Double Tier, Flat-top.

1. Configuration: Double tier locker 12 inches wide by 18 inches deep by 60 inches high at front with a compartment height of nominal 30 inches.
2. Body:
   a. Uprights 16 gage cold rolled steel sheet having diamond shaped perforations nominally 3/4 inch by 1-1/2 inch. Fabricate backs 16 gage steel sheet formed with uprights, perforated at back to back lockers.
   b. Form exposed ends of lockers of minimum 16-gage steel.
3. Door frame and cross members: 16 gage channel or 12 gage angles, with continuous door stop/strike integral with frame on both sides of opening.
4. Door: 14 gage perforated steel, formed with full channel shape on lock bar side, channel formation on hinge side and flanged top and bottom. Fabricate to swing 180 degrees.
   a. Reinforcing: Provide extra bracing or reinforcing on inside of doors over 15" wide.
5. Hinges: 5 knuckle, 2 inch high full loop pin hinge welded to frame and riveted to inside of door flange.
   a. Lockers doors 42 inches in height or less, provide 2 hinges.
6. Padlock strike plate: 20 gauge stainless steel 1-1/2 inches wide by 2-1/4 inches high attached with 2 slotless head machine screws or 2 rivets.
7. Latching method: Two point latching with spring steel latch contained in a lock bar under tension. Lock bar contained in door channel by self-lubricating polyethylene guides.
8. Base: Cast in place concrete, with wood sleepers provided under Section 06 10 00 – ROUGH CARPENTRY.
9. Sloping tops: 18 gage steel minimum having a sloped rise approximately 18 to 25 degrees, finished to match lockers, in lengths as long as practicable, but not less than 4 lockers. Provide closures at ends finish to match lockers.
10. Filler panels: 16 gage steel minimum, factory-fabricated and finished to match locker units.
11. Trim: 18 gage steel minimum finished to match lockers. Secure with concealed fasteners.
12. Accessories:
    a. Number Plates: Provide each locker door with polished aluminum number plate with black numerals not less than 1/2 inch height.

B. Locker Type 2 (Boys Locker Rooms): All welded construction athletic locker, Double Tier, Flat-top.

1. Configuration: Double tier locker 15 inches wide by 18 inches deep by 60 inches high at front with a compartment height of nominal 30 inches.
2. Construction: Same as Locker Type 1.

C. Locker Type 3 (Girls, & Boys Locker Rooms): All welded construction athletic locker, Four-Tier, Flat-top.

1. Configuration: Four tier locker 12 inches wide by 18 inches deep by 60 inches high at front with a compartment height of nominal 15 inches.
2. Construction: Same as Locker Type 1.

D. Locker Type 4 (Custodial & Kitchen): Double tier, flat-top ventilated metal locker.

1. Configuration: Double tier locker 12 inches wide by 18 inches deep by 60 inches high at front with a compartment height of nominal 30 inches.
2. Body: Backs, sides, tops, bottoms, shelves and sides minimum 24-gage. Flange tops, bottoms and shelves on four sides, and backs on two sides.
   a. Form exposed ends of lockers of minimum 16-gage steel.
   b. Lower shelf:
      1) Standard locker: 6 inches above finished floor.
      2) Handicapped accessible locker: 9 inches above finished floor.
   c. Top shelf:
      1) Standard locker: Manufacturer's standard height.
      2) Handicapped accessible locker: 48 inches above finished floor.
3. Door frame and cross members: 16 gage channel or 12 gage angles, with continuous door stop/strike integral with frame on both sides of opening.
4. Door: Flush design, double wall construction, with louvers top and bottom, 16 gage steel, formed with full channel shape on lock bar side, channel formation on hinge side and flanged top and bottom. Fabricate to swing 180 degrees.
   a. Quieting Pans: Provide quieting pans welded to inside of doors to reduce noise.
5. Hinges: Three 5 knuckle, 2 inch high full loop pin hinge welded to frame and riveted to inside of door flange.
6. Door handle:
   a. Latching method: Two point latching with spring steel latch contained in a lock bar under tension. Lock bar contained in door channel by self-lubricating polyethylene guides. Provide frame hooks welded to door frame, furnished with soft rubber silencers at each hook.
   b. Lock method: Combination lock shall be integral to locker and managed by a master system for tracking lock combinations and for changing combinations in the future.
   c. Pocket: Recessed formed 20 gage stainless steel pocket encased with molded ABS thermoplastic cover.
7. Base: Cast in place concrete, with wood sleepers provided under Section 06 10 00 – ROUGH CARPENTRY.

8. Sloping tops: 20 gage steel minimum having a sloped rise approximately 18 to 25 degrees, finished to match lockers, in lengths as long as practicable but not less than 4 lockers. Provide closures at ends finish to match lockers.
9. Filler panels: 18 gage steel minimum, factory-fabricated and finished to match locker units.
10. Trim: 18 gage steel minimum finished to match lockers. Secure with concealed fasteners.
11. Accessories:
    a. Double prong hook mounted to underside of locker top or back of locker.
    b. Single prong hook mounted on each side of locker.
    c. Number Plates: Provide each locker door with polished aluminum number plate with black numerals not less than 1/2 inch height.

E. Locker Type 2: Athletic double tier sloped top locker 12 inches wide by 18 inches deep by 36 inches high at front.
1. General Design: Same as Locker Type 1 except as modified above.

F. Locker Type 3: Athletic 5 tier sloped top locker 12 inches wide by 12 inches deep by 60 inches high at front with a compartment height of 29 inches.
1. General Design: Same as Locker Type 1 except as modified above.

G. Locker Type 2: Athletic double tier sloped top locker 12 inches wide by 18 inches deep by 36 inches high at front.
1. General Design: Same as Locker Type 1 except as modified above.

H. Locker Type 3: Athletic 5 tier sloped top locker 12 inches wide by 12 inches deep by 60 inches high at front with a compartment height of 29 inches.
1. General Design: Same as Locker Type 1 except as modified above.

I. Locker Type 4: Double tier, flat-top ventilated metal locker 12 inch wide by 18 inch deep by 60 inch high at front with a compartment height of 29 inches.
1. Body: Backs, sides, tops, bottoms, shelves and sides minimum 24-gage. Flange tops, bottoms and shelves on four sides, and backs on two sides.
    a. Form exposed ends of lockers of minimum 16-gage steel.
    b. Lower shelf:
        1) Standard locker: 6 inches above finished floor.
        2) Handicapped accessible locker: 9 inches above finished floor.
    c. Top shelf:
        1) Standard locker: Manufacturer’s standard height.
        2) Handicapped accessible locker: 48 inches above finished floor.
2. Door frame and cross members: 16 gage channel or 12 gage angles, with continuous door stop/strike integral with frame on both sides of opening.
3. Door: Flush design, double wall construction, with louvers top and bottom, 16 gage steel, formed with full channel shape on lock bar side, channel formation on hinge side and flanged top and bottom. Fabricate to swing 180 degrees.

a. Quieting Pans: Provide quieting pans welded to inside of doors to reduce noise.

4. Hinges: Three 5 knuckle, 2 inch high full loop pin hinge welded to frame and riveted to inside of door flange.
5. Door handle:
   a. Latching method: Two point latching with spring steel latch contained in a lock bar under tension. Lock bar contained in door channel by self-lubricating polyethylene guides. Provide frame hooks welded to door frame, furnished with soft rubber silencers at each hook.
   b. Lock method: Combination lock shall be integral to locker and managed by a master system for tracking lock combinations and for changing combinations in the future.
   c. Pocket: Recessed formed 20 gage stainless steel pocket encased with molded ABS thermoplastic cover.
6. Base: Cast in place concrete, with wood sleepers provided under Section 06 10 00 – ROUGH CARPENTRY.
7. Sloping tops: 20 gage steel minimum having a sloped rise approximately 18 to 25 degrees, finished to match lockers, in lengths as long as practicable but not less than 4 lockers. Provide closures at ends finish to match lockers.
8. Filler panels: 18 gage steel minimum, factory-fabricated and finished to match locker units.
9. Trim: 18 gage steel minimum finished to match lockers. Secure with concealed fasteners.
10. Accessories:
    a. Double prong hook mounted to underside of locker top or back of locker.
    b. Single prong hook mounted on each side of locker.
    c. Number Plates: Provide each locker door with polished aluminum number plate with black numerals not less than 1/2 inch height.

2.3 LOCKER ROOM BENCHES

A. Fixed-in-place benches, factory fabricated:
   1. Typical tops: Laminated maple, 9-1/2 inches wide by 1-1/4 inches thick of lengths indicated, sealed and varnished.
   2. Accessible tops: Laminated maple, 24 inches by 48 inches by 1-1/4 inches thick, sealed and varnished.
   3. Pedestals chromed-steel tubing, 1 inch inside diameter with 10 gage flanges welded to each end.
   4. Overall seating height shall be between 17-1/2 to 18 inches.
   5. Where seats are not located against walls provide backrest attached to bench.

2.4 FACTORY FINISHING

A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel finish.

1. Locker Type 1, 2, 3 and 4: Paint locker bodies and doors in 2 custom colors to match Architect's sample. Note locker doors and bodies will be separate colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. During the operation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled to match original finishes.

3.3 INSTALLATION

A. Do not commence installation of lockers until immediately adjacent surfaces have been completely installed and finished.

B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.

C. Furnish and install all sloped top pieces as required, refer to the Drawings for the various conditions.

D. Furnish and install all filler pieces as required to completely fill recesses, and to align with ends of partitions. Refer to the Drawings for the various conditions.

E. Set lockers absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation. Conceal screw heads and bolts as far as practicable, leaving exposed panels completely free from unused bolt holes.

F. Locate locker benches where shown on the Drawings.

3.4 ADJUSTING AND CLEANING

A. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

B. Remove all tape and other packing materials from locker surfaces, and thoroughly clean and polish all exterior and interior surfaces.

C. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

3.5 PROTECTION

A. Protect locker finish surfaces and hardware from damage until Owners Final Acceptance.

End of Section

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Section 10 51 23

PHENOLIC LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install single and double tier phenolic lockers, for installation on wood curb framing, complete with all required trim, closures and filler pieces.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 06 10 00 - ROUGH CARPENTRY: Wood framing and nailers.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements

a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
2. Warranty: Provide sample copies of manufacturers' actual warranties, clearly defining all terms, conditions, and time periods for the coverage thereof.
3. Shop drawings:
   a. 1/4 inch scale (minimum) plans of each area with specified lockers, include layout of all lockers, closures, and filler panels and large scale details of locker construction; and details of accessory items.
   b. Large scale details of locker and bench construction, showing filler trim, end and edge panels, attachment clips, brackets and complete installation details.
4. Verification samples: Two 12 x 12 inch samples of selected laminate with edging.
5. Sustainable Design Submittals: As required by NE CHPS.
6. Qualification Submittals.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Bonds and Warranty Documentation:
   a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

1.6 DELIVERY, STORAGE AND HANDLING

A. General: Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

B. Delivery and Acceptance Requirements:

1. Do not order or fabricate lockers, until all specified submittals have been submitted to, and approved by, the Architect.
2. Do not deliver lockers to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
   a. The locker manufacturer, locker installer and the Contractor are all jointly responsible to make certain that lockers is not delivered until the building and storage areas are sufficiently dry so that the lockers will not be damaged by excessive changes in ambient humidity and relative moisture content.

3. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
4. Sequence deliveries to avoid delays and to minimize on-site storage.

C. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Store lockers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

D. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.
1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, during, and after installation of casework; maintain temperature until Owner’s Final Acceptance.

B. Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, during, and after installation of casework: maintain relative humidity until Owner’s Final Acceptance.

1.8 WARRANTY

A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES:
1. Manufacturers standard material and workmanship warranty on the work of this Section for a period of 3 years following Date of Substantial Completion.
a. Provide 2 year warranty for lock parts.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on [___] company, Product: “ [___]
1. No substitution will be accepted.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Hollman, Inc., Irving, TX.
2. Treeforms Lockers, Greensboro NC.
3. Accu Tec Manufacturing, Santa Ana, CA.
4. Legacy Lockers, Inc., Dallas, TX.

2.2 MANUFACTURER

A. Manufacture: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Summit Lockers, Columbia, SC. Manufacturers offering similar products which may be considered as equal, are limited to the following:

1. Foreman Locker Systems, Murrieta, CA.
2. Columbia Lockers Division of PSiSC, Columbia, SC.
3. ASI Storage Solutions, Inc., Memphis, TN.
4. AccuTec Manufacturing, Santa Ana, CA.

2.3 LOCKERS

A. Materials: Class A fire rated solid phenolic with a high pressure melamine matte finish surface manufactured as an integral part of the core material. Laminated surfaces will not be accepted. Surface and edges shall be non-porous and shall not support the development of fungus or bacteria. Exposed surfaces that exhibit discolorations, pitting, seam marks, roller marks, stains, telegraphing of core material, chipping at edges or corners or other imperfections on finished units will be rejected. Solid phenolic shall meet or exceed all requirements for Class A Flame Spread Rating and Smoke Developed calculated according to ASTM E84. Certifications shall be in the name of the locker manufacturer and shall be less than six (6) months old.

B. Locker Types:

1. Solid phenolic three tier wardrobe lockers, mounted on wood curb. Solid phenolic doors with stainless steel hardware.
    a. Type 1(a): Single tier locker 12 inches wide by 12 inches deep by 24 inches high at front.
    b. Type 1(b): Double tier locker 12 inches wide by 12 inches deep by 48 inches high total (24 inches high per individual unit) at front.
    c. Type 2: Single tier locker 12 inches wide by 12 inches deep by 24 inches high at front, with countertop.

C. Locker body: Locker body shall incorporate mortise and tenon construction with unitized locker body construction to allow for multiple locker configurations within the same body. Locker body shall be mechanically fastened with stainless steel fasteners. Locker shelves shall be mortised into sidewalls of the body at locations determined by the Architect or as indicated on the Drawings. Relocation of shelves in the field shall be possible without the need for special tools or welders. Hinges shall be attached to the body with stainless steel theft-proof Torx head with pin bolt fasteners. Lockers shall be delivered fully assembled.

1. Locker box tops and bottoms and shelves: 3/8 inch (10 mm) thick fabricated from material as body.
2. End panels and toe kick plates: 1/2 inch (13 mm) thick fabricated from material as body.

D. Locker doors: 1/2 inch (13 mm) thick frameless locker doors shall be the full width of the locker and shall allow access to the entire width of the locker. Framed doors will not be approved. Perimeter ventilation shall be integral to the door construction. Doors shall be attached to hinges with stainless steel theft-proof Torx head with pin bolt fasteners.

E. Hardware and accessories

1. Built-in Combination Locks: All lockers shall be equipped with built-in combination locks. Locks shall have four number combination dialing and be capable of at least five different combination changes.
   a. Locks are to be installed on lockers using security-type machine screws.
   b. Provide Owner with master control key and combination change key chart and combination control charts upon completion of locker installation.
   c. Basis of design: Salisbury Model 33395BLK or approved equal.
2. Hinges: Concealed, 5 knuckle type constructed from 14 gauge Type 304 stainless steel with satin finish. Hinge shall allow door to open 90°.
3. Coat Hooks: Surface mounted, 11 gauge Type 304 stainless steel with satin finish. All edges shall be polished and smooth. Coat hooks shall be attached to locker body with stainless steel theft-proof Torx head with pin bolt fasteners or through bolts as recommended by the manufacturer. Provide three (3) coat hooks for all lockers.
4. Number Plates: Provide manufacturer's standard number plate for each door in the sequence. Number plate shall be engraved from the back side to prevent the accumulation of dirt and grime.

F. Finishes:

1. Door face and back: Selected from manufacturer's full range of wood grains.
2. Door sides: Selected from manufacturer's full range of colors and patterns.
3. Locker body: Selected from manufacturer's full range of colors and patterns.
4. Locker interior: Selected from manufacturer's full range of colors and patterns.

2.4 FABRICATION

A. Provide factory pre-assembled locker units. Lockers shall be complete with all hardware and accessories listed above. Knocked down units will not be accepted.

B. Factory machine attachment holes accurate and free of chips.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Do not commence installation of lockers until immediately adjacent surfaces have been completely installed and finished.

B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.

C. Set lockers absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation.

1. Anchor locker units to wall studs through the locker back and to the base through the locker floor. Join side by side lockers by attaching fasteners through pre-drilled holes.
2. Conceal screw heads and bolts as far as practicable, leaving locker cabinets completely free from unused bolt holes.

D. Furnish and install all trim and filler pieces required to completely fill recesses, and to align with ends of partitions. Refer to the Drawings for the various conditions.

E. Adjust and align doors for uniform spacing after installation of lockers.

F. Attach number plates in sequence after lockers are in place.

3.3 ADJUSTING AND CLEANING

A. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

B. Remove all tape and other packing materials from locker surfaces, and thoroughly clean and polish all exterior and interior surfaces.

3.4 PROTECTION

A. Protect locker finish surfaces and hardware from damage until Owners Final Acceptance.

End of Section

Section 11 31 00

APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide appliances, including the following:

1. Refrigerator.
2. Under-counter refrigerator.
3. Under-counter dishwasher.
4. Washer.
5. Dryer.
6. Heavy duty washer.
7. Heavy duty dryer.
8. Wall oven – built-in.
9. In-counter cook-top.
10. Range hood.
11. Ice Makers (one freestanding type where indicated, and two undercounter type at Science-Prep rooms).

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Division 22 – PLUMBING: Hot and cold water supply, and sanitary connections to appliances.

E. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Exhaust duct connections to appliances.

F. Division 26 - ELECTRICAL: Electrical supply to appliances.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. Comply with all applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder clearly indicating configurations, sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.
2. Manufacturer’s installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
3. Manufacturer’s certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
4. Manufacturer's sample warranties.
5. Shop drawings for coordination: Provide dimensioned locations for utility connections.
6. Sustainable Design Submittals: As required by NE CHPS.

B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:

1. Manufacturer’s warranties: Include coverage of installed equipment.
2. Maintenance Data: Include lubrication and periodic maintenance requirement schedules.

1.5 QUALITY ASSURANCE

A. Certification labels: Provide residential equipment which complies with standards and bears certification labels as follows:

1. Energy ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and energy information required by Federal Trade Commission.
2. UL standards: Provide residential equipment with UL labels.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store all materials in original packaging in protected interior location.

B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing,

windows or doors to place and install the work of this Section shall be performed at not additional cost to the Owner.

1.7 WARRANTY

A. Provide manufacturer's standard 2 year warranties under the provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Products requiring electrical connections: Listed and classified by UL, as suitable for the purpose specified and indicated.

B. Provide and install the work of this Section in conformance with all applicable federal, state and municipal codes, laws and regulations regarding utilities, health, fire protection and safety.

2.2 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. General Electric Company, (GE) Appliances Division, Louisville KY.
2. KitchenAid Company (division of Whirlpool Corp), St. Joseph, MI.
3. Maytag Company, Magic Chef Division, Cleveland TN.
4. Frigidaire Corp./ Division of Electrolux Home Products Inc., Martinez, GA.
5. Scotsman, Vernon Hills IL.
6. Summit, Bronx, NY.
7. Felix Storch, Inc., Summit Appliance Division, Bronx, NY.
8. Whirlpool Corporation, Benton Harbor MI.

2.3 EQUIPMENT

A. General: Without intent to limit competition, but to establish a standard of quality, design and function desired, Drawings and specifications have been based on the models listed below. Equal products are available from the manufacturers listed herein above.

B. Refrigerator: General Electric Model No. GSE25HSHSS.

C. Refrigerator, under-counter: Summit Appliance Model No. CT663BKCSSADA.

D. Counter-Depth Refrigerator: General Electric Model No. GBE17HYRFS.

E. Dishwasher, under-counter: General Electric Model No. GDT226SSLSS.

F. Washer: General Electric Model No. GFWR2705HMC.

G. Dryer: General Electric Model No. GFDR27EHMC.

H. Wall oven: General Electric Mode No. JKS3000SNSS, ADA Compliances Required.

I. In-counter cook top: General Electric Model No. PHP9030SJSS.

J. Range hood: 35 7/8 inch hood for mounting below cabinets, equal to General Electric Model No. PVX7360SJSS, ADA Compliances Required.

K. Ice Makers:

1. Freestanding self-contained: Ice-O-Matic model Nº. ICEU 300A or approved equal, 30 inch width Air Cooled condenser, half dice cube Ice Machine with 112 pound storage bin.
2. Undercounter types at Science Prep Rooms: Scottsman model Nº. CU3030MA-1, or approved equal. with 100 pound storage bin.

L. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories whether specified or not for a complete installation.

2.4 FINISHES

A. Finish Colors: Provide manufacturer's standard colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.

B. Verify clearances required for equipment.

C. Verify ventilation outlets, service connections, and supports are correct and in required location.

D. Verify that electric power is available and of the correct characteristics.

E. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

A. Install each product in accordance with manufacturers’ instructions.

1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.

B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

C. Anchor equipment using devices appropriate for equipment, substrate and expected usage.

3.3 ADJUSTING

A. Adjust work under provisions of Section 01 73 00 - EXECUTION.

B. Adjust equipment to ensure proper working order and conditions.

C. Remove and replace equipment creating excessive noise, or vibration.

D. After installation is completed, insure that operating parts work freely and fit neatly. Adjust hardware and catches. Repair or replace damaged parts dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

3.4 CLEANING

A. Clean Work under provisions of Section 01 73 00 - EXECUTION:

1. Wash and clean appliances.
2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.

B. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

End of Section

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Section 11 40 00
FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Sections, apply to this Section.

1.2 SCOPE

A. Attention is directed to the detailed Item Specifications, which provide for minimum acceptable products. Item Specifications paragraphs may indicate materials or components that exceed the manufacturer's standards and are required for this project.

B. Cooperate and coordinate with others engaged on the project in order that work will progress on schedule.

C. Work to be performed under this Section is shown on Foodservice Equipment Drawings.

D. Install materials furnished under this Section, other than materials that are expressly noted for installation under other Sections. Installation work shall be performed by workmen compatible with those existent on the project site. Equipment shall be of the latest design; new and unused, unless indicated otherwise in the Item Specifications, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.

E. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect.

F. Provide neatly punched openings or cutouts required to permit passage of plumbing and electrical services by related trades and to accommodate mounted switches and receptacles in the equipment.

1. Work in this Section shall include but shall not be limited to the following:
2. Catalog items of equipment.
3. Fabricated equipment other than catalog items.
4. Plumbing trim consisting of mechanical system components required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for equipment where water is introduced less than 2 in. above flood level.
5. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators and internal wiring to a control panel or switch, if mounted on the equipment.

G. Sustainable Design Intent: Comply with project requirements intended to achieve a rating, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building.

B. Connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, and the rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work.

C. Exhaust ventilating systems complete with blowers, ductwork, hangers, access panels, and insulation between the exhaust collars and the exhaust blowers.

D. External wiring; the mounting and wiring of motor starters, solenoid valves, switches and receptacles not integral with the equipment; mounting and wiring of walk-in refrigerated room ceiling mount light fixtures; wiring of walk-in refrigerated room interior evaporator coils; connecting conduit, and external connections to equipment to the building electrical distribution system.

1.4 SUBMITTALS

A. Submit Shop Drawings for approval in accordance with the General Conditions.

B. Stub-in drawings shall indicate the layout of equipment and dimensioned locations of all services to the equipment.

1. Hand drawn scale: 1/2 inch = 1 ft., 0 in.
2. CAD drawn scale: 1/4 inch = 1 ft., 0 in.
3. Stubbed services shall include electrical, hot and cold water, floor drains or floor sinks, solid wastes and exhaust collar connections. Point of connection services shall include steam supply, condensate return, gas connection and indirect waste connections. Service dimensions shall include height measured from finish floor.
4. Electrical and plumbing services shall be indicated and coordinated on the same drawing.
5. Call-outs for each stub point indicated at the point, or clearly keyed to a schedule on the same drawing.
6. Special conditions plan shall include all floor recesses, curbs and special wall construction indicated and dimensioned

C. Fabrication drawings shall be furnished for non-catalog items, showing plans, elevations and full construction details with gauges, components, fasteners, erection and connections. Drawings shall be to the minimum scale of 3/4 in. = 1 ft., 0 in.

D. Standard items of equipment, not built-in or part of other assemblies shall be submitted for approval in the form of bound catalog cuts. Each cut shall include a clearly marked item number, a listing of all optional accessories and finishes, and connection data.

E. Mechanical refrigeration system submittal shall include the firm name and address of the installation contractor and name of the qualified installer.

F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible. Kitchen Equipment Contractor shall clearly indicate that items are Energy Star rated both on the submittal cover sheet and manufacturer cut sheets.

G. Failure to comply with approved shop drawings shall be cause for rejection of an improperly built assembly.

1.5 SAMPLES

A. If the bidder's proposed equipment fabricator is unknown to the Consultant's office, immediately after award of contract, submit the following samples for selection and approval:

1. Section of table showing edge, bullnose, framing, fasteners, gusset, leg, and foot, all assembled.
2. Drawer assembly (will be returned for use on this project).

B. Work delivered to the job shall match approved samples.

1.6 GUARANTEES AND WARRANTEES

A. New equipment furnished for this facility shall be guaranteed for a period of not less than one calendar year beginning on the date of final acceptance of the work of this Section. In the case of a manufacturer whose standard warranty exceeds this period the longer period shall apply. Self-contained refrigeration units for reach-in refrigerators, freezers, ice cream chests and ice machines shall carry a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.

B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacement of an entire item is required, the Owner will have the option of full use of the defective equipment until a replacement has been delivered and completely installed.

C. Furnish manufacturer's warrantees for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warrantees to the Architect in accordance with conditions found in "Demonstration and Operating Instructions" paragraphs, contained in Part 3, this Section.

1.7 REGULATORY AGENCIES

A. Work shall be in accordance with the governing health, building and safety, and fire protection codes and regulations.

B. Standards of the National Sanitation Foundation (NSF) shall serve as guidelines for the work of this Section.

C. Electric equipment and accessories shall conform to the standards of the National Electric Manufacturers Association (NEMA), Underwriters Laboratories, Inc. (UL) or Electrical Testing Station (ETS).

D. Steam generating equipment and accessories shall conform to the standards of the American Society of Mechanical Engineers (ASME).

E. Gas fired equipment and accessories shall conform to the standards of the American Gas Association (AGA) and the American National Standards Institute (ANSI) Z83.11.

F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible.

1.8 EQUALITY OF MATERIALS AND EQUIPMENT

A. The base bid shall contain no substitutions to these drawings or specifications. Bidders may offer substitute equipment in a separate proposal, indicating the proposed model and sum to be added or deducted if the alternate item is accepted by the Owner. Each line item shall include delivery, installation and taxes. Decisions to accept or reject a piece of equipment shall be made by the Owner, and all decisions shall be final.

PART 2 - PRODUCTS

2.1 MATERIALS AND FINISHES

A. General

1. Metals shall be free from defects impairing strength, durability or appearance, made of new materials with structural properties to withstand strains and stresses to which normally subject.
2. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.

B. Stainless Steel

1. Stainless steel shall be non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy), polished to a Number 4 finish where exposed, unless otherwise noted. Minimum gauges shall be as specified under Item Specifications.

C. Galvanized (Galvannealed) Steel

1. Galvannealed steel shall be commercial quality with tight coat of zinc galvanizing metal applied to a soft steel sheet, subsequently passed through a 1200 degree F. oven, resulting in a spangle free paintable surface. Minimum gauges shall be as specified under Item Specifications.

D. Plastic Laminate Materials

1. The laminate facing shall be GP-50, .050 in. thick, general purpose, high pressure, decorative plastic laminate that meets or exceeds the requirements of NEMA Publication LD3-1985, and NSF Standard 35. The plastic laminate exposed surfaces shall be provided in accordance with the specified manufacturer, finish and color. Balancing sheet shall be backing grade GP-28 in matching color at semi-exposed and BK-20 unfinished where hidden.
2. Plastic laminate covered surfaces shall be factory fabricated with 3/4 in. thick core having plastic laminate facing on both faces and all edges, laminated with waterproof glue under pressure in accordance with the plastic laminate manufacturer's specifications.
3. The core shall be medium density phenolic resin particleboard conforming to ANSI A208.1, Type 2-M-2, 45 pound per cubic foot density minimum.
4. Provide veneer core plywood or solid hardwood edge banding for doors and vertical dividers or panels where hardware is attached to casework.
5. Hinges shall be articulated, spring loaded type equal to Grass CST65-170-F or Stanley, with quantity adequate to support the door without deformation. Do not provide handles on plastic laminate clad doors.

2.2 CONSTRUCTION

A. General

1. Flat metal work items of equipment, such as tables, sinks, or counter tops, and other non-catalog items described under Item Specifications, shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacture high quality food service equipment.
2. The equipment fabricator shall be subject to the approval of the Architect, Owner and Consultant. Refer to Paragraph 1.05, Samples.
3. Fabricated foodservice equipment shall be manufactured by one manufacturer, of uniform design, material and finish.
4. Equipment shall conform to the applicable requirements of current Federal, State, and Local Codes and Regulations.

B. Welding

1. The words "weld", "welded" or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the exposed parts ground smooth and polished to match adjoining surfaces. Welding electrodes shall match the material being welded.
2. Where spot welding is specified, the welds shall be a maximum spacing of 3 in. on center.
3. Where tack welding is specified, the pieces welded shall have 1/2 in. minimum lengths of welding material at 4 in. on center maximum spacing.

C. Grinding, Polishing and Finishing

1. Exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if

necessary, again welded and ground to eliminate low spots. Ground surfaces shall be polished or buffed to a degree consistent with good workmanship. Coves shall be ground and polished to match adjoining material.

2. Care shall be exercised in grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding stainless steel shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth. Grain direction shall be uniform, uni-directional for a total length of material. Cross grains and random polishing are not acceptable.
3. The general finish of equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. Mitered or bullnosed corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable. The equipment surfaces, where exposed, shall be finished to a grained Number 4 (satin) finish unless otherwise specified. An exposed surface shall include an inside surface, which is exposed to view when a swinging or sliding door is opened. Underside of shelves need not be satin finish unless otherwise specified.
4. Excessive distortion caused by welding shall be cause for rejection for that item of equipment.

2.3 BUY-OUT COMPONENTS

A. CASTERS: 5 in. diameter polyurethane tired, swivel, plate or stem mount to suit application, 300 pound capacity, brakes only if specified, NSF approved; Component Hardware C-21-3050 (plate/no brake), C21-3051 (plate/brake) C23-3350 (stem/no brake) or C23-3351 (stem/brake), or equal by Kason, or PDI Atlanta.

B. COUNTER LEGS: Stainless steel, 6 in. to 7-3/4 in. height adjustment; Component Hardware A72-0811, or A77-5048, or equal by Kason, or PDI Atlanta.

C. DOOR AND DRAWER PULLS: Stainless steel, full grip type with beveled edge, NSF approved for stud mounting in device, in horizontal attitude to meet NSF requirements; Component Hardware P63-1012, or equal by Kason, or PDI Atlanta.

D. DOOR HINGES: Stainless steel, lift off type, swedged knuckle for minimum clearance, nylon bearings; Component Hardware M75-1002 or equal by Kason, or PDI Atlanta.

E. DRAWER PANS: Molded plastic or fiberglass, 20 in. by 20 in. by 5 in. deep, NSF approved; Component Hardware S80-2020, or equal by Kason, or PDI Atlanta.

F. DRAWER SLIDES: Stainless steel, NSF approved, full extension, 200 pound capacity with stainless steel ball bearing wheels; Component Hardware S-52 series, or equal by Kason, or PDI Atlanta.

G. FAUCET SETS, DECK MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on swivel nozzle or swivel gooseneck to suit the

application; T&S Brass B-0221 or B-0321, or equal by Component Hardware, Chicago, or Fisher.

H. FAUCET SETS, POTWASHING SINK: Chrome plated cast bronze with removable cartridges, 3/4 in. passages, eccentric flanged female inlets on 8 in. centers with LL street EL inlets with locknuts, four prong handles, 12 in. swing spout; T&S Brass B-0290 or equal by Component Hardware, Chicago, or Fisher.

I. FAUCET SETS, SPLASH MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on 12 in. swing spout; T&S Brass, B-0231-CC or equal by Component Hardware, Chicago, or Fisher. Provide each with a mounting kit.

J. GUSSETS: Stainless steel, stepped side, fully closed, NSF approved, mild steel interior reinforcement, wide flange for welding to framing, set screw anchor for leg; Component Hardware A20-0206C, or equal by Kason, or PDI Atlanta.

K. LEG AND BULLET FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-6272-C, or equal by Kason, or PDI Atlanta.

L. LEG AND FLANGED FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with 3-1/2 in. diameter flange and two holes for securing to floor, minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-4272-C, or equal by Kason, or PDI Atlanta.

M. NUTS: Zinc plated "Pal Nuts" with integral cap and lockwasher; Component Hardware Q-34-1024 or equal by Kason, or PDI Atlanta.

N. SEALANT: Sealant for sealing equipment to walls or filling crevices between components. All materials listed below that are used in the building interior must not exceed the following requirements:

1. South Coast Air Quality Management District (SCAQMD) Rule #1168
2. For interior adhesives and sealants applied within the weatherproof barrier, submit a printed statement of VOC content.

O. SOUND DEADENING BASINS: Component Hardware Q75-1366 or equal by Kason, or PDI Atlanta.

P. SOUND DEADENING TOPS AND SHELVES: Component Hardware Q85-5225, or equal by Kason, or PDI Atlanta, "Tacky Tape" installed between all channel or angle reinforced tops, drainboards or undershelves.

Q. WASTE OUTLETS, CRUMB CUP: Stainless steel body, removable crumb cup stopper, gasket, coupling nut and sealing washer, 1-1/2 in. IPS, and optional 4 in. long nickel plated brass tailpiece with gasket; Component Hardware E38-1010, or equal by Kason, or PDI Atlanta.

R. WASTE OUTLETS, LEVER OPERATED: Cast stainless steel rotary type with 1-1/2 in. NPS and 2 in. NPS threads, and removable beehive crumb-cup; Component Hardware DSS-8000 or equal by Component Hardware, Chicago, or Fisher.

S. WELD STUDS: Copper flashed steel with 10-24 threads, length to suit; Component Hardware Q-36, or equal by Kason, or PDI Atlanta.

T. GFCI RECEPTACLES: Pass & Seymour 2095-W, 115 volt, 20 amp GFCI Duplex Receptacle or equal.

2.4 FABRICATED COMPONENTS

A. Box Type Cabinet Construction

1. Sheet metal cabinet bases of box type construction shall be fabricated without general interior framing. Structural strength shall be achieved by the gauge of the metal and the formed angle and channel edges and corners. Vertical sections shall be closed. Cabinet base shall be fabricated of 18 gauge minimum of material specified at Item Specifications. Mount on counter legs or base as specified.
2. Intermediate shelf shall be fabricated of 16 gauge stainless steel with rear and sides turned up 1-1/2 in. tight to the cabinet sides. The front edge of shelf shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees and shelf spot welded in place. Reinforce underside with longitudinal 14 gauge channel on the centerline.
3. Bottom shelf shall be fabricated of 16 gauge stainless steel similar to the intermediate shelf except that the front edge shall be formed into a full width 1-1/2 in. by 4 in. welded in boxed channel. Rear edge shall be fitted with a full width channel. Underside shall be reinforced.

B. Counters and Drainboards

1. Counters, table tops and drainboards shall be 14 gauge stainless steel, of NSF construction, with edges per Item Specifications. Metal tops shall be made of the largest pieces available and shall appear as one piece with all field and shop joints reinforced and welded, ground and polished. Short pieces of metal will not be acceptable. Counter bends shall be not less than 1/8 in. radius. Wherever a fixture has a waste or drain outlet, the surface shall pitch toward the outlet.
2. Counters, table tops and drainboards shall be reinforced with channel or angle frame as specified in the Item Specifications. Framing shall be secured to the underside with sound deadening material sandwiched between the surfaces, weld studs, and nuts.
3. Wherever bolts or screws are welded to the underside of trim or tops, neatly finish the reverse side of the weld uniform with the adjoining surface of the trim or top. Depressions at these points will not be acceptable. Raise dimples and depressions by peening, or heating and shrinking, and grind and polish to present a flat surface.

C. Crossrails

1. Crossrails shall be not less than 1-1/4 in. outside diameter 16 gauge stainless steel tubing welded, ground and polished to a Number 4 finish. Crossrails shall be welded to legs at a height of 10 in. above finished floor, and shall extend from left to right between front legs, unless otherwise specified, and from front to back between all legs.

D. Drawer Assembly

1. Drawer assemblies shall consist of a removable drawer pan set in a removable 16 gauge stainless steel channel shaped drawer support frame with gusset plate reinforced corners.
2. Support frame shall have double pan front cover consisting of boxed 18 gauge stainless steel outer shell with welded corners, flush mounted recessed stainless steel pull, 20 gauge stainless steel back shell tack welded to outer shell with fiberglass sound deadening between. Drawer shall be provided with rubber bumpers to quiet closing. Support drawer frame on full extension drawer slides.
3. Drawer shall be suspended from table in a three-sided, 16 gauge stainless steel enclosure with flanged-in bottom edges, banded lower front, flanged-out front side and top edges. All sharp corners shall be broken and any exposed exterior threads of slide mounting bolts shall be provided with solid metal acorn nuts.
4. Component Hardware S91-0020 with thermoplastic pan is considered as equivalent to the above specified construction.

E. Edges

1. Marine: Bumped up 1/2 in. at 45 degrees and turned down 1-1/2 in. and in 1/2 in. at 45 degrees; corners welded and square.
2. Raised roll: Coved up and rolled 180 degrees on a 1-1/2 in. diameter with 3 in. height; corners welded and rounded or coved.
3. Rolled: Rolled 180 degrees on a 1-1/2 in. diameter; corners welded and bullnosed.
4. Short (6 inch) splash on counters and tables: Coved up 6 in., turned back to wall or equipment 1 in. and down 1/2 in.; ends welded closed. Secure tight to face of wall with clips unless specified otherwise and seal joint.
5. Tall (10 inch) splash on preparation sinks, dishtables, counter, and tables: Coved up 8-1/2 in., turned back to wall or equipment 1-1/2 in. at 45 degrees and down 1/2 in.; ends welded closed. Secure 3 in. off face of wall with brackets unless specified otherwise.
6. Turn down: Turn down 2 in. and in 1/2 in. at 45 degrees; corners welded and square.

F. Framing of Tops, Drainboards, Undershelves

1. Channel: Reinforce with 1 in. by 4 in. by 1 in. 14 gauge galvannealed steel channels; stainless steel if exposed to view. Channels shall run front-to-back at all legs and longitudinally on the centerline. Cross and longitudinal members shall be welded into a single assembly at intersections and sharp corners shall be broken. Framing shall be secured to underside of tops with pairs of weld studs. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. The following specified angle framing is considered superior to channel framing and may be used in its place.
2. Angle: 1-1/2 in. by 1-1/2 in. by 1/8 in. perimeter angle frame with crossmembers not over 30 in. on center. Framing shall be secured to top with weld studs, 18 in. on center maximum with three minimum studs on any single face of a table. Perimeter angle frame that is exposed to normal view, shall be stainless steel. Crossmembers and framing not unexposed to normal view

shall be iron. Corners of angle frame shall be mitered, or notched and brake formed to form a closed corner. Corner gusset plates used for mounting of leg gussets shall be 1/8 in. thick and sealed to underside of the top. Iron framework joints shall be ground smooth, and shall be painted with a minimum of two coats of aluminum lacquer after degreasing. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. Channel framing shall not be considered equal to specified angle framing.

3. Sound deaden all horizontal framed surfaces with material sandwiched between the framing and the bottom of the surface.

G. Hinged Doors

1. Hinged doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle, and an adjustable tension door catch equal to Component Hardware M22-2430. Doors shall close against the bottom shelf and flush with body of equipment.
2. Louvered hinged doors for ventilation shall be fabricated of the same components and provided with a full perimeter 3 in. wide channel reinforcing frame on the interior face. Remaining face shall be die punched with drip-proof louvers fully utilizing the remaining flat metal or a stainless steel flattened expanded metal grille per Item Specifications.

H. Sinks and Sink Inserts

1. Unless otherwise specified, sinks including sink inserts built into tops of fixtures, shall be made of 14 gauge stainless steel with all vertical and horizontal corners rounded to a radius of approximately 3/4 in. with the intersections meeting in a spherical section. Sinks shall be integrally welded to fixture tops.
2. Sinks with two or more compartments shall have full height, 1 in. thick double wall partitions consisting of two pieces of stainless steel back-to-back so fabricated that each compartment will be a deep bowl with coved corners. Partitions shall be welded in place to the bottom, front and back of the sink with smooth rounded coved corners. Top edges of the partitions shall be continuously welded. The front of the sinks shall consist of a stainless steel smooth, flush apron, same gauge as the sinks. Bottom and rear of partitions shall be closed. Sink dimensions contained in Item Specifications are inside dimensions.
3. Sinks shall be provided with integral 14 gauge stainless steel drainboards when specified. Drainboards and sink basins shall be pitched toward waste outlets and shall be self draining. The underside of all sink basins shall sound deadened. Sink units shall be provided with an integral splash at walls. Provide the necessary holes for the mounting of faucet sets.

I. Sliding Doors

1. Sliding doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle. Provide sliding doors with nylon roller bearing sheaves and overhead track components equal to Component Hardware B58-5523

and 5513 sheaves, B57 track, B62-1093 nylon door guides and B60-1086 door stops.

J. Undershelves

1. Undershelf in an open type table shall be 16 gauge stainless steel unless otherwise noted. Edges shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees with corners notched out to fit legs to which shelf shall be welded from underside. Line up all edges of shelf with centerline of legs. Reinforce underside with longitudinal 14 gauge channel on the centerline.

K. Wall Brackets

1. Dish tables, sinks and counters with sinks shall be securely anchored 3 in. off the face of the wall unless specified otherwise. Brackets shall be "Z" shaped and fabricated of 3 in. wide, 14 gauge stainless steel. Brackets shall be secured in a vertical attitude to the rear of equipment backsplash with weld studs, and to the wall with appropriate fasteners.
2. Counters that are specified tight-to-wall shall be secured in a hidden manner with steel clips, and the wall/fixture joint shall be sealed.

L. Wall Shelves

1. Wall shelves shall be fabricated of 16 gauge stainless steel, size per Item Specifications, with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45 degrees. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30 degrees, measured from horizontal.

2.5 ELECTRICAL EQUIPMENT AND WIRING

A. Under this Section, items of equipment having mounted electrical motors, electrical heating units, lighting fixtures, controllers, control stations, switches, receptacles and the like shall be internally wired as specified herein, terminating at a junction box mounted on the equipment and left ready for connection to the building electrical distribution system by the Electrical Contractor. Extra ceiling mount light fixtures for refrigerated rooms shall be delivered to Electrical Contractor for field installation and wiring. Connections to evaporator coils mounted inside refrigerated rooms shall be wired by the Electrical Contractor.

B. Provide openings or cutouts required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes.

C. Electrically operated equipment and fabricator wiring shall conform to the requirements of Underwriter's Laboratories, Inc. Motors over one horsepower shall be equipped with overload protection.

D. Furnish wiring diagrams for equipment as requested by the Architect or Contractor.

2.6 ITEM SPECIFICATIONS

Item 1
MOP SINK CABINET
Make - Advance Tabco 9-OPC-84DR-300, or equal by IMC Teddy or Eagle
Size - 50-3/8” x 22-3/4" x 84" high, 12” deep basin
Description - Cabinet assembly shall be all standard heavy gauge type 304 stainless steel construction with satin finish, tile edge at rear of sink, vented cabinet walls, hinged double doors, four fixed intermediate shelves, two mop holders, stainless steel floor panel, and central mop sink drain with stainless steel strainer.
Accessories - Provide unit with K-240 faucet with K-244 hose and bracket, SU-27 door lock, K-94-BACK-300 stainless steel back panel, K-472 8” on center holes in back panel for service faucet. Seal gaps at the wall.

Item 2
STAFF LOCKER, THREE-TIER
Quantity - 2
No work in this Section. Item to be provided and installed by General Contractor.

Item 3
No item

Item 4
No item

Item 5
MOBILE SHELVING UNIT, FOUR-TIER
Quantity - 2
Make - MetroMax Q*C166 or equal by Cambro or Fermod
Size - 48" x 21" x 69" high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5" diameter polyurethane tired swivel casters with donut bumpers.
Accessories - Provide with polymer posts in lieu of standard.

Item 6
STORAGE SHELVING, FIVE-TIER
Quantity - 12
Make - Metro Super Adjustable Super Erecta or equal by ISS or Cambro
Size - (9) 48" x 21", (1) 42" x 21", and (2) 36" x 21", all 74-5/8" high; five tier with bottom shelf up 14" clear above floor
Description - Unit shall be all standard construction with Super Adjustable Chrome plated wire shelves and tubular steel uprights with capped tops, adjustable feet, and 1" shelf height adjustment capability with Corner Release System. Each unit shall include four legs.

Item 7
DUNNAGE RACK
Quantity - 3
Make - New Age 2000 Series or equal by Channel or Kelmax
Size - 42" x 20" x 12" high
Description - Dunnage platforms shall be all standard construction with 1-1/2" x 1-3/4" x .070" thick wall extruded Type 6063-T5 aluminum tubing with four horizontal tubes and four legs welded together, and each unit capable of supporting a minimum of 2,500 pounds.

Item 8
WALK-IN COOLER
Make - American Panel or equal by Bally or Thermo-Kool
Size - 15'-10" x 10'-11" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor
Power - 1.1 KW - 120/60/1 to light fixtures, temperature monitor/alarm, and door defrost heater strip
Installation, Construction, Materials and Accessories - See Item 9
Guarantee - See Item 9

Item 9
WALK-IN FREEZER
Make - American Panel or equal by Bally or Thermo-Kool
Size - 10'-1" x 10'-11 x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor.
Power - 1.3 KW - 120/60/1 to light fixtures, temperature monitor/alarm, door defrost heater strip, and pressure relief port
Installation - The walk-in refrigerated room shall be installed in a 7" deep ID recess (below finished floor). Recess depth allows 1" for use of leveling sand; 4" for the insulated floor panels; 2" for finished floor and setting bed that shall be carried in from the adjacent room and level to same. The finished floor and setting bed shall be furnished and installed by the General Contractor, and shall have coved joints at all walls, turned up a minimum of 4" inside and out. The unit shall be set level on a bed of clean, dry mason's sand. Shims are not acceptable for leveling material.
Construction - All standard construction per the manufacturer, modified to meet the specific following points:

- Walls to be 4" thick with CFC free urethane foam insulation, UL Class 1 rated
- Cam type locking devices
- 34" x 80" minimum door clearance
- Polished hardware (hinges and latch to match)
- Three hinges on doors (to include one Kason 1248 spring assist hinge per door)
- Leveraged pull handle (mechanical advantage type, Kason 1236 or equal)
- Quarter turn inside safety release lever handle mechanism (not screw type)
- Prewired door sections with heater wires and light fixtures and switches
- Kason 1806 LED light fixtures or Kason 1808 LED light fixtures
- Dial type thermometers at doors
- Model IC+ (with dry contacts) temperature and HACCP monitoring system at doors. Cooler and freezer alarms to interconnect with access control system for alert monitoring. Provide each system with a pair of 22 gauge low voltage wires. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment.
- NSF construction throughout with exception of buried floor panels

- Interior and exterior faces of doors and exposed exterior walls shall be provided with aluminum diamond tread plate protective material to a height of 48" above finished floor. Hold diamond plating up 6" from the finish floor to accommodate the coved base.

Minimum materials - Interior and exterior wall surfaces shall be clad with .038" pebble finished aluminum. The ceiling shall be finished in white polyester over 24 gauge galvanized steel. Interior floor shall be 14 gauge galvanized steel.

Accessories - Freezer shall be provided with an electrically heated pressure relief port. Each door shall be provided with a heated vision panel, 14-1/2" x 23" constructed of three panels of tempered unbreakable glass, electrically heated, with sealed air spaces between. Provide matching trim strips and closure panels to adjoining surfaces, fabricated per details, made of largest pieces available to minimize number of joints, and installed in accordance with NSF Brochure 770202, Installation Manual for Walk-in Refrigerators and Freezers. Provide ten total extra Kason 1806 LED OR Kason 1808 LED light fixtures for mounting in the rooms and deliver to Electrical Contractor for field installation.

Guarantee - The walk-in refrigerated room panels shall be guaranteed for a period of ten (10) years from the date of approved installation for defects in materials and workmanship when subjected to normal use and service; remainder of rooms for one year.

Item 10
REMOTE REFRIGERATION SYSTEM
Quantity - 2
Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler

Scope - Furnish and install complete refrigeration systems for the walk-in refrigerated rooms in accordance with the plans. The systems shall include condensing units, evaporator coils, piping, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted refrigeration practice.

Important: The installation work shall be performed by a fully qualified refrigeration contractor employing a certified mechanic fully trained in the installation of commercial refrigeration systems. Submittal shall list the installing company and the qualified system installer.

Piping - Furnish and install the interconnecting piping between the condensing units and their respective unit coolers. Piping shall be installed in a neat and workmanlike manner with adjustable hangers spaced at no more than ten foot intervals on horizontal runs; six foot intervals, vertical runs.

Line sizes shall be in accordance with ASHRAE standards and best refrigeration practice to assure proper feed to evaporator, avoid excessive pressure drop, and prevent excessive amounts of lubricating oil from being trapped in any part of the system. Line sizing shall be such that it will protect the compressor from loss of lubrication at all times, prevent liquid refrigerant from entering the compressor during operating or idle time, and maintain a clean and dry system.

Refrigeration piping shall be Type L, ACR grade, hard drawn seamless copper tubing, wrought type copper fittings, and silver soldered joints. Precharged lines are not acceptable.

Furnish and install sleeves for refrigerant and evaporator drain piping wherever piping passes through a wall or ceiling. Sleeves shall be non-conductive gray plastic tubing, with interior dimension sized at least 1/4" larger than piping, and shall be neatly packed with brine putty after installation.

Furnish and install condensate drain piping from the unit cooler to an open drain. Piping shall consist of not less than 7/8" Type L copper tubing, supported 36" on center

maximum, in such a way that there will be 1" clearance between the wall and the tubing. Provide a union or slip fitting at the connection to the evaporator drain pan to allow easy disassembly for service and cleaning. Drain piping shall be pitched 4" to the foot and carried through the wall of the refrigerated area. It shall be trapped to prevent entry of warm air and insects to the refrigerated rooms and discharged to a floor drain with the code required air gap. The exposed drain piping shall be spray painted.

Provide an electric drainline heater tape in the freezer, with a length equal to five wraps per foot of length of the drainline located within the freezer compartment. Wrap and secure in accordance with manufacturer's recommendations.

Provide chrome plated escutcheon plates at all exposed points where piping penetrates the wall or ceilings.

Insulation - Suction lines for refrigerated rooms having a temperature above freezing shall be covered with 3/4" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

Suction lines for refrigerated rooms having a temperature below freezing shall be covered with 1" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

The insulation shall be applied to these lines in accordance with manufacturer's recommendations, and as they are being installed so that insulation will not be split. All joints shall be completely sealed with overlapping, cemented material to prevent the formation of frost on the lines.

Controls - Each evaporator shall be provided with an iNtelliGen electronic control as manufactured by Heatcraft Refrigeration. Provide each system with a pair of twisted 24 gauge low voltage wires, Belden 9841 or equal. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts at the evaporators to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

Refrigerant Testing - The entire system shall be pressure and leak tested at no less than 100 PSIG, cleaned and dehydrated by maintaining a vacuum of 500 microns or lower for a period of twelve hours. The required operating charge of refrigerant and oil, if necessary, shall be added and the entire system tested for performance. Each system shall be clearly marked as to the type refrigerant required.

Guarantee - The equipment shall be guaranteed to maintain the specified temperatures. All mechanical refrigeration equipment shall be mechanically guaranteed for a period of one year after date of acceptance by the Owner. The emergency service shall be provided free of charge, whenever necessary on a 24 hour, seven day-per-week basis during the guarantee period.

Any leaks that occur during the first year of operation after acceptance by the Owner, shall be repaired and the necessary refrigerant added at no expense to the Owner.

The year's service shall be provided by the installing company, and under no circumstances will the service policy be sublet to another refrigeration contractor. The name of the installer/service agency for the guarantee period shall be located at a prominent place on the condensing units.

The condensing units shall be provided with an additional four year parts warranty to commence upon the completion of the aforementioned guarantee, bringing the total parts warranty to five years.

Condensing Units - The condensing units shall consist of an EC energy saving motor with variable speed controller, compressor, refrigerant condenser, liquid receiver, compressor service valves, and a dual high-low pressure control. The units shall be as manufactured by Heatcraft Refrigeration.

The condensing units shall be outdoor type, wall mountable, and quiet type with an approximate 51 to 63 decibel rating at 100 percent fan speed. The compressor shall be Microchannel Coil Technology scroll type per schedule, and fitted with gold coated aluminum fin condenser, suction service valve, discharge service valve, compressor contactor, high and low pressure controls, receiver with fusible plug, liquid shut-off valve and charging port, mounted non-fused disconnect switch, waterproof electrical control box, discharge line vibration eliminator, weather resistant UL painted steel cabinet, access guard, liquid line assembly, suction line filter and vibration eliminator, crankcase heater, and 1-1/2" high raised steel base.

Mount on roof per drawings with structural supports, roof penetrations and weatherproofing provided by the General Contractor. Mount with clearance above roof deck per Manufacturers recommendation.

Evaporator Coils - Each evaporator shall be provided with iNtelliGen electronic control as manufactured by Heatcraft Refrigeration, thermostatic expansion valve, and solenoid valve. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit. iNtelliGen Controls to include iIC integration card for BMS connection direct to evaporator controls.

The freezer shall be provided with an automatic electric defrost system consisting of one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with variable speed EC energy saving fan motors with controller. Coil shall be NSF and UL Listed.

The cooler shall be provided with one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with EC energy saving fan motors. Coil shall be NSF and UL Listed.

Furnish and install 1/4" minimum diameter stainless steel threaded mounting rods for the hanging of the evaporator coils, with stainless steel washers and nuts on the interior ends, and reinforcing angle at the exterior top of the room. Plated steel running thread is not acceptable.

Refrigeration Equipment Schedule

Cooler (8)	Room Temp:	+35 degrees F		TD: 10 degrees F	
Condensing unit (10a)	Amps	Ref	BTU/hour	Evap Temp	Cond Temp
BCH0015MCACZ	8.7 - 208/3	448A	13,888	+25 degrees F	+95 degrees F
Evaporator coil (10b)	BTU/hour	CFM	Fan amps	Defrost amps	Defrost type
BEL0115AS6AM	14,488	1,220	1.8 - 120/1	NA	Timed ambient

Freezer (9)	Room Temp:	-10 degrees F		TD: 10 degrees F	
Condensing unit (10c)	Amps	Ref	BTU/hour	Evap Temp	Cond Temp
BCH0025LCACZ	8.7 - 208/3	448A	10,440	-20 degrees F	+95 degrees F
Evaporator coil (10d)	BTU/hour	CFM	Fan amps	Defrost amps	Defrost type
BEL0080BS6EE	8,400	1,371	1 - 208/1	9.1 - 208/1	Timed electric

Item 10a
COOLER CONDENSING UNIT
Specified as part of Item 10

Item 10b
COOLER EVAPORATOR COIL
Specified as part of Item 10

Item 10c
FREEZER CONDENSING UNIT
Specified as part of Item 10

Item 10d
FREEZER EVAPORATOR COIL
Specified as part of Item 10

Item 11
MOBILE SHELVING UNIT, FOUR-TIER
Quantity - 16
Make - MetroMax Q*C166 or equal by Cambro or Fermod
Size - (1) 60" x 21", (10) 48" x 21", (5) 36" x 21", all 69" high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5" diameter polyurethane tired swivel casters with donut bumpers.
Accessories - Provide with polymer posts in lieu of standard.

Item 12
DUNNAGE RACK, MOBILE
Quantity - 6
Make - New Age 1200 Series or equal by Channel or Kelmax
Size - (2) 48” x 20” and (4) 36" x 20"
Description - Dunnage platforms shall be all standard construction with 1-1/2" x 1-3/4" x .070" thick wall extruded Type 6063-T5 aluminum tubing with four horizontal tubes and plate mounted casters with unit capable of supporting 1,000 pounds.
Accessories - Provide two total 1208 handles. All casters to swivel.

Item 13
PAN RACK, MOBILE
Quantity - 5
Make - New Age 1332*C166 or equal by Channel
Size - 20-1/2 in. by 26 in. by 69 in. high
Capacity - Fifteen 18 in. by 26 in. pans on 4 in. centers
Description - Rack shall be fabricated of welded extruded aluminum 1 in. by 1 in. by .070 in. tubular uprights and framing, and 1-1/4 in. by 1-5/8 in. by .100 in. angle pan slides with corners chamfered and deburred. Gussets of 1-1/2 in. by 1-1/2 in. by 5/8 in. angle aluminum shall be welded to the bottom inside angles where horizontal bracing meets vertical uprights. Mount on platform type, 5 in. polyurethane tired swivel casters.

Item 14
No item

Item 15
No item

Item 16
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 7'-6" x 12" mounted 54" above floor
Construction - Wall shelf shall be fabricated of 16 gauge stainless steel with back and ends raised 1-1/2", front edges of ends angled back, all corners broken, and front turned down 1-1/2", and in 1/2" at 45°. Shelf corners shall be welded, ground and polished. Mount shelf 1" off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48" on center maximum. Flag brackets shall have a web angle of 30° measured from horizontal.

Item 17
PREP TABLE WITH SINKS
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 11'-0" x 27" x 36" high to work surface plus 10" high splash at rear; two 18" x 20" x 10" deep integral sink basins
Construction - 14 gauge stainless steel top, basins and splash, channel reinforced, eight legs with gussets and adjustable feet, partial undershelf, four crossrails, tall splash rear, and marine front and ends, secured 3" off face of wall.
Accessories - Drawer assembly, splash mounted faucet set and two 2" lever waste outlets.

Item 18
WASTE BARREL
Quantity - 4
No work in this Section. Item to be provided by Owner.

Item 19
HAND SINK
Quantity - 4
Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne
Description - Unit shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor

Accessories - Provide with a splash mounted faucet set with wrist handles (Item 19a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provide three units (adjacent to Items 17, 22, and 69) with a left side welded stainless steel splash. Provide one unit (adjacent to Item 53) with a right side welded stainless steel splash.

Item 19a
FAUCET
Quantity - 4
Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore
Description - Unit shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item 20
WASTE BIN
Quantity - 4
No work in this Section. Item to be provided by Owner.

Item 21
SERVICE FAUCET
Make - Fisher 29556 or equal by T&S Brass or Encore
Description - Unit shall be all standard construction with right hand mounted lever and top mounted vacuum breaker.

Item 22
UTILITY CART
Quantity - 2
Make - Lakeside 521 or equal by Channel
Size - 32-5/8 in. by 19-3/8 in. by 34-1/2 in.
Description - Cart shall be all standard NSF construction, stainless steel throughout, with top and bottom shelves supported by an angle frame, and mounted on two 8 in. fixed and two 5 in. swivel casters. Capacity of cart to be 650 pounds.

Item 23
No item

Item 24
No item

Item 25
WORK TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 8'-0" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame, edges formed in turndown, six legs with gussets, adjustable feet, two crossrails and partial undershelf.
Accessories - Drawer assembly. Provide four rigid stainless steel brackets for mounting of electric outlets in setback positions complete with work boxes, GFI receptacles and stainless steel cover plates. Prewire receptacles through table legs to a junction box mounted below the undershelf.

Item 26
MOBILE WORK TABLE
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 48" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5" diameter swivel casters, two with brakes, and full undershelf.
Accessories - Drawer assembly.

Item 27
VENTILATOR DEMAND CONTROL SYSTEM
Make - CaptiveAire DCV-1011 (Job #5953857) or equal by Gaylord or Halton
Power - 15 amps circuit - 120/60/1 to logic controller
Scope - Furnish and install complete exhaust control system for the exhaust canopy in accordance with the plans and Manufacturers shop drawings. The system shall include programmable logic controller (PLC), variable frequency drive (VFD), stainless steel control enclosure, exhaust duct temperature sensors, room temperature sensor, LCD screen interface with cable, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted HVAC practice. System shall control Items 29 and 30. Mount LCD screen control in UDS riser. Mount system processor in the cabinet mounted on the right end of exhaust ventilator 29. Mount the room air temperature sensor on the wall 60" above the finished floor.
Important: The installation work shall be performed by a fully qualified contractor employing a certified mechanic fully trained in the installation of the DCV hood system. Submittal shall list the installing company and the qualified system installer. Provide wiring diagrams and guidance to related trades to achieve correct operation of the system.
Accessories - Service Design Verification: Factory Services and on site coordination to be performed by the Manufacturers service technician (not a sales representative). On site supervision shall include two site visits: One visit to coordinate preparations for installation, and a second visit at startup and calibration. Provide BacNet monitoring system.

Item 27a
VENTILATOR CONTROL INTERFACE SCREEN
Specified as part of Item 27

Item 27b
ROOM TEMPERATURE SENSOR
Specified as part of Item 27

Item 28
FIRE SUPPRESSION SYSTEM
Make - Ansul R-102 "Overlapping" or equal by Kidde or Pyro-Chem
Power - 20 amps circuit - 120/60/1
Protection for hoods: 29 and 30
Design - Provide an automatic liquid fire suppressant system sized to meet all local codes, UL 300 and NFPA Codes. System shall provide surface protection for cooking equipment, hood and the exhaust duct work, if required. Tanks shall be mounted in the hood manufacturer provided utility cabinet and piping shall run hidden wherever possible. All pipes and fittings used to convey the chemical shall be scale free steel, 40 weight. Exposed piping located within the ventilator shall be stainless steel and limited to vertical

drops only. Horizontal piping shall be run over the ventilator's top. Nozzles shall be swivel type with metal caps. Detection shall be fusible links rated per codes, and system shall rely on no outside source of power. The system shall be provided with a control box with indicator to indicate system status. Control head shall also include integral micro switch offering "normally open" and "normally closed" terminals for use by the Electrical Contractor for the shut-down of equipment and the sounding of alarms, etc. Suppressant tanks shall be stainless steel. Provide and install a remote pull station per codes, complete with cables, conduit and pulleys. Coordinate installation of remote pull station with General Contractor to provide a flush mounted pull box with cable conduit concealed within walls. Provide system with class-K extinguisher as required. Delete standard gas valve and reset relay switch. Gas valve and reset switch shall be provided as part of Item 31.

Workmanship - Exposed stainless steel fittings and piping shall be assembled with special care to avoid marring or damaging the surfaces. Any pieces showing marks shall be removed and replaced with new materials. Chrome sleeves are not acceptable.

Test - Perform a puff test on the completed system and obtain the written approval of the local Fire Inspector.

Accessories - Provide metal blow-off caps on all nozzles.

Item 29

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5953857) or equal by Gaylord or Halton

Size - 11’-6" plus a 12" utility cabinet on the right end x 60" x 24" high plus 4" high collars, mounted up 6'-8" above finished floor; flat bottom

Power - 120/60/1 power to lights from Item 27

Exhaust - 2,300 CFM through a 16" diameter collar at -0.753" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.

Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edge with integral front baffle, double wall insulated front, and NSF Listed. Unit shall have grease collection trough, storage container, and hanger brackets. Provide with 430 stainless steel Captrate Grease-Stop Solo Filter UL classified S-baffle extractors that shall remove at least 75% of grease particles five microns in size, and 90% of grease particles seven microns in size and larger, with a corresponding pressure drop not to exceed 1.0 inches of water gauge. Provide all materials necessary for the hanging of the ventilator, and seal to wall.

Accessories - Provide unit with five recessed UL Listed light LED fixtures factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3" above finished ceiling to close to adjacent surfaces on three sides. Provide quarter end panels, balancing dampers, and a full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.

Item 30

EXHAUST VENTILATOR

Make - CaptiveAire 6024 ND-2 (Job #5953857) or equal by Gaylord or Halton

Size - 12’-6" x 60" plus a 12" extended rear stand-off x 24" high plus 4" high collars, mounted up 6'-8" above finished floor; flat bottom

Power - 120/60/1 power to lights from Item 27

Exhaust - 2,688 CFM through an 18" diameter collar at -0.764" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.

Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96,

with reinforced front bottom edge with integral front baffle, double wall insulated front, and NSF Listed. Unit shall have grease collection trough, storage container, and hanger brackets. Provide with 430 stainless steel Captrate Grease-Stop Solo Filter UL classified S-baffle extractors that shall remove at least 75% of grease particles five microns in size, and 90% of grease particles seven microns in size and larger, with a corresponding pressure drop not to exceed 1.0 inches of water gauge. Provide all materials necessary for the hanging of the ventilator, and seal to wall.

Accessories - Provide unit with five recessed UL Listed light LED fixtures factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3" above finished ceiling to close to adjacent surfaces on three sides. Provide quarter end panels, balancing dampers, and a full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.

Item 31
UTILITY DISTRIBUTION SYSTEM
Make - CaptiveAire UDI (Job #5953857) or equal by Gaylord or Halton
Size - 12'-6" x 12" x 6'-8" high
Power - 50 amps circuit - 120/208/60/3
Rating - 2" gas manifold at 940 MBTU/Hour (1,450 MBTU/Hour capacity)
Description - Utility distribution system shall be all standard construction of 300 series stainless steel with primary service riser, secondary riser and a horizontal raceway with separate compartments for plumbing and electrical services. Raceway plumbing compartment shall include gas and water piping, service drops with shut-off valves, Dormont quick disconnect gas hoses and flexible water connectors. Raceway electrical compartment shall include wiring to appliance connectors along and individual appliance electrical connectors with weatherproof covers. Primary service riser shall include load center with individual service breakers, main shunt trip breaker with reset handle, emergency kill switch, status indicators lights, DCV control interface, gas delay reset, and GFI convenience outlet. Secondary riser shall include a pre-plumbed 2 in. electric gas valve, manual shut-off valves for gas and water supply, and GFI convenience outlet. Mount DCV interface screen in main service riser.

Item 32
FOUR-BURNER RANGE WITH OVEN
Make - Vulcan 24S-4BN*C166 or equal by Garland or Southbend
Size - 24" x 32" x 37" high to work surface; 47" high overall
Rating - 3/4" gas inlet at 143,000 BTU/hour
Description - Range shall be all standard construction with fully welded aluminized steel frame, four 30,000 BTU/hour open burners with one pilot lights for every two burners, level cast iron removable grates, stainless steel front, sides, and back riser, 20-1/4" x 26" x 14-1/2" high thermostatically controlled 23,000 BTU/hour oven with two racks and safety pilot, full width pull-out crumb tray below burners, and provided with pressure regulator.
Accessories - Provide with Flame Safety device with manual spark ignition for all open top burners, and oven pilot. Provide a 10" high stainless steel flue riser, and mount on casters.

Item 33
FORTY-GALLON TILTING BRAISING PAN
Make - Groen BPP-40GA*C166 or equal by Cleveland or Market Forge
Size - 35-3/4" x 28-1/4" x 10" deep inside pan dimensions
Power - 5 amps - 120/60/1
Rating - 1/2" gas inlet at 144,000 BTU/Hour

Description - Unit shall be all standard stainless steel construction, with tubular support frame, adjustable feet, flanged feet at rear, electric motorized crank tilt mechanism with manual override and three position control switch, torsion bar counterbalanced hinged cover with vent, and a 40 gallon pan. The cooking surface shall be constructed with 5/8" thick stainless steel and bonded clad plate with integral heat transfer fins, and a multi-tube gas burner. Pan shall be polished to a 100 emery grit finish and provided with electronic ignition, 7° off level cooking capable, power on switch and indicator light, heat on indicating light, thermostatically controlled with timer and LED display, and provided with a high limit cut-off.
Accessories - Provide unit with a faucet mounting bracket with a double pantry water fill faucet and aerator tip, and BPC pan carrier.

Item 34
EXISTING DOUBLE COMBINATION OVEN
Make - Alto-Shaam CTP7-20G/CTP7-20G
Work - Relocate unit per plan, level in place, and leave ready for reconnection of service by Related Trades.

Item 35
DOUBLE COMBINATION OVEN
Make - Alto-Shaam 7-20G PRO/7-20G PRO
Size - 44-1/8" x 46-3/16" over handle x 74-3/16" high
Rating - (2) 3/4" gas inlet at 98,000 BTU/hour
Power - (2) 6.8 amps - 120/60/1 - cord and plug
Capacity - Seven full size sheet pans per compartment
Certification - Unit shall be Energy Star compliant
Description - Combination steamer/ovens shall be boiler-free with all standard construction with stainless steel exterior and interior, tempered triple pane window glass panel in right hand hinged 130 degree door swing with hinged interior pane, easily replaced door gasket, air circulation system with auto reverse fan with five fan speeds, removable probe, door mounted self-draining drip tray, LED lit interior, automatic quenching system, retractable hand shower with automatic rewind, and ProTouch Control panel system with programmable cool-down, four cooking modes (steam, convection, combination and retherm) plus three power levels and 0-100 percent humidity level control. Provide unit with factory authorized start-up service and one year warranty. Mount assembly on casters.
Accessories - Provide one case of liquid cleaner and one case of CombiClean tablets. Provide with four flexible water line hoses and a cord and plug for each unit.

Item 36
DOUBLE COMBINATION OVEN
Make - Alto-Shaam 7-20G PRO/7-20G PRO
Size - 44-1/8" x 46-3/16" over handle x 74-3/16" high
Rating - (2) 3/4" gas inlet at 98,000 BTU/hour
Power - (2) 6.8 amps - 120/60/1 - cord and plug
Capacity - Seven full size sheet pans per compartment
Certification - Unit shall be Energy Star compliant
Description - Combination steamer/ovens shall be boiler-free with all standard construction with stainless steel exterior and interior, tempered triple pane window glass panel in right hand hinged 130 degree door swing with hinged interior pane, easily replaced door gasket, air circulation system with auto reverse fan with five fan speeds, removable probe, door mounted self-draining drip tray, LED lit interior, automatic quenching system, retractable hand shower with automatic rewind, and ProTouch Control panel system with

programmable cool-down, four cooking modes (steam, convection, combination and retherm) plus three power levels and 0-100 percent humidity level control. Provide unit with factory authorized start-up service and one year warranty. Mount assembly on casters.

Accessories - Provide one case of liquid cleaner and one case of CombiClean tablets. Provide with four flexible water line hoses and a cord and plug for each unit.

Item 37
GRIDDLE ON MOBILE STAND
Make - AccuTemp GGF1201A3650-S2 or equal by Garland or Vulcan
Size - 36-1/4" x 38-1/3" x 42-3/8" high, 36" high to cooking surface, 36" x 30" cooking surface
Power - 0.5 amps - 120/60/1 - cord and plug
Rating - 3/4" rear gas connection at 65,000 BTU/hour
Description - Griddle shall be all standard construction with stainless steel body, 8 gauge stainless steel griddle plate with stainless steel splashes on three sides, a stainless steel grease trough, and stainless steel bullet feet. Mount on stainless steel mobile stand with bottom shelf and locking casters at front.

Item 38
FLOOR PAN & GRATE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 20" x 36" x 4" deep inside dimensions; 23" x 39" overall
Construction - Pan shall be fabricated of 14 gauge stainless steel, all welded construction, pitched to a 4" outside diameter drain fitting with stainless steel removable, perforated basket and perforated dome strainer. Long sides shall be fitted with integral grate support ledges. Provide a model CGF molded fiberglass grate (Chemgrate) with 1" x 4" pattern, 3/4" clear slots and ends finished in accordance with manufacturer's instructions. Grate shall be cut in a manner that closed pockets will not be formed where they rest on the pan ledges.

Item 39
No item

Item 40
FOOD PROCESSOR
Make - Robot Coupe R301 Ultra Dice*C166 or equal by Berkel or Hobart
Power - 12 amps - 120/60/1 - cord and plug
Description - Combination food cutter shall be all standard construction with 1-1/2 HP direct drive fan cooled capacitor start motor with brake, magnetic interlocks, stainless steel cutter bowl with handle and see-thru lid, continuous feed top unit with attached large feed pusher, two standard discs and dicing kit.

Item 41
COOK'S WORK TABLE WITH OVERSHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 78" x 30" x 36" high; overshelf 78" long with shelf at 54" above floor
Construction - 14 gauge stainless steel top over angle frame, edges formed in turndown, six legs with gussets, adjustable feet, two crossrails and partial undershelf. Overshelf shall be 16 gauge stainless steel, constructed similar to a wall shelf, channel reinforced, and welded to three extended rear table legs with support webs, and supported in integrally welded inverted gussets with sleeved joints for rigidity.

Accessories - Drawer assembly. Provide two rigid stainless steel brackets for mounting of electric outlets in setback positions complete with work boxes, GFI receptacles and stainless steel cover plates. Prewire receptacles through table legs to a mounted junction box below the undershelf.

Item 42
TWENTY-QUART MIXER
Make - Hobart HL-200 or equal by Globe or Univex
Power - 8 amps - 1/2HP - 120/60/1 - cord and plug
Description - Mixer frame and body shall be fabricated of welded heavy gauge steel finished in Hybrid Powder coat finish, and provided with a stainless steel splash guard at the column, stainless steel bowl guard with electrical interlock, single point bowl installation with swing-out bowl support, manual bowl lift and an attachment hub with No. 12 taper. Transmission shall be gear driven constant mesh heat treated and hardened gears on similar shafts be mounted in ball bearings with recirculating oil and grease to all gears and shafts. Mixing action shall be planetary and shall have speeds of 59 (stir), 107, 198, 365, agitator RPM speeds as selected by an external dial. Speeds to be selectable on-the-fly and include a soft start and stir speed while lifting the bowl into place and controlled with a 15 minute timer with automatic time recall
Accessories - Provide mixer with a 20 quart stainless steel bowl, one flat "B" beater and one "D" wire loop whip with stainless steel wires.

Item 43
AUTOMATIC SLICER
Make - Hobart HS9, or equal by Bizerba or Globe
Power - 5.6 amps - 1/2 HP - 120/60/1 - cord and plug
Description - Slicer shall be all standard construction, automatic type with anodized cast aluminum housing and base, removable 13 in. diameter 304L stainless steel knife with removable ring guard cover, totally enclosed, permanently lubricated PSC knife motor, with poly-v belt drive, zero knife exposure, linear automatic carriage drive system with speeds of 28, 38, 48 and 58 strokes per minute, manual assist mode, and provided with thermoplastic coated steel feed grip, glass bead finished gauge plate and knife cover, tilting carriage, water protected push-button switches, top mounted and removable knife sharpener with two borazon stones, adjustable gauge plate from "0" to 1 in., lift lever system and rubber feet. Unit to be provided with mechanical and electrical interlocks to include home position start, close gauge plate to stop, carriage will not tilt away or remove if gauge plate is not closed, locked gauge plate when carriage is removed, no-volt release, and 30 second automatic shut-off without carriage motion. Slicer shall be NSF 8 compliant.
Accessories - Provide unit with knife removal tool

Item 44
MOBILE EQUIPMENT STAND
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 30 in. by 30 in. by 32 in. high
Construction - 14 gauge stainless steel top over channel frame, edges formed in turn down, mounted on four legs with gussets, undershelf, and 5 in. diameter casters, two with brakes.

Item 45
WORK TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 78" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame, edges formed in turndown, six legs with gussets, adjustable feet, two crossrails and partial undershelf.
Accessories - Drawer assembly. Provide three rigid stainless steel brackets for mounting of electric outlets in setback positions complete with work boxes, GFI receptacles and stainless steel cover plates. Prewire receptacles through table legs to a junction box mounted below the undershelf.

Item 46
UTENSIL RACK, CEILING MOUNT
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 72" x 24" mounted up 6'-6" and 7'-6" above floor
Construction - Rack shall be fabricated of 1/4" x 2" stainless steel bar stock throughout, fully welded construction, consisting of a two bar upper rail with full radiused ends, a single lower rail, reinforcing straps, and suspended from the overhead structure on four hangers. Provide unit with forty-eight Component Hardware J77-4401 stainless steel double pot hooks.

Item 47
WATER FILTER ASSEMBLY
Quantity - 3
Make - 3M ScaleGard HT SF165 Modified or equal by Everpure or Selecto
Description - Unit shall be all standard construction designed for wall mounting and consisting of a mounting bracket, quarter-turn cartridge release mechanism, manifold with integral pressure gauge, integral quarter turn shut-off valve, outlet check valve, filter cartridge with internal prefilter membrane and external scale feeder cartridge. Provide with HF95-CL chloramine reduction filter cartridge in lieu of standard HF65 cartridge.
Accessories - Provide four spare HF95-CL filter cartridges and four spare HF8-S cartridges.

Item 48
CLEAN WARE TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 66" x 30" x 34" high plus 10" splash at wall; 3" high raised roll at front and end
Construction - 14 gauge stainless steel top and splash over channel frame with raised roll front and end, tall splash at rear, turned down into dishwasher and secured with stainless steel machine screws, and mounted on four legs with gussets, adjustable feet and undershelf. Secure to wall and seal.

Item 49
WAREWASHER, CONVEYOR TYPE
Make - Hobart CL44eN-BAS L-R*C166, or equal by Champion or Meiko
Size - 43-1/2 in. by 30-1/8 in. by 65-1/2 in. high
Power - 68 amps - 480/60/3
Conveyor speed - 5.6 feet per minute; 202 racks per hour
Maximum Water Usage - 0.62 gallon per rack
Certification - Unit shall be Energy Star compliant

Description - Unit shall be standard construction, double tank, fully automatic, rack conveyor type with l6 gauge stainless steel wash and rinse chambers, welded stainless steel frame and motor supports, stainless steel chambers, housing, insulated inspection doors and legs with adjustable feet. Conveyor structure, tracks, and drive unit to be all stainless steel with a conveyor speed of 5.6 feet per minute. Warewasher to be complete with 30 KW booster heater, insulated cabinet style doors, dirty water indicator, configurable de-lime notification, top mounted computer controls with "start/stop" button and digital display, NSF approved pot and pan cycle mode, 19-1/2 in. standard chamber height, and ten plastic racks.

Accessories - Provide with 30 KW internal booster heater, two standard vent hoods with 4 in. by 16 in. stainless steel stacks all welded water tight complete with locking dampers, table limit switch, drain water tempering kit, and four plastic peg racks and two plastic flat racks. Provide with SL30 side loader.

Item 49a
WATER FILTER ASSEMBLY
Make - WaterSpec WS-SSEXT or equal by 3M or Everpure
Description - Unit shall be all standard construction designed for vertical wall mounting per plan and consisting of a mounting bracket, manifold, and filter cartridge with housing. Assembly shall have an operating inlet water temperature range of 35 to 160 degrees Fahrenheit.
Accessories - Provide four spare SS-EXT filter cartridges.

Item 50
STAINLESS STEEL EXHAUST DUCT
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 4" x 16" with length as necessary to reach 3" above finished ceiling
Construction - 18 gauge stainless steel welded exhaust ducts, sized to suit the vent stacks. Ducts shall be provided with a one-piece perimeter angle collar at the ceiling, installed "leg up".

Item 51
SIDE LOADER
Specified as part of Item 49

Item 52
HOSE REEL ASSEMBLY
Make - T&S Brass B-1457-7102-01C or equal by Fisher or Reel Craft
Size - 12 foot hose, 3/8" ID
Maximum Water Use - 1.07 Gallons per minute
Description - Unit shall be all standard construction with stainless steel open type reel, adjustable bumper, blue hose, B-107-J low flow spray valve, heat resistant spray valve handle, chrome risers, two wall brackets, continuous pressure vacuum breaker, 36" flexible water hose, control valve, and deck type base faucet, designed for wall mounting per plan up 7'-6" measured at the inlet.
Accessories - Provide with G019430-45 stainless steel wall mount swing bracket.
Installation - The hose reel bracket for wall mounted units shall be rotated 90° downward and installed such that it allows the hose to hang straight down and parallel to the wall. Refer to T&S Brass instructions manual page four figure one for further details.

Item 53
THREE-COMPARTMENT SINK/SOILED WARE TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 9'-9" x 30" plus approximately 36" x 30" return to ware washer x 34" high plus 10" high splash at walls; 3" high raised open roll on front and end; three 21" x 27" x 12" deep integral wash sink basins; 18" x 18" x 8" deep integral scrap sink
Construction - 14 gauge stainless steel top, basins and splash, stainless steel channel reinforced, seven legs with gussets, adjustable feet and six lengths of crossrail. Secure 3" off face of wall. Turn end down into ware washer side loader and secure with stainless steel machine screws and nuts. Top of splash shall be fitted with integral flat spot for mounting of the pre-rinse fixture. Provide each wash basin with a lift out, 16 gauge stainless steel cover with all edges flanged down 1", corners rounded and welded, provided with two neatly punched thumb holes, and designed to rest on 1/4" rod stock supports welded across the basin corners at proper height to provide a flush surface. Provide a hook under the drainboard for hanging the lids when not in use. Integral scrapping sink shall be provided with a 2" x 1/4" bar stock rack guide attached to the reinforced splash with stainless steel through bolts. Sink shall be provided with two 16 gauge perforated stainless steel scrapping baskets, 6" deep, on 1/2" high angle legs set back to clear the basin cove, and integral tubular handles flush with counter tops.
Accessories - Two splash mounted faucet sets, three 2" lever waste outlets, a 2" free flow waste outlet Component Hardware D36-2080 at the scrap sink.

Item 54
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 60" x 12" mounted 54" above floor
Construction - Wall shelf shall be fabricated of 16 gauge stainless steel with back and ends raised 1-1/2", front edges of ends angled back, all corners broken, and front turned down 1-1/2", and in 1/2" at 45°. Shelf corners shall be welded, ground and polished. Mount shelf 1" off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48" on center maximum. Flag brackets shall have a web angle of 30° measured from horizontal.

Item 55
No item

Item 56
No item

Item 57
REFRIGERATOR, REACH-IN
Make - Victory RSA-1D-S1-EW-HD-HC or equal by Continental or TurboAir
Power - 6.5 amps - 1/3 HP - 120/60/1 - cord and plug
Capacity - 26.06 cubic feet
Doors - Half height, hinged on left
Certification - Unit shall be Energy Star compliant
Description - Unit shall be all standard construction with stainless steel exterior, and aluminum interior. Unit shall include automatic interior LED lighting with proximity door switch, condensate evaporator, self-closing cam lift door hinges, automatic energy saver switch, plasticized fin coil, stainless steel interior door liners, non-conductive thermal breaker strips, and electronic microprocessor control system with exterior LED display. Mount on

6" high stainless steel adjustable legs. Refrigeration shall be a self-contained, air cooled system with R-290 refrigerant, interior temperature governed by an adjustable pre-set control, supercool mode feature with a lower “set-point” refrigeration condition for a set period of time, and automatic energy saving mode which reverts when there are no door openings for four hours. Unit shall be provided with HAACP compliant monitoring and reporting system with Wi-Fi communication.

Accessories - Provide adjustable Type A/C tray slide kit spaced 3” on center in the top half, adjustable wire shelf in the bottom half, and optional four year compressor warranty. Provide unit mounted on 6” high casters.

Item 58
CONVEYOR OVEN, VENTLESS
Make - Lincoln V2501 or equal by TurboChef
Size - 50” x 31-3/8” x 18” high
Power - 27 amps - 6.0 KW - 208/60/1 - cord and plug (NEMA 6-50P)
Description - Ventless conveyor oven shall be all standard construction with stainless steel exterior, catalytic converter for ventless operation, 20” long cooking chamber, 200°F to 550°F cooking temperature range, axial type fan with 1/10 HP AC motor, fuses (for control and blower) located on control box side, 16” wide stainless steel flexible and removable conveyor with direct drive via DC stepping motor, 30 second to 15 minute cook time, stainless steel crumb pans, four separate removable air distribution fingers, digital controls with power On/Off, temperature control, conveyor speed control, four preset menu buttons, and time/temperature display, and mounted on 4” high stainless steel legs.

Item 59
MOBILE OVEN STAND
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 60" x 27" x 32" high
Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5" diameter swivel casters, two with brakes, and full undershelf.
Accessories - Drawer assembly.

Item 60
MOBILE HOT FOOD HOLDING CABINET
Make - Food Warming Equipment MTU-12*C166 or equal by Vulcan or CresCor
Size - 29-3/4" x 30-1/4" x 69" high
Power - 13.85 amps - 16.5 KW - 120/60/1 - cord and plug
Certification - Unit shall be Energy Star compliant
Description - Cabinet shall be all standard construction with stainless steel interior and exterior, stainless steel base frame with tubular perimeter and 10 gauge stainless steel reinforcing plates at corners, high density fiberglass insulation on all sides, flush mounted door with high temperature gasket mounted on the cabinet, edge mounted heavy duty hinges and latch, twelve pair of removable universal chrome plated and epoxy coated rod type pan slides capable of supporting 18" x 26" or 12" x 20" pans on 4-1/2" centers, mounted thermometer, recessed controls, thermostatically controlled system with separate heat and humidity controls, air distribution blower and removable stainless steel reservoir, and 10' cord set and cord storage loop. Mount on 5" diameter plate mounted polyurethane tired casters; two swivel, two rigid. Provide with two year warranty.
Accessories - Provide unit with see-thru Lexan Dutch doors, perimeter vinyl bumper and push/pull handles.

Item 61
REFRIGERATOR, REACH-IN
Make - Victory RSA-1D-S1-EW-HD-HC or equal by Continental or TurboAir
Power - 6.5 amps - 1/3 HP - 120/60/1 - cord and plug
Capacity - 26.06 cubic feet
Doors - Half height, hinged on right
Certification - Unit shall be Energy Star compliant
Description - Unit shall be all standard construction with stainless steel exterior, and aluminum interior. Unit shall include automatic interior LED lighting with proximity door switch, condensate evaporator, self-closing cam lift door hinges, automatic energy saver switch, plasticized fin coil, stainless steel interior door liners, non-conductive thermal breaker strips, and electronic microprocessor control system with exterior LED display. Mount on 6" high stainless steel adjustable legs. Refrigeration shall be a self-contained, air cooled system with R-290 refrigerant, interior temperature governed by an adjustable pre-set control, supercool mode feature with a lower “set-point” refrigeration condition for a set period of time, and automatic energy saving mode which reverts when there are no door openings for four hours. Unit shall be provided with HAACP compliant monitoring and reporting system with Wi-Fi communication.
Accessories - Provide adjustable Type A/C tray slide kit spaced 3” on center in the top half, adjustable wire shelf in the bottom half, stainless steel case back, and optional four year compressor warranty. Provide unit mounted on 6” high casters.

Item 62
MOBILE HOT FOOD HOLDING CABINET
Make - Food Warming Equipment MTU-12*C166 or equal by Vulcan or CresCor
Size - 29-3/4" x 30-1/4" x 69" high
Power - 13.85 amps - 16.5 KW - 120/60/1 - cord and plug
Certification - Unit shall be Energy Star compliant
Description - Cabinet shall be all standard construction with stainless steel interior and exterior, stainless steel base frame with tubular perimeter and 10 gauge stainless steel reinforcing plates at corners, high density fiberglass insulation on all sides, flush mounted door with high temperature gasket mounted on the cabinet, edge mounted heavy duty hinges and latch, twelve pair of removable universal chrome plated and epoxy coated rod type pan slides capable of supporting 18" x 26" or 12" x 20" pans on 4-1/2" centers, mounted thermometer, recessed controls, thermostatically controlled system with separate heat and humidity controls, air distribution blower and removable stainless steel reservoir, and 10' cord set and cord storage loop. Mount on 5" diameter plate mounted polyurethane tired casters; two swivel, two rigid. Provide with two year warranty.
Accessories - Provide unit with see-thru Lexan Dutch doors, perimeter vinyl bumper and push/pull handles.

Item 63
REFRIGERATOR, REACH-IN
Make - Victory RSA-1D-S1-EW-HD-HC or equal by Continental or TurboAir
Power - 6.5 amps - 1/3 HP - 120/60/1 - cord and plug
Capacity - 26.06 cubic feet
Doors - Half height, hinged on right
Certification - Unit shall be Energy Star compliant
Description - Unit shall be all standard construction with stainless steel exterior, and aluminum interior. Unit shall include automatic interior LED lighting with proximity door switch, condensate evaporator, self-closing cam lift door hinges, automatic energy saver switch, plasticized fin coil, stainless steel interior door liners, non-conductive thermal breaker

strips, and electronic microprocessor control system with exterior LED display. Mount on 6" high stainless steel adjustable legs. Refrigeration shall be a self-contained, air cooled system with R-290 refrigerant, interior temperature governed by an adjustable pre-set control, supercool mode feature with a lower “set-point” refrigeration condition for a set period of time, and automatic energy saving mode which reverts when there are no door openings for four hours. Unit shall be provided with HAACP compliant monitoring and reporting system with Wi-Fi communication.

Accessories - Provide adjustable Type A/C tray slide kit spaced 3” on center in the top half, adjustable wire shelf in the bottom half, stainless steel case back, and optional four year compressor warranty. Provide unit mounted on 6” high casters.

Item 64
No item

Item 65
VENTILATOR AUTO-START CONTROL SYSTEM
Make - CaptiveAire SC-310110MA (Job #5953857) or equal by Gaylord or Halton
Power - 15 amps circuit - 120/60/1 to logic controller
Scope - Furnish and install complete exhaust control system for the exhaust canopy in accordance with the plans and Manufacturers shop drawings. The system shall include programmable logic controller (PLC), stainless steel control enclosure, exhaust duct temperature sensors, room temperature sensor, LCD screen interface with cable, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted HVAC practice. System shall control Item 67. Mount LCD screen control on wall per plan in a recessed junction box provided by the general contractor. Mount system processor in a stainless steel cabinet, wall mounted per plan at 80" high minimum above the floor. Mount the room air temperature sensor on the wall 66" above the finished floor.

Important: The installation work shall be performed by a fully qualified contractor employing a certified mechanic fully trained in the installation of the hood control system. Submittal shall list the installing company and the qualified system installer. Provide wiring diagrams and guidance to related trades to achieve correct operation of the system.

Accessories - Provide BacNet monitoring system. Service Design Verification: Factory Services and on site coordination to be performed by the Manufacturers service technician (not a sales representative). On site supervision shall include two site visits: One visit to coordinate preparations for installation, and a second visit at startup and calibration.

Item 65a
VENTILATOR CONTROL INTERFACE SCREEN
Specified as part of Item 65

Item 65b
ROOM TEMPERATURE SENSOR
Specified as part of Item 65

Item 66
FIRE SUPPRESSION SYSTEM
Make - Ansul R-102 or equal by Kidde or Pyro-Chem
Protection for hood: 67

Design - Provide an automatic liquid fire suppressant system sized to meet all local codes, UL 300 and NFPA Codes. System shall provide surface protection for cooking equipment, hood and the exhaust duct work, if required. Tanks shall be mounted on wall per plan, 80" high to bottom and within a 16-1/2" x 7-1/2" x 23-1/2" high stainless steel cabinet and

piping shall run hidden wherever possible. All pipes and fittings used to convey the chemical shall be scale free steel, 40 weight. Exposed piping located within the ventilator shall be stainless steel or chrome and limited to vertical drops only. Horizontal piping shall be run over the ventilator's top. Nozzles shall be swivel type with metal caps. Detection shall be fusible links rated per codes, and system shall rely on no outside source of power. The system shall be provided with a control box with indicator to indicate system status. Control head shall also include integral micro switch offering "normally open" and "normally closed" terminals for use by the Electrical Contractor for the shut-down of equipment and the sounding of alarms, etc. Suppressant tanks shall be stainless steel. Provide a properly sized mechanically operated gas shut-off valve (up to 3" diameter) for mounting by the Plumber at a point in the gas supply that will shut off fuel to all gas fired equipment. Provide and install a remote pull station per codes, complete with cables, conduit and pulleys. Coordinate installation of remote pull station with General Contractor to provide a recessed junction box mounted for installing the pull box with cable conduit concealed within walls. Provide system with class-K extinguisher as required.

Workmanship - Exposed stainless steel fittings and piping shall be assembled with special care to avoid marring or damaging the surfaces. Any pieces showing marks shall be removed and replaced with new materials. Chrome sleeves are not acceptable.

Test - Perform a puff test on the completed system and obtain the written approval of the local Fire Inspector.

Accessories - Provide metal blow-off caps on all nozzles.

Item 67
EXHAUST VENTILATOR
Make - CaptiveAire 4224 ND-2 (Job #5953857) or equal by Gaylord or Halton
Size - 63" x 42" x 24" high plus 4" high collar, mounted up 6'-8" above finished floor; flat bottom
Power - 120/60/1 power to lights from Item 65

Exhaust - 919 CFM through a 10" diameter collar at -0.612" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.

Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edge with integral front baffle, double wall insulated front, and NSF Listed. Unit shall have grease collection trough, storage container, and hanger brackets. Provide with 430 stainless steel Captrate Grease-Stop Solo Filter UL classified S-baffle extractors that shall remove at least 75% of grease particles five microns in size, and 90% of grease particles seven microns in size and larger, with a corresponding pressure drop not to exceed 1.0 inches of water gauge. Provide all materials necessary for the hanging of the ventilator, and seal to wall.

Accessories - Provide unit with two recessed UL Listed light LED fixtures factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3" above finished ceiling to close to adjacent surfaces on three sides. Provide quarter end panels, and a full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.

Item 68
PANINI GRILL
Quantity - 3
Make - Star Pro-Max 2.0 PGT14T or equal by Equipex or Waring
Power - 6.5 amps - 208/60/1 - cord and plug (NEMA 6-15P)

Description - Double sided grill shall be all standard construction with stainless steel body, heavy-duty torsion spring hinge, 14" wide grooved top and bottom cooking surface, aluminum cooking plates, and operating temperature between 175°F (79°C) and 550°F (288°C).

Item 69
WORK TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 60" x 30" x 36" high plus 6” high rear splash
Construction - 14 gauge stainless steel top and splash over angle frame with front and ends formed in turndown, rear formed in short splash, and mounted on four legs with gussets and adjustable feet, and full undershelf.
Accessories - Drawer assembly.

Item 70
SERVING COUNTER
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 13’-0” x 39" x 34" high
Power - 20 amps circuit - 120/60/1 to each of two body mounted GFI receptacles;
20 amps circuit - 120/208/1 to body mounted NEMA 14-20R receptacle
American Disabilities Act Requirements - Self-service food pans and food protectors shall be mounted in accordance with ADA code requirements for side reach per code section 4.2.6.
Construction - Top shall be 1-1/4 in. Quartz over a 3/4 in. marine grade plywood substrate. Mount on angle frame, and provide openings for the drop-in equipment with thermal protection at all edges per detail. Provide stainless steel cladding on exposed underside of substrate.

Counter tops: Superior Marble and Granite LLC (Middleton, Ma) or equal (submit warranty letter for stone top and installation with counter submittal)
Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Mount on eight 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist.

Undershelves shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees. Rear and ends shall be turned up 1-1/2 in. and corners welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with plastic laminate clad panels. Plastic laminate manufacturer shall be as selected by the Architect. Plastic laminate color shall be as selected by the Architect from Wilsonart's full range of colors. Panels shall be mounted with a minimum of joints. All joints to be hairline type. Joint between a front and end panel shall appear on the end panel face. Panels shall be secured to counter

legs and crossrails with welded stainless steel clips and stainless steel wood screws. Do NOT secure THROUGH the legs or crossrails. Provide a continuous 14 gauge support-protector strip at the lower edge of all finish panels, extending 1/16 in. past front face.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face. Provide pins in top and apron brackets for cutting board.

Accessories - Provide with a 12'-5" long (between end posts on centers) Versa-Gard VG21-SK convertible food protector assembly (Item 70a) with five front and three rear brushed stainless steel uprights, end panels, concealed mount flanges, and mounted per plan. Provide with a 72" long x 1/2" thick long removable polyethylene cutting board (made of two 36" pieces).

Item 70a
CONVERTIBLE GLASS FOOD PROTECTOR ASSEMBLY
Specified as part of Item 70

Item 71
CUTTING BOARD
Specified as part of Item 70

Item 72
COLD WELL, DROP-IN
Make - Low Temp Industries (LTI) DI-2063TA*C166 or equal by Hatco or Atlas
Power - 8.5 amps - 1/3 HP - 120/60/1 - cord and plug
Size - 70-1/2" x 26-3/4" with 64" x 20" pan
Description - Mechanically refrigerated cold pan shall be all standard construction with stainless steel pan and mounting frame, full perimeter sealing gasket, 1-1/2" to 2" insulation all contained in 18 gauge galvanized steel wrapper, pan divider bars, drain outlet, and self-contained thermostatically controlled refrigeration system with convected air flow and automatic defrost, R507 refrigerant and mounted on an integral angle frame with removable closure panels.
Accessories - Provide with remote control for mounting in counter apron. Provide unit with an optional five year compressor warranty.

Item 73
HOT/COLD WELL ASSEMBLY, DROP-IN
Make - Low Temp Industries (LTI) QSCHFP-4 or equal by Hatco or Delfield
Size - 64-3/4" x 26-3/4 x 21-5/8" high
Power - 14.4 amps - 208/60/1 - cord and plug (NEMA 14-20P)
Description - Drop-in unit shall be all standard construction with stainless steel top perimeter frame and food wells, four fully insulated, individual heated or refrigerated wells each with a 500 watt heat source, self-contained refrigeration with 1/3 HP, hermetically sealed compressor, R-507 refrigerant, individual solid state digital controls in remote enclosure, wet or dry operation, and drain manifold with individual drain valves for each well.

Item 74
No item

Item 75
No item

Item 76
SERVING COUNTER
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 19’-0” x 39" x 34" high
Power - 20 amps circuit - 120/60/1 to each of two apron mounted GFI receptacles;
20 amps circuit - 120/208/1 to each of three body mounted NEMA 14-20R receptacles
American Disabilities Act Requirements - Self-service food pans and food protectors shall be mounted in accordance with ADA code requirements for side reach per code section 4.2.6.
Construction - Top shall be 1-1/4 in. Quartz over a 3/4 in. marine grade plywood substrate. Mount on angle frame, and provide openings for the drop-in equipment with thermal protection at all edges per detail. Provide stainless steel cladding on exposed underside of substrate.

Counter tops: Superior Marble and Granite LLC (Middleton, Ma) or equal (submit warranty letter for stone top and installation with counter submittal)
Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Mount on ten 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist.

Undershelves shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees. Rear and ends shall be turned up 1-1/2 in. and corners welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with plastic laminate clad panels. Plastic laminate manufacturer shall be as selected by the Architect. Plastic laminate color shall be as selected by the Architect from Wilsonart's full range of colors. Panels shall be mounted with a minimum of joints. All joints to be hairline type. Joint between a front and end panel shall appear on the end panel face. Panels shall be secured to counter legs and crossrails with welded stainless steel clips and stainless steel wood screws. Do NOT secure THROUGH the legs or crossrails. Provide a continuous 14 gauge support-protector strip at the lower edge of all finish panels, extending 1/16 in. past front face.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face.

Accessories - Provide with an 8’-7-1/2" long (between end posts on centers) Versa-Gard VG21-SK convertible food protector assembly (Item 76a) with three front and two rear brushed

stainless steel uprights, end panels, concealed mount flanges, and mounted per plan. Provide with a 51-3/4" long (between end posts on centers) Versa-Gard VG21-SK convertible food protector (Item 76b) with two front and two rear brushed stainless steel uprights, end panels, concealed mount flanges, and mounted per plan.

Item 76a
CONVERTIBLE GLASS FOOD PROTECTOR
Specified as part of Item 76

Item 76b
CONVERTIBLE GLASS FOOD PROTECTOR
Specified as part of Item 76

Item 77
HOT/COLD WELL ASSEMBLY, DROP-IN
Quantity - 3
Make - Low Temp Industries (LTI) QSCHFP-3 or equal by Hatco or Delfield
Size - 49-1/2" x 26-3/4 x 21-5/8" high
Power - 12 amps - 120/208/60/1 - cord and plug (NEMA 14-20P)
Description - Drop-in unit shall be all standard construction with stainless steel top perimeter frame and food wells, four fully insulated, individual heated or refrigerated wells each with a 500 watt heat source, self-contained refrigeration with 1/3 HP, hermetically sealed compressor, R-507 refrigerant, individual solid state digital controls in remote enclosure, wet or dry operation, and drain manifold with individual drain valves for each well.

Item 78
HEATED DISPLAY SHELF, TWO-TIER
Quantity - 2
Make - Hatco HXMH-24D*C166 or equal
Size - 28" x 28-1/2" x 32-3/4" high
Power - 11.7 amps - 1.4 KW - 120/60/1 - cord and plug
Description - Unit shall be all standard construction with two heated horizontal shelves with Hardkote finish, constructed of stainless steel and extruded aluminum with hinged tempered glass end panels, Xenon display lights, ten divider rods, and thermostatic controls.

Item 79
REFRIGERATED SELF-SERVICE AIR SCREEN CASE
Make - Structural Concepts CO45R*C166 (provide shop drawing for review)
Size - 47-1/4" x 33" x 61-5/8" high
Power - 15.3 amps - 120/60/1 - cord and plug (NEMA L5-20P)
Description - Display case shall be all standard construction with black interior and display deck, solid black back panel, one piece formed ABS plastic tub, removable deck pan, top mounted LED lights, four tiers of adjustable solid metal shelves, mirrored interior ends, plastic laminate clad exterior in color as selected by Architect, digital thermometer, self-contained refrigeration system with adjustable control, condensate evaporator and coil capable of maintaining average product temperature of 40°F or less, and mounted on casters with levelers.
Accessories - Provide unit with, cutaway ends, rear loading hinged door with lock, shelf lights, Clean Sweep coil cleaner, retractable night curtain, locking power cord, and premium exterior laminate option.

Item 80
SERVING COUNTER
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, SML Stainless Steel Group, or Julien Inc.
Size - 15'-6" x 39" x 34" high
Power - 20 amps circuit - 120/60/1 to apron mounted GFI receptacle;
20 amps circuit - 120/60/1 to body mounted GFI receptacle;
20 amps circuit - 120/60/1 to body mounted NEMA L5-20R receptacle;
20 amps circuit - 120/208/1 to each of two body mounted NEMA 14-20R receptacles;
5.3 amps - 208/60/1 to apron mounted heat lamp control
American Disabilities Act Requirements - Self-service food pans and food protectors shall be mounted in accordance with ADA code requirements for side reach per code section 4.2.6.
Construction - Top shall be 1-1/4 in. Quartz over a 3/4 in. marine grade plywood substrate. Mount on angle frame, and provide openings for the drop-in equipment with thermal protection at all edges per detail. Provide stainless steel cladding on exposed underside of substrate.

Counter tops: Superior Marble and Granite LLC (Middleton, Ma) or equal (submit warranty letter for stone top and installation with counter submittal)
Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Mount on eight 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist.

Undershelves shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees. Rear and ends shall be turned up 1-1/2 in. and corners welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with plastic laminate clad panels. Plastic laminate manufacturer shall be as selected by the Architect. Plastic laminate color shall be as selected by the Architect from Wilsonart's full range of colors. Panels shall be mounted with a minimum of joints. All joints to be hairline type. Joint between a front and end panel shall appear on the end panel face. Panels shall be secured to counter legs and crossrails with welded stainless steel clips and stainless steel wood screws. Do NOT secure THROUGH the legs or crossrails. Provide a continuous 14 gauge support-protector strip at the lower edge of all finish panels, extending 1/16 in. past front face.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face.

Accessories - Provide with a 14’-9-1/2" long (between end posts on centers) Versa-Gard VG21-SK convertible food protector assembly (Item 80a) with six front and four rear brushed stainless steel uprights, end panels, concealed mount flanges, mounted per plan, and with mounted and pre-wired Hatco GRNH-48 heat lamp with remote control enclosure for mounting in counter apron.

Item 80a
CONVERTIBLE GLASS FOOD PROTECTOR WITH WARMER
Specified as part of Item 80

Item 81
HOT/COLD WELL ASSEMBLY, DROP-IN
Make - Low Temp Industries (LTI) QSCHFP-3 or equal by Hatco or Delfield
Size - 49-1/2" x 26-3/4 x 21-5/8" high
Power - 12 amps - 120/208/60/1 - cord and plug (NEMA 14-20P)
Description - Drop-in unit shall be all standard construction with stainless steel top perimeter frame and food wells, four fully insulated, individual heated or refrigerated wells each with a 500 watt heat source, self-contained refrigeration with 1/3 HP, hermetically sealed compressor, R-507 refrigerant, individual solid state digital controls in remote enclosure, wet or dry operation, and drain manifold with individual drain valves for each well.

Item 82
HEATED SURFACE, DROP-IN
Make - Hatco HBGB-4818*C166 or equal by BSI
Size - 48" x 18" plus perimeter flange
Power - 7.1 amps - 850 watts - 120/60/1 - cord and plug
Description - Black ceramic glass aluminum surface with thermostatic controlled heated base with 100° to 200°F. range, stainless steel flanged edge for drop-in installation, and remote control box.
Accessories - Provide with flush mount control box with lighted power switch for mounting in counter apron.

Item 83
HOT/COLD WELL ASSEMBLY, DROP-IN
Make - Low Temp Industries (LTI) QSCHFP-4 or equal by Hatco or Delfield
Size - 64-3/4" x 26-3/4 x 21-5/8" high
Power - 14.4 amps - 208/60/1 - cord and plug (NEMA 14-20P)
Description - Drop-in unit shall be all standard construction with stainless steel top perimeter frame and food wells, four fully insulated, individual heated or refrigerated wells each with a 500 watt heat source, self-contained refrigeration with 1/3 HP, hermetically sealed compressor, R-507 refrigerant, individual solid state digital controls in remote enclosure, wet or dry operation, and drain manifold with individual drain valves for each well.

Item 84
No item

Item 85
No item

Item 86
MILK COOLER
Make - Beverage-Air SMF58HC-1-S*C166 or equal by Continental or True
Size - 58" x 33-1/2" x 47" high; sixteen 13" x 13" x 11" milk crate capacity
Power - 3.3 amps - 1/3 HP - 120/60/1 - cord and plug
Description - Milk cooler shall be all standard construction with stainless steel interior and exterior front and ends, self-contained refrigeration system with thermostatic controls and blower, urethane foam insulation, exterior dial thermometer, and hinged and lockable drop-front covers. Interior shall be fitted with a vinyl coated wire rack. Mount on 4" diameter swivel casters and provide with R-290 refrigerant.
Accessories - Provide unit with optional five year compressor warranty.

Item 87
MILK COOLER
Make - Beverage-Air SMF34HC-1-S*C166 or equal by Continental or True
Size - 34" x 33-1/2" x 47" high; eight 13" x 13" x 11" milk crate capacity
Power - 3 amps - 1/6 HP - 120/60/1 - cord and plug
Description - Milk cooler shall be all standard construction with stainless steel interior and exterior front and ends, self-contained refrigeration system with thermostatic controls and blower, urethane foam insulation, exterior dial thermometer, and hinged and lockable drop-front covers. Interior shall be fitted with a vinyl coated wire rack. Mount on 4" diameter swivel casters and provide with R-290 refrigerant.
Accessories - Provide unit with optional five year compressor warranty.

Item 88
MOBILE CASHIER STAND
Quantity - 2 (two left; one right)
Size - 30 in. x 30 in. x 36 in. high main section with 42 in. x 10 in. trayslide set at 34 in. above floor
Construction - Top shall be 1-1/4 in. Quartz over a 3/4 in. marine grade plywood substrate. Mount on angle frame and provide stainless steel cladding on exposed underside of substrate. Provide neat hole in top for cord passage behind casher terminal. Mount on four 2 in. square legs with crossrails on three sides, footrest set in 8 in., undershelf and plastic laminate clad panels on three sides all of similar construction to the serving counter, with a solid stainless steel trayslide mounted on fold-down brackets. Provide 5 in. diameter swivel casters; two with brakes.
Accessories - Provide unit with a Component Hardware S95-1000 locking cashier drawer.

Item 89
CASHIER TERMINAL
Quantity - 3
No work in this Section. Item to be provided by Owner.

Item 90
CONDIMENT CART
Quantity - 2
Make - Lakeside 70410
Size - 51-1/2” x 25” x 31” high to counter top, 44-1/2” high overall
Construction - Cart shall be all standard construction with stainless steel base cabinet with laminate exterior, laminate top with four drop-in pump type condiment dispensers and two drop-in portion cup dispensers. Dispensers accept sealed 1.5-gallon (6L) condiment pouches with 16mm fitment with adjustable portion control. Cabinet shall include an

additional stainless steel shelf, sliding doors with locks, and mounted non-marking swivel caster, two with brakes. Exterior laminate finish to be selected by Architect.

Item 91
PORTABLE TRAFFIC STANCHION
Quantity - 3
Make - Lawrence Tensabarrier 889 Advance/Universal Base or equal
Size - 38-1/4 in. high post; 13-1/2 in. diameter base; 7 ft., 6 in. maximum belt length
Description - Units shall be all standard construction with satin stainless steel finish, and retractable belts. Belt color shall be as selected by Architect from standard options.

Item C01
THREE-COMPARTMENT SINK WITH PRE-RINSE SPRAY
Make - Advance K7-CS-21, Eagle, Aero, or an approved equal
Size - 58 in. by 19-1/2 in. by 34 in. high to drain board plus 8 in. high rear splash, 2-1/2 in. high raised open roll on three sides; three 10 in. by 14 in. by 10 in. deep integral sink basins
Description - Sink shall be all standard stainless steel construction with stainless steel legs with gussets adjustable feet, and crossrails.
Accessories - Provide unit with three lever waste outlets and a T&S Brass MPZ-8WLN-08 pre-rinse spray with add-on faucet and modified with a B-107-J spray valve.

Item C02
WALL SHELF
Make - Advance Tabco WS-10-60-16, Eagle, Aero, or an approved equal
Size - 60” x 10”, mounted 54” above floor
Description - Wall shelf shall be all standard 16 gauge stainless steel construction with bullnose front edge, turned down ends, rear turned up 1-1/2”, and mounted to wall with suitable fasteners on two stainless steel flag brackets.

Item C03
HAND SINK WITH FAUCET
Make - Advance 7-PS-70-CM*C166 or equal by IMC Teddy or Krowne
Description - Unit shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor
Accessories - Provide with a splash mounted faucet set with wrist handles (Item C03a), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provide with stainless steel welded splash on both ends.

Item C03a
FAUCET
Make - T&S Brass B-0330-04 modified or Fisher 1953 modified, or Encore
Description - Unit shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item C04
WASTE BIN
No work in this Section. Item to be provided by Owner.

Item C05
REFRIGERATOR, REACH-IN, GLASS DOOR
Make - Beverage-Air MMR27HC-1-B*C166 or equal by Continental or True
Size - 30" x 33-1/2" x 78" high overall
Power - 3 amps - 1/4 HP - 120/60/1 - cord and plug
Door - Hinged on left
Description - Refrigerator shall be all standard construction with black coated steel exterior front, sides and doors, white steel coated interior, self-closing field reversible hinged double pane glass door with hold-open feature, LED lighted interior, lit sign panel, bottom mounted self-contained refrigeration system with thermostatic controls and non-electric condensate evaporator, R-290 refrigerant, and a removable compressor compartment grille. Mounted on leveling feet.
Accessories - Provide six epoxy coated wire shelves, door lock, 3” casters, and optional five year compressor warranty.

Item C06
MOBILE HOT FOOD HOLDING CABINET
Make - Food Warming Equipment MTU-12*C166 or equal by Vulcan or CresCor
Size - 29-3/4" x 30-1/4" x 69" high
Power - 13.85 amps - 16.5 KW - 120/60/1 - cord and plug
Certification - Unit shall be Energy Star compliant
Description - Cabinet shall be all standard construction with stainless steel interior and exterior, stainless steel base frame with tubular perimeter and 10 gauge stainless steel reinforcing plates at corners, high density fiberglass insulation on all sides, flush mounted door with high temperature gasket mounted on the cabinet, edge mounted heavy duty hinges and latch, twelve pair of removable universal chrome plated and epoxy coated rod type pan slides capable of supporting 18" x 26" or 12" x 20" pans on 4-1/2" centers, mounted thermometer, recessed controls, thermostatically controlled system with separate heat and humidity controls, air distribution blower and removable stainless steel reservoir, and 10' cord set and cord storage loop. Mount on 5" diameter plate mounted polyurethane tired casters; two swivel, two rigid. Provide with two year warranty.
Accessories - Provide unit with see-thru Lexan Dutch doors, perimeter vinyl bumper and push/pull handles.

Item C07
WORK TABLE WITH SINK
Make - Advance Tabco KMS-11B-305L, Eagle, Aero, or an approved equal
Size - 60” x 30” x 36” high plus 5” high rear splash, 16” x 20” x 12” deep integral sink basin at left end
Description - Work table shall be all standard construction with 16 gauge stainless steel top, basin and splash mounted on channel frame, four 1-5/8” diameter, tubular stainless steel legs with stainless steel gussets and 1” adjustable stainless steel bullet feet, and 18 gauge stainless steel undershelf. Top shall have rolled edge front, turned down ends and 5” high rear splash. Secure 3” off face of wall with brackets. Delete standard facuet.
Accessories - Provide with lever type waste, 8” on center faucet holes in top, T&S Brass B-0221 deck mount faucet, and wall brackets for securing table 3” from wall.

Item C08
MOBILE WORK TABLE
Quantity - 2
Make - Advance Tabco MS-305, Eagle, Aero, or an approved equal
Size - 60” x 30” x 34” high
Description - Table shall be all standard construction with 16 gauge stainless steel top mounted on channel frame, four 1-5/8” diameter, tubular stainless steel legs with stainless steel gussets and 18 gauge stainless steel undershelf.
Accessories - Provide with modified 34” high table height, mount on swivel casters, two with brakes at front, and mounted SS-2020-DL drawer assembly.

Item C09
MOBILE WORK TABLE
Make - Advance Tabco MS-305, Eagle, Aero, or an approved equal
Size - 60” x 30” x 34” high
Description - Table shall be all standard construction with 16 gauge stainless steel top mounted on channel frame, four 1-5/8” diameter, tubular stainless steel legs with stainless steel gussets and 18 gauge stainless steel undershelf.
Accessories - Provide with modified 34” high table height, mount on swivel casters, two with brakes at front, and mounted SS-2020-DL drawer assembly.

PART 3 - EXECUTION

3.1 SANITATION REQUIREMENTS

A. Equipment specified herein shall be fabricated to conform to the "Food Service Equipment Standards" of the National Sanitation Foundation prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation will be referred to the State Department of Health for a ruling.

B. Equipment shall be installed in accordance with the manufacturer's instructions and the best practices of the food service industry, with careful attention to eliminating all cracks, crevices and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.

3.2 EXAMINATION AND ACCEPTANCE

A. Determine whether the General Contractor will furnish and provide temporary power and light, openings and storage space to permit scheduled delivery of equipment. Verify water pressure and provide necessary reducing valves.

B. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of specified work will be construed as acceptance of space conditions.

C. Obtain and verify all measurements and conditions on the job, and assume responsibility in respect to same.

D. Inspect flooring and raised concrete bases, wall finishes, painting, ceiling installation and all related work for readiness to commence installation of

foodservice equipment. Verify the existence of required mechanical and electrical rough-ins.

3.3 CLEANING UP

A. Debris and surplus materials resulting from installation work shall be removed promptly as work progresses, to a location indicated by the General Contractor.

B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.4 DEMONSTRATION AND OPERATING INSTRUCTIONS

A. Before final acceptance, and by appointment with the Owner and his representatives, completely demonstrate with power, the correct operation of each new item of operating equipment.

B. Prior to the demonstration, turn on all mechanical and electrical foodservice equipment. Test for leaks, poor connections, and inadequate or faulty performance and correct if necessary. Adjust for proper operation. Thermostatically controlled equipment and equipment with automatic features shall be operated for a sufficient length of time with proper testing equipment to prove controls are functioning as intended. Recalibrate thermostats if necessary.

C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Provide with a list of equipment to include make, model, and serial number where applicable. Book shall be turned over to Owner after review and approval.

D. Submit guarantees and warrantees to the Architect in the above specified manual with all warranty cards completed and becoming effective at the time the equipment was satisfactorily demonstrated.

3.5 PROTECTION OF WORK

A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.

B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.

C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by the Architect.

3.6 EXISTING EQUIPMENT

A. Foodservice equipment that is scheduled for reuse shall be removed and stored in a location provided by the General Contractor on site. This Contractor shall provide transportation of equipment.

B. Verify and document the operating condition of all relocated equipment prior to its being disconnected. Document the condition of the equipment to note any dents, scratches, broken components or other damage prior to placing it in storage. Protect equipment during transport and storage, and assume responsibility for its re-installation in the condition viewed prior to removal. Transport and install the equipment in accordance with Item Specifications.

C. This Contractor is not responsible for refurbishing equipment noted as "Existing" on plans or specifications unless work is specifically called for in the Item Specifications.

D. Disconnecting and reconnecting of services to "Existing" equipment shall be performed by related trades.

E. This Contractor shall restart all existing equipment following its reconnection to building services and verify its correct operation as viewed prior to removal.

F. This Contractor shall not provide a warranty or guarantee on "Existing" equipment. In the case of a new component being provided by this Contractor for an "Existing" piece of equipment, the component shall be warranteed or guaranteed as specified hereinbefore.

G. Foodservice equipment that is scheduled for reuse must be verified for NSF certification.

End of Section

Section 11 52 13

PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Electrically-operated, ceiling recessed, front projection screens.

1. Coordinate Auditorium and Lecture Hall projection screens with Section 27 40 00 – AUDIO-VIDEO COMMUNICATIONS. Projection screens at these locations shall be controlled by the AV system via RS232.
2. Projector lifts.
3. Universal grid system for support of overhead work required as part of this Section 11 52 13.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

D. Section 09 22 16 - METAL SUPPORT ASSEMBLIES: Metal framing and ceiling suspension system for veneer plaster surfaces.

E. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate behind wall mounted projection screens.

F. Division 26 - ELECTRICAL: Electrical connections to projection screens, empty conduit from motor to control.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements
   a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
   b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets for projection screens, including electrical characteristics.
2. Manufacturer’s installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
3. Manufacturer's sample warranties.
4. Shop drawings: Installation details showing mounting conditions, clearances, dimensions, and electrical connections.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:

1. Manufacturer’s warranty.
2. Maintenance information on regular cleaning, stain removal for screen surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Do not deliver projection screens to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
3. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.7 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

B. Provide manufacturer's standard warranty which shall include coverage of screen surfaces from discoloration. Warranty is in addition to and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Draper, Inc., Product: “Premier” (Type 1 screen), “Access XL/Series V” (Type 2 screen).

B. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

1. Draper, Inc. Spiceland, Indiana.
2. Bretford Manufacturing Inc., Schiller Park, Illinois.
3. Da-Lite Screen Company, Inc., Warsaw, Indiana.
4. Stewart Filmscreen Corporation, Torrance, California.

2.2 ELECTRICALLY OPERATED SCREEN UNITS

A. Projection Screens:

1. Electrically operated drop projection screen.
2. Motor: Instant reversing motor in size and capacity recommended by screen manufacturer, with permanently lubricated bearings, automatic thermal overload protection, preset limit switches to automatically stop screen in "up" and "down" position, and positive stop action to prevent coasting; and as follows:
   a. Mount motors with vibration insulators to reduce noise transmission.

3. Screen Characteristics: Provide mildew-resistant and flame-resistant glass fiber fabric mounted on rigid roller, with vinyl-coated viewing surfaces complying with the following requirements, in sizes indicated:
    a. Size:
        1) Type 1 screen: 146 inch high by 260 inch wide.
        2) Type 2 screen: 111 inch high by 198 inch wide.
        3) Type 3 screen: 111 inch high by 198 inch wide.
    b. Type of Viewing Surface: Matt White, textile backed.
        1) Screen format (all types): 16:10 Format.
    c. Edge Treatment: Black masking borders.
    d. Direction of roll: Reverse roll.
    e. Provide extra drop length:
        1) Type 1 screen: 9 feet 0 inch (field coordinated).
        2) Type 2 screen: 3 feet 6 inch (field coordinated).
        3) Type 3 screen: 3 feet 6 inch (field coordinated).
4. Screen Control: Single station control with low voltage control system consisting of a single control unit, directionally lighted, single button control stations of number and at locations indicated, with metal device boxes and flush cover plates.
5. Case: Extruded aluminum case, UL approved "suitable for use in environmental air space." Case size 9-3/4 inches (248 mm) deep and 9-1/8 inches (232 mm) wide for screen sizes up 144 inches wide; 11 inches (279 mm) x 9-1/8 inches (232 mm) for larger screen sizes. Bottom of case shall be fully enclosed by aluminum panels and motorized aluminum trap door with concealed hinges. Trap door supported entirely along front and back edges without crack around perimeter of door. Trap door opens into case when screen is lowered. Closure panels screw-attached to case and may be removed manually for access to roller and drive assembly. Case shall have manufacturer’s standard white finish.
    a. Screen Types 1: Suspended mount attached to roof framing. Provide manufacturers standard finish in black.
    b. Screen Types 2, and 3: Recess mounted above ceiling.

2.3 ACCESSORIES

A. Universal Grid System:

1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Unistrut Corporation, Itasca IL.
    a. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.
        1) Unistrut Corporation, Itasca IL., product “Unistrut”.
        2) Cooper US, Inc., Houston TX., product “Cooper B-Line”.
        3) Gleason Partners, LLC., Grand Rapids, MI., product “Strut Channel Systems”.

4) Thomas & Betts Corporation, Memphis TN, product “Kindorf Superstrut”.

b. There are no other manufacturers of this product type available in the United States, fabricators may choose to fabricate grid system components using structural steel shapes, with submittal and approval of complete engineering Drawings and calculations as a substitution.

c. Finish:

1) Rust inhibiting acrylic enamel paint applied by electro-deposition, after cleaning and phosphating, and thoroughly baked. Color is per Federal Standard 595a color number 14109 (dark limit V-). Finish to withstand minimum 400 hours salt spray when tested in accordance with ASTM B 117.

2. All channel members shall be fabricated from structural grade steel confirming to the following ASTM specifications:

a. ASTM A 653 Grade A

3. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications:

a. ASTM A 36, A 575, or A 576.

4. All materials shall be stamped and identifiable by manufacturer and part number (where appropriate). Materials that appear damaged, distressed, unidentifiable or rusted shall not be used and will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and concealed blocking are ready to receive work of this Section.

B. Beginning of installation means acceptance of existing substrate.

3.2 INSTALLATION

A. Verify that electric power is available and of the correct characteristics.

B. Install projection screen units in accordance with manufacturer's instructions. Secure units level and plumb.

C. Establish top of units as indicated on the Contract Drawings.

3.3 CLEANING

A. Clean projection screen surfaces in accordance with manufacturer's instructions.

B. Cover units with protective cover taped to frame. Remove cover at Date of Substantial Completion.

End of Section

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Section 11 53 00

LABORATORY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:
   1. Acid storage cabinets.
   2. Flammable material storage cabinets.
   3. Glassware pegboards.
   4. Safety glass goggle cabinets.
   5. Water Distiller.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

D. Section 11 31 00 – APPLIANCES: Appliances in science classrooms.

E. Section 12 30 00 - CASEWORK: Laboratory casework, including base cabinets and epoxy resin work surfaces for fume hoods, is specified in.

F. Division 22 - PLUMBING: Connections to all plumbing work furnished under this Section.

G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Fume hood vent connections and ductwork (from hood duct collar to hood exhaust system).

H. Division 26 - ELECTRICAL: Electrical work related to items in this Section

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
   1. Comply with all applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
2. Manufacturer’s instructions: Manufacturer’s installation instructions indicating special procedures, and perimeter conditions requiring special attention.
3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
4. Selection samples: Sample card indicating Manufacturer's full range of colors available for selection by Architect.
5. Sustainable Design Submittals: As required by NE CHPS.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Do not deliver equipment to the project until all concrete, masonry, plaster and other wet work has been completed and dry.

C. Deliver and store equipment in original, sealed packaging showing manufacturer’s identification and model number.

D. Protect equipment from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

PART 2 - PRODUCTS

2.1 SCIENCE CLASSROOM EQUIPMENT

A. Flammable/Corrosive Storage Cabinets

1. Acid storage cabinets:
   a. Acid Storage Cabinet (Chemical Storage Rooms): 45 gallon cabinet fabricated with adjustable polypropylene shelves, and lockable.
      1) Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Justrite Manufacturing Company, Inc., Des Plaines, IL, Product, “45 Gallon, 2 Shelves, 2 Doors, Self Close, Corrosives/Acid Steel Safety Cabinet, Sure-Grip EX, Blue” - model “894522”.

2. Flammable storage cabinets:
    a. Flammable storage cabinets (Chemical Storage Rooms): NFPA and OSHA compliant 22 gallon under counter cabinet fabricated from 18 gauge steel with double wall construction incorporating a 1-1/2 inch air space, two vents with 2 inch threaded fittings, fire baffle and caps and double doors with 3 point locks, 2 inch raised leak proof sill, self-closing doors. Shelves shall be capable of supporting up to 350 pounds each.
3. Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Eagle Manufacturing Company, Wellsburg, WV, Product, EAGLE Safety Cabinet Model 1907X.
    Acceptable manufacturers:
    a. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
        1) Eagle Manufacturing Company, Wellsburg, WV.
        2) Scientific Materials Company, Inc., Batavia, IL.
        3) Securall/A & A Sheet Metal Products, LaPorte, IN.
        4) Justrite Manufacturing Company, Inc., Des Plaines, IL.

B. Glassware Pegboard
1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Thermo Fisher Scientific Product No. 52L82000, with two Pegboard Support Brackets 1/4 inch thick by 2 inch with legs in lengths by the following sizes:
    a. Pegboards: 30 inches wide by 30 inches high in Prep. Room(s).
2. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    a. Thermo Fisher Scientific, Two Rivers, WI.
    b. Institutional Casework, Inc., Campbell Rhea, Paris, TN.
    c. ALC Collegedale, Ooltewah, TN.
    d. Kewaunee Scientific Corporation, Statesville, NC.
3. Stainless steel construction with No. 4 finish, 30 inches by 30 inches, with integral drip trough and 36 inch long PVC hose, screen insert (Product No. 52L8820), and thirty 6 inch long polypropylene pegs.

C. Safety Glass Goggle Cabinet
1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Thermo Fisher Hamilton Model No. 58L02110.
2. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    a. Sellstrom Manufacturing Company, Palatine, IL.
    b. Institutional Casework, Inc., Campbell Rhea, Paris, TN.

c. Thermo Fisher Scientific, Two Rivers, WI.

d. ALC Collegedale, Ooltewah, TN.

e. Kewaunee Scientific Corporation, Statesville, NC.

3. Features: 24 gauge steel fabricated case with white enamel finish, automatically timed germicidal lamp with plug cord for 115 v single phase outlet, key locked with vault rods. Safety interlock switch turns off UV light when doors are opened.

4. Size: 9-1/2 inches deep by 24-1/2 inches wide by 32 inches high with a capacity of holding 30 pairs of chemical splash goggles.

D. Water Distiller: 12 gallon per day capacity, with automatic fill and 4 gallon reserve tank and dispenser. Type 316 Stainless steel construction.

1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Durastill Inc., Muskegon MI, model Nº. 46C (400228-400104), or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.

B. Verify clearances required for equipment.

C. Verify ventilation outlets, service connections, and supports are correct and in required location.

D. Verify that electric power is available and of the correct characteristics.

E. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

A. Install each product in accordance with manufacturers' instructions.

1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.

B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

C. Anchor equipment using devices appropriate for equipment, substrate and expected usage.

3.3 ADJUSTING

A. Adjust equipment to ensure proper working order and conditions.

B. Remove and replace equipment creating excessive noise, or vibration.

C. After installation is completed, insure that operating parts work freely and fit neatly. Adjust hardware and catches. Repair or replace damaged parts dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

3.4 CLEANING

A. Clean Work under provisions of Section 01 73 00 - EXECUTION:

1. Wash and clean equipment.
2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.

B. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

End of Section

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Section 11 53 13

LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install laboratory ductless fume hoods, related component fittings, fixtures, and accessories required for a fully piped and wired unit ready for attachment to building plumbing and electrical systems.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 12 30 00 - CASEWORK: Laboratory casework, epoxy resin tops.

D. Division 22 - PLUMBING: Connections to all plumbing work furnished under this Section.

E. Division 26 - ELECTRICAL: All electrical work related to items in this Section

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ADAAG - Accessibility Guidelines for Buildings and Facilities
2. ANSI/ASHRAE Standard 110.1995 - Method of Testing Performance of Laboratory Fume Hoods
3. ASTM D 552 – Bending Test
4. ASTM D 2197 - Standard Method of Test for Adhesion of Organic Coatings.
5. ICC/ANSI A117.1 - Providing Accessibility and Usability for Physically Handicapped People.
6. NSF/ANSI Standard 49 – Photometric Method of Testing.
7. NIH03-112C - National Institute of Health Specification

8. UL 1805 – Underwriters Laboratories Fume Hood Classification
9. NFPA 45 – Standard on Fire Protection for Laboratories Using Chemicals

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner or designated representative, Architect, General Contractor, Installer’s Project Superintendent, manufacturer’s technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
   a. Division 22 - PLUMBING.
   b. Division 26 – ELECTRICAL.
2. Agenda:
   a. Scheduling of operations.
   b. Review of staging and material storage locations.
   c. Coordination of work by other trades.
   d. Installation procedures for ancillary equipment.
   e. Protection of completed Work.
   f. Discuss process for manufacturer’s inspection and acceptance of completed Work of this Section.

C. Sequencing:

1. Field Measurements
   a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
   b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

D. Scheduling:

1. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Manufacturer's data for each type of fume hood including service fittings.
2. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
3. Certificates: Provide manufacturer’s certification and test data indicating compliance with ASRAE Standard 110-1995 with a performance rating of 4.0 (tracer gas release in liters/minute), AM (as manufactured), 0.01 (level of control of tracer gas in parts per million (ppm).
4. Shop drawings for fume hoods, showing plan layout, elevations, ends, cross-sections, service run-spaces, location and type of fixtures and service fittings, together with indication of associated service supply connections required.
    a. Include details and location of anchorages and fitting to floors, walls, and base.
    b. Include layout of units with relation to surrounding walls, doors, windows, lighting and air-conditioning fixtures, connections of hood-to-hood exhaust system, location of access doors, cut-off valves, junction boxes.
    c. Coordinate shop drawings with other trades whose work affects installation or performance of fume hood.
    d. Provide roughing-in drawings for mechanical and electrical services.
5. Sustainable Design Submittals: As required by NE CHPS.

1.6 QUALITY ASSURANCE

A. Catalog Standards: Manufacturer's catalog numbers may be indicated on drawings for convenience in identifying certain fume hoods. Unless modified by notation on drawings or otherwise specified, manufacturer's current catalog description for indicated number, together with indicated or specified options or accessories, constitutes requirements for each such unit.

1. Use of catalog numbers and specific requirements indicated on drawings and in specification are not intended to preclude use of equivalent products by other listed acceptable manufacturers, but are given for purpose of establishing a minimum standard of design and quality for materials, construction, workmanship, capacity, and performance of each fume hood.

B. General Performance: Design fume hoods so that, when connected to exhaust system that provides proper exhaust volume under normal laboratory conditions, fume hoods will operate in a safe, efficient manner, within acceptable tolerances for

face velocities specified. Dead-air pockets and reverse-air currents will not be permitted along surface of hood interiors.

1.7 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of fume hoods with delivery of other laboratory casework components.

B. Delivery and Storage: Deliver materials under protective cover and store within dry enclosed space. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no change in Contract Sum.

1.8 WARRANTY

A. Provide manufacturer's one-year warranty against all defects in material or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer and Product: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Air Master Systems, Muskegon, MI, product: "Green Solution Fume Hood".

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Air Master Systems, Muskegon, MI.
2. Labconco Corporation, Kansas City, MO.
3. Wood/Metal Industries, Brantford, Ontario, CN.

2.2 FUME HOOD CONSTRUCTION

A. Superstructure: Rigid, self-supporting assembly. Manufacturer's standard post thickness.

1. Width: 4 feet.
2. Interior height to be minimum of 47 inches.
3. Hood shall be designed so sash opening is 28 inches minimum for loading and unloading purposes.
4. Hoods to have side viewing panels that are flush with the outside steel.
5. Hood to have glass back for demonstration purposes without baffles obstructing views.
6. Hoods must pass ASHRAE 110 containment test with only the fans supplied by Erlab or approved equal. No external fans allowed to aid in flow of hood.

B. Exhaust outlet: Top of filters to be a maximum of 9 feet off the floor with a 36 inch high work surface.

C. Airfoil and sill to be low profile design. A secondary containment trough shall be located in front of the work surface and extend below the airfoil.

D. Fume hood sash (vertical rising): Sash must be capable of being opened to allow a 28 inch opening for loading and unloading purposes. Flip up panels are not acceptable.

E. Counter balance system: An integral counterbalance system.

F. Fume Hood liner: Laboratory grade powder coat steel, UV stable. Epoxy based or polypropylene liners are not acceptable.

G. Sash shall be designed to promote usage as an upper body and face shield. Face velocities and volumes shall be based on an 18 inch operating opening. Sash shall have the capability to be raised to full vertical 28 inch height for all sizes of fume hoods for loading and unloading of large apparatus. Sash and front viewing area shall be angled to enhance comfort and viewing.

H. Plumbing fixtures are to be WaterSaver ColorTech front-loaded valves with color coded handles.

I. Hood to be equipped with (2) GFI 20 amp electrical receptacles.

J. Fume hood front posts shall be angled to provide better viewing and ergonomics.

K. Regulatory Requirements:

1. All designs, clearances, construction, workmanship, and material, unless specifically excepted, shall be in accordance with the requirements of:
    a. NFPA 70 National Electrical Code.
    b. Work shall be in full conformance with all regulations for the physically handicapped in accordance with ANSI Publication No. A-117.1 Part 4, Series 4.12, Design of Barrier-Free Facilities, the recommendations of United States Department of Justice, Nº 28 CFR Part 36 - American with Disabilities Act Public Law 101-336, (referred to herein as "ADA"), local authorities, and all other governing bodies which may have jurisdiction.
    c. Products requiring electrical connection: Listed and classified by Underwriter’s Laboratories, Inc., as suitable for the purpose specified and indicated.

2.3 PERFORMANCE/DESIGN CRITERIA

A. Fume hoods shall be of complete airfoil design to insure maximum operating efficiency. Foil sections at the front fascia of the hood shall minimize eddying of air currents at the hood face and the rear baffle system shall minimize turbulence in the upper portion of the hood interior.

2.4 MATERIALS

A. Exterior Metal: Manufacturer's standard with acid-resistant and alkali-resistant, baked-on finish. Provide in color as selected by Architect from manufacturer's standard range of available colors.

B. Stainless Steel: AISI Type 302/304 with No. 4 finish.

C. Laminated Safety Glass: Two sheets of clear float glass, complying with ASTM C 1036 requirements for Type I, Class I, Quality q3 glass, permanently laminated to clear polyvinyl butyral interlayer.

D. Fasteners: Provide stainless steel fasteners wherever exposed to fumes in hood.

2.5 FINISHES

A. Assembled fume hood components shall be given a pre-paint treatment for adhesion of the final finish system and to aid in the prevention of corrosion due to humidity or presence of chemicals. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine-grained crystalline phosphate surface.

B. After pre-paint treatment has fully cured provide all steel surfaces with a chemical and corrosion resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.

2.6 FINISH PERFORMANCE TESTING:

A. Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4 inch diameter watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2 ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77° ±3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

B. Test results:

1. Level 0 - No detectable change.
2. Level 1 - Slight change in color or gloss.
3. Level 2 - Slight surface etching or severe staining.

4. Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

C. Test results: After testing, panel shall show no more than three (3) Level 3 conditions.

D. Test Reagents (Where concentrations are indicated, percentages are by weight):

Chemical Reagent	Test Method
Acetate,Amyl	Cotton ball & bottle
Acetate, Ethyl	Cotton ball & bottle
Acetic Acid, 98%	Watch glass
Acetone	Cotton ball & bottle
Acid Dichromate, 5%	Watch glass
Alcohol, Butyl	Cotton ball & bottle
Alcohol, Ethyl	Cotton ball & bottle
Alcohol, Methyl	Cotton ball & bottle
Ammonium Hydroxide, 28%	Watch glass
Benzene	Cotton ball & bottle
Carbon Tetrachloride	Cotton ball & bottle
Chloroform	Cotton ball & bottle
Chromic Acid, 60%	Watch glass
Cresol	Cotton ball & bottle
Dichlor Acetic Acid	Cotton ball & bottle
Dimethylformanide	Cotton ball & bottle
Dioxane	Cotton ball & bottle
Ethyl Ether	Cotton ball & bottle
Formaldehyde, 37%	Cotton ball & bottle
Formic Acid, 90%	Watch glass
Furfural	Cotton ball & bottle
Gasoline	Cotton ball & bottle
Hydrochloric Acid, 37%	Watch glass
Hydrofluoric Acid, 48%	Watch glass
Hydrogen Peroxide, 3%	Watch glass
Iodine, Tincture of	Watch glass
Methyl Ethyl Ketone	Cotton ball & bottle
Methylene Cloride	Cotton ball & bottle
Mono Chlorobenzene	Cotton ball & bottle
Naphthalene	Cotton ball & bottle
Nitric Acid, 20%	Watch glass
Nitric Acid, 30%	Watch glass
Nitric Acid, 70%	Watch glass
Phenol, 90%	Cotton ball & bottle
Phosphoric Acid, 85%	Watch glass
Silver Nitrate, Saturated	Watch glass
Sodium Hydroxide, 10%	Watch glass
Sodium Hydroxide, 20%	Watch glass
Sodium Hydroxide, 40%	Watch glass
Sodium Hydroxide, Flake	Watch glass
Sodium Sulfide, Saturated	Watch glass
Sulfuric Acid, 33%	Watch glass
Sulfuric Acid, 77%	Watch glass

Sulfuric Acid, 96%	Watch glass
Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
Toluene	Cotton ball & bottle
Trichloroethylene	Cotton ball & bottle
Xylene	Cotton ball & bottle
Zinc Chloride, Saturated	Watch glass

E. Performance Test Results (Heat Resistance):

1. Hot water (190° F - 205° F) shall be allowed to trickle (with a steady stream at a rate not less than 6 ounces per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.

F. Performance Test Results (Impact Resistance):

1. A one-pound ball (approximately 2 inches diameter) shall be dropped from a distance of 12 inches onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close eye ball examination.

G. Performance Test Results (Bending Test):

1. An 18 gauge steel strip, finished as specified, when bent 180º over a 1/2" diameter mandrel, shall show no peeling or flaking off of the finish.

H. Performance Test Results (Adhesion):

1. Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1/16 inch apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination.

I. Performance Test Results (Hardness):

1. The test sample shall have a hardness of 4H using the pencil hardness test.
2. The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel like manner until one is found that will cut or scratch the film. The pencil used before that one that is, the hardest pencil that will not rupture the film is then used to express or designate the hardness.

2.7 ACCESSORIES

A. Service Fittings: Manufacturer's standard heavy-duty, chrome plated finish over brass. Type, configuration and location of fittings are shown on Drawings.

B. Airflow Alarm: Provide fume hoods with audible and visual alarm that activates when airflow sensor reading is outside of preset range.

1. Provide with either thermal-anemometer or aneroid gage airflow sensor.

2. Provide with reset and test switches.
3. Provide with switch that silences audible alarm and automatically resets when airflow returns to within preset range.

C. Sash Alarm: Provide fume hoods with audible and visual alarm that activates when sash is opened beyond preset position.
1. Provide with silence and test switches.

D. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 50 percent of sash height. Sash stops can be manually released to open sash fully for cleaning hood and for placing large apparatus within hood.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install fume hoods plumb, level, aligned, rigid, and securely anchored to building and adjacent laboratory casework, in proper location, in accordance with manufacturer's instructions and approved shop (layout) drawings. Install closures neatly. Securely attach access panels, but provide for easy removal and secure reattachment.

B. Coordinate sequence of work with mechanical and electrical trades and with related work such as laboratory casework specified in Section 12 30 00 – CASEWORK.

3.2 FIELD QUALITY CONTROL

A. Field Test: Field test each unit after completion of installation to verify proper operation of hoods.

B. Field test hoods according to fume hood standard after completing installation to demonstrate proper operation. Also test one hood selected by Architect, for each type of hood installed, according to ASHRAE 110 to verify performance. If any hood tested for performance fails to perform as specified, field test additional hoods as directed by Architect.
1. Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.
2. After making corrections, retest fume hoods that failed to perform as specified.

3.3 ADJUST AND CLEAN

A. Moving Parts: Carefully check and adjust moving parts to insure smooth, near-silent, and accurate sash operation with one hand and with uniform contact of rubber bumpers. Ensure counter-balances operate without interference.

B. Clean surfaces including both sides of glass.

C. Damaged Work: Repair equal to new undamaged work, or replace with new units, as acceptable to Architect.

End of Section

Section 11 53 54

CHEMICAL STORAGE CONTAINERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:

1. HDPE Chemical storage ‘carboy’ containers.
    a. STE Storage Room, quantity of 5 containers.
    b. Prep Room, quantity of 5 containers.
    c. Prep Room, quantity of 5 containers.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
2. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
3. Sustainable Design Submittals: As required by NE CHPS.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Manufacturer’s field quality control reports of field inspections, including, revised “as-built” shop drawings and manufacturer’s final punch list.

1.6 QUALITY ASSURANCE

A. Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

1.8 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

B. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Thermo Fisher Scientific, Two Rivers, WI.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Thermo Fisher Scientific, Two Rivers, WI.
2. Institutional Casework, Inc., Campbell Rhea, Paris, TN.
3. ALC Collegedale, Ooltewah, TN.
4. Kewaunee Scientific Corporation, Statesville, NC.

2.2 CHEMICAL STORAGE CONTAINERS

A. Chemical Storage Containers: Nalgene HDPE Rectangular Carboy, without spigots having capacity of 5.3 gallons (20L). ThermoFisher Scientific model 2211-0050.

1. Construction and materials: Manufacturer's standard 18 gage enameled steel. Shelves and case to be covered with 1/4 inch thick non-asbestos transite liner. Double doors provided with three way locking device and cylinder lock.
   a. Cabinet fabricated of welded construction on sides and doors, with all exposed welds grind smooth.
2. Size 48 inches width by 24 inches deep by 84 inches high.
3. Shelving within each cabinet: Five adjustable shelves, 18 gage steel with all edges flanged down and under, capable of supporting 5 gallon glass bottles.
4. Doors provided with louvers for air circulation.
5. Signage: Red warning letters painted on front of cabinet, indicating "hazardous storage".
6. Ventilation: Provide 1-1/2 inch high, 6 inch diameter collar for ductwork connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.

B. Verify clearances required for equipment.

C. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

A. Install each product in accordance with manufacturers' instructions. Maintain sanitary seal, do not open containers. Containers have been factory washed.

3.3 CLEANING

A. Clean Work under provisions of Section 01 73 00 - EXECUTION:

1. Wash and clean equipment.
2. Clean and polish glass, plastic, hardware and accessories.

B. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

End of Section

Section 11 61 00
THEATRE AND STAGE EQUIPMENT

Part 1. GENERAL

1.01 GENERAL

A. Attention is directed to the Contract and General Conditions and all sections within Division 01 – General Requirements which are hereby a part of this Section of the Specifications.

B. The majority of this specification Section is **Alternate #1** the exception being; Part 4 Items 4.06 Gym Audio and AV system, 4.07 Student Dining Audio System, and 4.08 IDF Closet Equipment **are the Base bid.**

1.02 DEFINITION OF TERMS

A. The term Electrical Contractor as used herein, refers to the organization, individuals, and their representatives who shall provide the conduit, wire, back boxes, and high voltage installation and labor. Division 26 work relating to this specification shall be coordinated through the Theatrical Equipment Contractor.

B. The term Theatrical Equipment Contractor as used herein refers to the organization, individuals, and their representatives who shall provide; the stage dimming and control equipment, circuit distribution, stage lighting fixtures, accessories, stage rigging, stage curtains, Auditorium, Gym, band and chorus rooms, student commons, Audio and Video equipment, supervise system installations, furnish low voltage wire, terminations and system programming.

C. The term Owner and Architects as used herein refer to the organization(s), Individuals, and their representatives as typically defined.

D. Technical terms peculiar to the stage, audience, special lighting, and related work shall be construed in the following order, in accordance with:

1. Captions on related drawings.
2. Generally recognized theatrical usage.
3. Relevant usage and definitions of handbooks, guidebooks, or trade-group recommendations by manufacturer's associations or professional and engineering societies such as UL, IES, SMPTE, NEC, NEMA and USITT.

1.03 CONTRACTOR APPROVAL REQUIREMENTS

A. Only qualified contractors shall be used to supply equipment and labor for this section.

B. The work of this section shall be contracted to a single firm, referred to as the Theatrical Equipment Contractor.

C. Items 1 thru 5 below shall be included as part of the Bid submittal package.

1. Furnish proof that the Theatrical Equipment Contractor is factory certified to provide warranty service for equipment in this section.

2. Show proof that the Theatrical Equipment Contractor has an ETCP certified rigger on staff. Include a copy of the riggers ETCP Certificate with bid.

3. Provide proof that each Project Manager and each on-site employee has an OSHA 10-hour card. Include a copy of the Project manager's OSHA 10 card with the submittal.

4. Submit a certified statement from the bidder's bonding company showing proof of bondability for this segment of the work.

5. Each Bid shall be accompanied by a Bill of Materials, showing the quantity of each item to be furnished with the Manufacturer's name, the quantity of each unit being provided, model and part number on all items listed in the Specification or proposed by the Manufacturer or Theatrical Equipment Contractor to be part of the total system.

D. Contractor's seeking qualification must submit the following to the Architect to be considered a qualified Theatrical Equipment Contractor.

1. A listing of 5 equivalent installations including (within a 75-mile radius of this job site): Submit using Appendix "A" reference list at end of section.

a. Name, address, and current telephone number of Owner.

b. Name, address, and current telephone number of Architect or theater consultant associated with the installation.

2. A brief written description of the contractor's operation, including facilities, key personnel and biographical information of the project manager who shall be assigned to this project should the contractor be successful.

3. A list of all sub-contractors who the Theatrical Equipment Contractor proposes to use including their qualifications to perform the work.

4. The Theatrical Equipment Contractor shall maintain a factory-authorized service center within a seventy five (75) mile radius of the project. Submit the name or names of contractor's factory authorized service representative, a brief resume of the service department's personnel, a 24-hour service number that is not the manufacturer's service center.

1.04 RELATED WORK

A. Section 260000 - Common Work Results for Electrical

C. Section 260000 - Medium-Voltage Cables

D. Section 260000 - Low-Voltage Electrical Power Conductors and Cable

E. Section 260000 - Control-Voltage Electrical Power Cables

F. Section 260000 - Grounding and Bonding

G. Section 260000 – Raceway and Boxes

1.05 SCOPE

A. Furnish Stage Dimming and Control equipment to Division 26 contractor for Installation.
B. Provide Stage Rigging and Drapery, Stage lighting fixtures, Accessories, Circuit distribution, hang and focus light plot as shown in the plans.
C. Provide Performance Audio and AV for the Auditorium and Audio for the Student Commons, Gym, Band and Chorus rooms. Conduit with pull strings shall be provided by the Division 26 contractor.
D. Due to the complexity of this project and the specific combination of equipment and services required for a professional installation, equipment in this specification shall be purchased from an approved Theatrical Equipment Contractor.
E. This is a single source specification, one Theatrical Equipment Contractor shall be responsible for supplying the stage dimming and control equipment, dead hung rigging, motorized rigging, stage curtains, Performance Audio and AV, Project Management, Stage lighting fixtures, hanging, focusing and programming of the system prior to Owner's possession.
F. The Theatrical Equipment Contractor shall be a sub-contractor to and fully coordinated by the General Contractor.
G. The Theatrical Equipment Contractor shall be responsible for supervising the installation of the dimming and control equipment. Specifically; provide a full-time Project Manager, to schedule shipments of equipment, coordinate deliveries, answer system inquiries, and generally oversee the installation of the Dimming and Control equipment, Stage rigging, Curtains and Circuit distribution.
H. The Manufacturers shall furnish, in conjunction with the Theatrical Equipment Contractor, the following services:
    1. Verification of dimensions and conditions in contract documents prior to equipment installation.
    2. Schedule coordination and shipping to job site.
    3. Termination of all low voltage control wire.
    4. Inspection and adjustment of completed installation by Factory Authorized personnel.
    5. Programming of House lighting control system.
    6. Eight sets of shop drawings and fabric samples for approval by Architect prior to fabrication.
    7. Turn-on/Energization of the theatrical dimming system, the initial programming of house lighting control system and training of all theatrical components.
    8. Installation of smart relay breakers and house light control faceplates.
    9. Coordination with associated trades in the field.
    10. Submission of recorded drawings, service and operational data, test certificates and warranties. Provide 2 (two) bound copies of the manuals and two digital copies.

1.06 STANDARDS

A. All applicable requirements of The State of Rhode Island govern work in this Specification.
B. All Equipment and work shall comply with NEC, NEMA and ANSI codes and standards.
C. All Equipment shall be UL listed. Proof of listing shall be provided.
D. All Equipment shall be New in the box with full factory warranty. Used or refurbished equipment is not allowed.
E. To insure uniform installation and single responsibility, all dimming and control equipment shall be the products of Electronic Theatre Controls to allow integration with the Owner's other School installations. ETC dimming equipment; complete with all required wall plates, interconnect cables, devices, controls, or accessories.
F. Catalog designations of Altman, Crestron, ETC, Panasonic, QSC, and SSRC are referenced herein to establish standards of design, function and quality. Bidders submitting alternate equipment must meet or exceed the performance standards as listed by these manufacturers in catalogs and data sheets.
G. The Theatrical Equipment Contractor's service representative shall be capable of responding to a service request within eight hours of notification.
H. System apparatus, conduit and wiring shown on drawings are for estimating purposes only. Actual work will depend on furnished product's Manufacturer's standards. It is the submitting Theatrical Equipment Contractor's responsibility to ascertain Manufacturer's requirements prior to bidding. No claim or extra charge will be accepted for any variation from data shown on drawings or descriptions in specifications.
I. System rough in wiring and installation shall be made according to Manufacturer's instructions and wiring diagrams.

1.07 DESCRIPTION OF WORK

A. It is the intent of this specification to provide a complete Stage Lighting, Stage Audio, AV and Rigging system as specified and enumerated herein and on the drawings, including delivery F.O.B. job site and installation.
B. All components, consoles, racks, devices, shall be complete and functioning units internally wired, complete to numbered terminal strips to facilitate connection to the building wiring system.
C. Where devices and material are mentioned by name and/or model number, it shall be interpreted as referring to that particular item as completely specified in the manufacturer's published data as though that data and literature were printed herein in their entirety.
D. Any cabinets, racks, or other components which must be separated from contiguous parts to enable shipment and/or handling at the site shall be furnished complete with all necessary connecting hardware, buss bars, wire jumpers, to provide a complete, functioning system when reassembled in the building.
E. Check actual site conditions, ceiling support positions and openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings.

1.08 WORK INCLUDED

A. The work of this section shall be contracted to a single firm, referred to as the Theatrical Equipment Contractor.
B. The Theatrical Equipment Contractor shall examine the plans and specifications in detail to familiarize him or herself with the scope of work.

C. The Theatrical Equipment Contractor shall furnish all equipment specified herein and shown on the drawings, including low voltage control wire specified by the dimming manufacturer. Furnish and install the stage lighting fixtures and accessories as enumerated in the specifications.

D. The Theatrical Equipment Contractor shall coordinate the control wire conduit and device locations with the electrical contractor to insure wiring paths meet the requirements of the stage lighting and audio equipment manufacturers.

E. The Theatrical Equipment Contractor shall provide and terminate all audio, AV and theatrical low voltage system control devices.

F. The Theatrical Equipment Contractor shall provide the dimming and Audio, AV system start-ups and two (2) bound and two (2) digital copies and of all system manuals, and system warranties.

G. The Theatrical Equipment Contractor shall uncrate, assemble, set DMX address, produce a light plot with hook-up, Set up/program the Magic sheet in the lighting console, hang and focus all stage lighting fixtures specified herein, shown on the drawings or on a Light Plot provided by the Architect or Architect's Representative.

H. Demonstrate the stage lighting fixtures in the presence of the Owner or Architect or Architect's Representative, proving them to be operating properly and provide instructions in the use and in the Owner performed maintenance of the fixtures and accessories.

I. Provide two (2) additional, four (4) hour training periods for the lighting and (2) four hour training periods for the audio and video systems, for each room or teaching space, separate from the Manufacturer's demonstration and offered at the convenience of the Owner's schedule, for lighting console training, fixture operation and dimming system maintenance procedures. Owner shall be permitted to video record training sessions at Owner's expense.

J. Provide all labor and materials for the installation of one (1) Front of House hoist, and (17) other dead hung line sets with curtains track and connector strips as shown on the plans.

K. Provide all labor and materials for the installation motorized lighting batten control system complete with remote control location.

L. Furnish and Install Performance Audio Systems for the Theater, Gymnasium, Student Commons, Band and Chorus rooms, as shown on the plans and specifications.

M. Furnish and terminate the DMX/NET equipment panels as described in the specifications.

N. Provide a full time project manager to coordinate the construction schedule and other services listed in this Section.

O. The following matrix of responsibilities is intended to provide a guide for delineating the work between the Theatrical Equipment Contractor and the Electrical Contractor.

Division of Responsibilities	Electrical Contractor		Theatrical Equipment Contractor	
ITEM	Furnish	Install	Furnish	Install
All Line and High voltage wire	X	X		
Low voltage wire for Dimming system.		X	X	
Low voltage wire for Clear-com communications systems		X	X	

Conduit with pull strings for Audio and Video systems	X	X		
All conduit, raceways and interconnecting boxes	X	X		
Line voltage wire testing and labeling	X	X		
Control wire continuity, testing and labeling	X	X		
Labeling back boxes and conduit	X	X		
Junction Boxes	X	X		
Power (Line Voltage) Terminations	X	X		
Provide Power feed, control wire to FOH Batten Hoist and Stage Electric hoists including motor control.	X	X		
Provide terminations for all dimmer line/load circuits	X	X		
Furnish and Mount FOH and stage hoists			X	X
Termination of Dimming system low voltage wire			X	
Termination of Motor Hoist control wire.			X	
Architectural Control - House lighting back boxes		X	X	
Dimmer Racks or cabinets		X	X	
Theatrical Control Devices			X	X
Stage Circuit Distribution Outlet Boxes		X	X	
Mounting of Stage Circuit Raceways to Pipes			X	X
Theatrical Lighting Fixture Installation and testing			X	X
Theatrical Lighting Fixture Focus			X	X
Stage & House Lighting Initial programming			X	X
Performance Audio/Video wiring			X	X
Mounting/Hanging Audio Speakers			X	X
Audio Equipment Racks		X	X	
Projector Screen Control Conduit and wire	X	X		
Stage curtains and Stage Rigging			X	X
Band and Chorus Audio System set-up			X	X
Gym Audio and Video equipment			X	X
Student Commons Audio and Video Equipment			X	X

1.09 WORK NOT INCLUDED

A. The following work, although in another section, has a significant impact on the scope of this work. The Theatrical Equipment Contractor is responsible for the successful coordination of the following.

1. System conduit, both line and low voltage
2. Installation of Lighting and Rigging low voltage wire (Audio wire installed by Theater Equip. Contractor)
3. Installation and termination of Line Supply
4. Installation and termination of load wire
5. Connector strip/distribution load wire termination
6. Front Lighting motor and distribution feed and load wire
7. IQ rack and ER rack installation

1.10 PRODUCTS / MANUFACTURERS

A. Products are specified based on the following:

Manufacturer	Item
ETC 3030 Laura Lane Middleton, WI 53562	Stage Dimming, Lighting control, Stage Lighting Fixtures
Altman Stage Lighting 57 Alexander Street Yonkers, NY 10701	Stage Lighting, Cyc Lighting
SSRC 11 Freedom Court Greer, SC 29650	Circuit Distribution Equipment
Crestron Electronics Inc. 15 Volvo Drive Rockleigh, NJ 07647	Audio Visual Control Equipment
QSC 1675 MacArthur Blvd. Costa mesa, CA 92626	Audio Processing Equipment
Innovox Audio 296 Pascal Street North St. Paul, MN 55104	Speakers and Audio equipment

Note that, notwithstanding the product designations listed herein, it is the Manufacturer's responsibility to meet or exceed the functional criteria described or implied by the product descriptions (Parts 2 through 5).

B. For use of non-specified manufacturers refer to section 013300 – Submittal Procedures of substitution requirements.

1.11 SUBMITTALS DUE

A. Submit all items as may be required under the General Conditions and this Specification.

B. Submit within 45 days of bid acceptance for review and approval by the Architect or Architect's Representative; four (4) complete sets of shop drawings and one electronic set of, riser diagrams, detailed parts list, pin configurations and cut sheets.

C. Complete product descriptions including any changes required in the wiring schematic shown on the bid drawings to connect the proposed system into the building. Proposals, which do not provide adequate data for product evaluation and installation criteria, shall not be considered.

D. Indicate all variations from these specifications on submittal drawings.

E. Prior to the commencement of fabrication and delivery, the Theatrical Equipment Contractor shall submit for approval to the Architect, an outline of a proposed commencement and completion schedule of the project requirements.

1.11 WORKMANSHIP

A. The fabrication of all equipment shall incorporate only new and unused materials. This includes all metal components in various shapes required such as plate, bar, rod, castings, structural, stampings, forging, clamps, bolts, and all other accessories not mentioned.

B. The mechanical fabrication and workmanship shall incorporate neat and mechanically acceptable practices such as clean drilled and punched holes without flash; hand smooth finish for all sheared, machined, and cut edges; and proper fit of component and contiguous parts without irregularity where matching is intended. Welding shall meet qualifications of AWS D1, 1-81 and shall be without spatter and other evidence of poor practice. All bolts and rivets shall be sized and located in conformity with minimum acceptable standards as set forth in the Machinery's Handbook and all revisions to date.

C. All moving parts shall have acceptable tolerances, mountings, connections, and accessories coordinated into the system in a manner approved by the Architect. No wood construction or equipment shall be incorporated into the system excepting as may be set forth in the specifications.

D. All electrical and electronic parts and components selected and installed shall be consistent with good practice and conservatively rated in their use in the circuit design. Each piece of equipment shall meet accepted basic engineering standards.

E. All low voltage control wire runs shall be one continuous run. No splices are permitted.

1.12 FIELD ENGINEERING SERVICES

A. Manufacturer shall furnish engineering assistance as needed during delivery and installation to the Theatrical Equipment Contractor. A qualified Field Engineer shall check the installation prior to initial energization of the system. The Field Engineer shall supervise initial turn-on and shall make or cooperate with the Theatrical

Equipment Contractor in making any required adjustments or trimming of components to enable the system to function as specified.

B. The Field Engineer shall be fully experienced in the programming requirements of both theatrical and architectural controllers and shall assist the Owner with all necessary on-site programming.

C. The Field Engineer shall demonstrate the system in the presence of the Owner and the Architect or Architect's Representative, proving it to be operating properly. Provide instructions in the use and in the Owner performed maintenance of the system.

D. Provide Instruction in systems operation, Audio Console operation, Lighting control console operation and system maintenance on two (2) separate occasions for audio and Lighting. These instruction sessions shall be a minimum four-hour period separate from the manufacturers training demonstration and offered at the convenience of the Owner's schedule.

E. Provide time and manpower to verify that all stage lighting circuits are properly wired by moving stage lighting fixtures from receptacle to receptacle during the system energization.

1.13 TESTING

A. Standard factory tests of Manufacturer's equipment shall be performed and two (2) typewritten copies submitted to the Architect for record purposes.

B. Provide for final adjustments to systems, the adjustments shall accomplish at least the following:

1. Provide smooth, continuous light level control from zero percent light output through full light output for both increasing and decreasing light levels.
2. Limit dimmer output voltage to incandescent circuits of house lighting to between 90 and 95 percent of the rated lamp voltage.
3. Set trim height, both upper and lower for new FOH Hoist, low trim should not allow the stage lighting fixtures to touch the auditorium seats.
4. Verify each DMX output device is working to ESTA standards.
5. Demonstrate that each installed curtain track runs smooth, is free from squeaks and smooth in operation.
6. Tune/balance each audio system. Set up simple operation control on each Crestron control panel.

1.14 UNDERWRITERS LABORATORIES

A. All equipment and components shall be approved and listed by U/L where applicable standards have been established. This approval applies specifically but is not limited to Dimmers, Dimmer and Power Racks, Breaker Panels, Devices, and Fixtures.

B. All equipment and materials shall be manufactured and tested in accordance with the applicable portions of the latest editions of ANSI, NEC, NEMA, U/L, ASA, AIEE, and IPECA standards.

1.15 NOTIFICATION

A. Upon notification of completion of work, the Architect or Architect's Representative will run tests on the Lighting, and Rigging system. If any problem arises during the tests, the Theatrical Equipment Contractor must correct the problem within 5 working days.

1.16 WARRANTY

A. All systems, including all parts and labor, shall be under full warranty for a period of not less than two (2) years from the date of written final acceptance. In the event that any of the equipment should fail to produce capacities or meet design characteristics as specified, it shall be replaced with equipment that will meet requirements without additional cost. After occupancy, any necessary work performed shall be done at the convenience of the Owner's operational schedule, including overtime, if required.

B. Two signed copies of the above are required as a condition for final approval of the work.

Part 2. STAGE DIMMING AND LIGHTING (ALTERNATE #1)

2.01 Control Enclosures

A. The control enclosure shall be the Unison ERn Series Control Enclosure as manufactured by Electronic Theatre Controls, Inc., or equal.

B. The Unison Control Enclosure (ERn) shall be a surface mounted enclosure constructed of 18 gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter. The enclosure door shall have an opening to allow limited access to the control module face panel.

C. Control Enclosures shall be sized to accept one or two Control Processors, including options and accessories.

D. All enclosure components shall be properly treated and finished.
   1. Exterior surfaces shall be finished in fine textured, scratch resistant, powder based epoxy paint.

E. Top, bottom, and side knockouts shall facilitate conduit entry.

F. Enclosure shall also be available in a 19" rack mounted (RM) version

G. Enclosures shall contain an integral electrostatic air filter.

H. Enclosures shall be convection cooled without the use of fans.

I. Control Enclosures shall be available in 100, 120, 230 and 240 volt, single-phase configurations.

J. Control enclosures shall be completely pre-wired by the manufacturer. The contractor shall provide input and control wiring.

K. All control wire connections shall be terminated via factory provided connectors.

L. External Processing enclosures shall be designed to support the wire terminations for AC (single phase), Echelon link power, 24Vdc, 2x configurable DMX512A (In or Out), RS232 Serial In/Out ,Unshielded Twisted Pair (UTP) Category 5, 4x Contact Closure In, and 4x Contact Closure Out.

2.02 CONTROL PROCESSOR MODULES

A. The Architectural Control Processor shall be the Unison Paradigm P-ACP-3 Series Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.

B. Mechanical

1. The Architectural Control Processor (ACP3) assembly shall be designed for use in DRd Series Dimming Enclosures and Ern Series Control Enclosures.

2. DRd Series Dimming Enclosures and Ern Series Control Enclosures.

3. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.

4. ACP3 module electronics shall be contained in a plug-in assembly.

   a. The module shall be housed in a formed steel body and contain no discrete wire connections.

      1) No tools shall be required for module removal or insertion.

5. The ACP shall be convection cooled.

6. User Interface

   a. The ACP3 shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.

   b. The ACP3 shall provide an alpha-numeric keypad for data entry and navigation.

   c. The ACP3 shall provide a touch-sensitive control wheel for navigation.

   d. The ACP3 shall provide shortcut buttons to assist in navigation, selection, and data entry.

   e. The ACP3 keypad, buttons, and wheel shall be backlit for use in low-light conditions.

      1) The backlight shall have a user selectable time out, including no time out.

7. The ACP shall provide a front-panel RJ45 jack for Ethernet connection to the processor for configuration, live control, and web-browser-based system access.

   a. The Ethernet port shall be secured behind the locking door.

8. The ACP3 shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data.

a. The SD slot shall be secured behind the locking door.

9. The ACP3 shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.

   a. The USB port shall be secured behind the locking door.

10. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.

    a. The ACP3 shall provide a Compact Flash (CF) Card as backup flash memory and storage.

    b. The CF Card is stored in the back of the ACP, and can be accessed only by removing the ACP.

    c. The ACP data can be exchanged by inserting the CF card into another ACP.

C. Electrical

1. The ACP3 shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.

2. The ACP3 shall require low-voltage power supplied by the Dimming or Control enclosure.

3. The ACP3 shall be hot-swap capable.

4. The ACP3 shall support Echelon LinkPower communications with remote devices, including button stations, button/fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.

   The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for a system not using grounded metal conduit. Touchscreen stations, interface stations and portable stations connectors will also require (2) #16 AWG wires.

   a. The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.

   b. Link power wiring shall permit a total wire run of 1640 ft. (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 ft. (500m).

   c. Link power wiring between stations shall not exceed 1313 ft. (400m).

5. The ACP3 shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.

6. The ACP3 shall support EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
7. The ACP3 shall support two discrete ESTA DMX512A ports, configurable as input or output ports.*
   *When used in a Dimming Enclosure, the second port is always an output port.
8. The ACP3 shall provide four onboard dry contact closure inputs for integration with third-party products.
9. The ACP3 shall provide four onboard contact closure outputs, rated at 1A@30VDC, for integration with third-party equipment.

D. Functional

1. Capacity
   a. Shall support 1024 channels of control.
   b. Shall support 2 physical DMX ports, each of which may be configured as an input or output.

2. System
   a. Runtime application shall utilize support Net3 system interoperability.
   b. System shall support the use of Network Time Protocol for real time clock synchronization.
   c. System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.
   d. System shall support local firmware upload from removable media (SD Card, USB Flash Drive)

3. Diagnostics
   a. Shall output an Event log.
   b. Standard log shall store a fixed-length history of recent activity.
   c. Separate critical log shall only store important messages (such as boot-up settings)

4. Configuration Data
   a. Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application.
   b. Configuration Data can be retrieved from another Paradigm Processor
   c. A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism.
   d. Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units
   e. Configuration Data may be loaded to and from removable media access provided on front panel.
   f. Configuration Data for the entire System shall be available for download from any single Processor.
   g. Shall store configuration data for Dimming enclosure processors and shall make available for download.

5. Scalability
   a. Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum System size.
   b. The maximum number of Processors configured as a System shall be at least 12.

c. Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information.

d. Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made.

e. Failure of a single Processor shall not prohibit continuing operation of the remaining Processors.

f. It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems.

6. Local User Interface

a. Shall provide access to Processor setup (IP address)

b. Shall provide access to Processor status and diagnostics.

c. Where the Processor is installed within a Dimming enclosure, shall provide access to Dimming enclosure setup, status and diagnostics.

d. Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.

e. Shall provide functionality to schedule astronomical and real time events (add/edit/delete)

f. Shall allow for display of local DMX information.

g. Shall allow for transfer of log files to local removable media.

h. Shall allow to perform firmware upgrades for connected Dimming enclosures.

i. Shall allow for transfer of configuration to and from Dimming enclosures using removable media.

j. Shall allow for transfer of configuration to and from LCD Stations using removable media.

k. Shall allow for binding of Stations.

7. Access Controls

a. There shall be 2 user accounts – Administrator, and User with separate password protection.

b. Account and password settings shall be local to each Processor.

c. Access Controls shall be applied to certain areas of the Paradigm Local User Interface and Web Interface

8. Web User Interface

a. Shall be an internal web server accessible via Ethernet port.

b. Shall support common web browsers on Windows and Mac platforms.

c. Shall provide functionality to Activate and Deactivate Presets

d. Shall provide functionality to schedule timed events (add/delete)

e. Shall display status information.

f. Shall display log files.

g. Shall allow for configuration of Processor settings (date, time)

h. Shall allow for upload and download of configuration data.

i. There shall be links to other web-enabled devices in the System, including other Paradigm Processors

9. Stations

a. Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet.

b. Station discovery and binding shall be accomplished from the Local User Interface or Light Designer

10. Net3 and ACN Devices

a. Net3 Devices shall be connected to and controlled from Paradigm Processors via Ethernet

b. Paradigm Processors shall provide DMX-Net3 gateway functionality.

c. It shall be possible to send and receive Macro triggers defined within the System configuration via Net3.

d. There shall be support for Streaming ACN on up to 24 universes per Processor.

11. Operation

a. When contained in a dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot

b. DMX output refresh rate shall be configurable.

c. There shall be support for 16-bit DMX Attributes

d. DMX inputs may be patched to DMX and Streaming ACN outputs as external sources.

e. Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources.

f. Where there are multiple external sources then priority and HTP shall be used to perform arbitration

g. External and internal sources shall be arbitrated based on user-selection of standard or custom rules.

h. On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output.

i. The total output may be the combination of many different Presets running concurrently.

j. There shall be no hard limit on number of concurrent cross fades.

k. Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence(LTP) or Highest Takes Precedence (HTP)

l. LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP.

m. Settings due to LTP Presets may be automatically discarded from operation when overridden.

n. It shall be possible to specify that a Preset or Attribute Control will persist when overridden.

o. A Preset may be designated as an HTP Override and shall cause HTP values to be discarded.

p. It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System

q. Each Preset shall have a status that can be Activated, Deactivated or Altered

r. Preset status may be set based on matching levels in the current output as an option.

s. On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day

12. Serial Input/Output

a. RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits.

b. RS232 shall support baud rates from 4800 to 115,200 bps.

c. Serial input and output messages are fully customizable.

d. Serial output messages can be generated by any Control or Event

2.03 WALL MOUNT RELAY PANEL

A. General

1. The wall mount relay panel shall be IQ-48 as manufactured by Electronic Theatre Controls, Inc., or equal. Panels shall be UL Listed (UL508 FILE #E92154) and CSA approved, and shall be so labeled when delivered.

2. The IQ-48 relay panel shall consist of any quantity between one and forty-eight -20 amp relays, single- or double pole as specified, control electronics, sub-panel and enclosure.

B. Mechanical

1. The small panel shall be 26.25” (622 cm) high by 17” (432 cm) wide and 6.3” (161 cm) deep and weigh no more than 45 pounds (20.5kg). The large panel

shall be 47.27” (1201 cm) high by 17” (432 cm) wide and 6.3” (161 cm) deep and weigh no more than 81 pounds (36.8 kg).

2. It shall be constructed of 16-gauge steel. All panel components shall be properly treated, primed and finished in fine-textured, scratch resistant paint. The entire unit shall surface mount.

3. Equally sized top, bottom, and side removable knockout panels shall facilitate conduit entry, with an internal pass-through plenum for side-by-side

or top-to-bottom mounting. The front panel shall be easily removable as well for full front access to input, output and data connections.

4. The unit shall ship with a cover complete with a locking door, allowing controlled access to the Class 2 wiring only.

   a. Optional center-pin reject security screws shall be available for all accessible screws.

5. The panel enclosure shall be available separately from the sub-panel containing the control electronics to allow for pre-installation. The panel shall be UL Listed to be available in this configuration.

C. Thermal

1. The panel shall be convection cooled.

2. The panel shall operate safely in an environment having an ambient temperature between 32ºF (0ºC) and 104ºF (45°C), and humidity between 10-90% (non-condensing).

D. Electrical

1. The panel control electronics shall operate on single phase, two wire + ground, 120/277V AC 60Hz, at an amperage sufficient to power the panel (8 amps max). Standard fault current protection shall be 35,000 AIC.

2. The individual relays shall be mechanically latching and capable of switching 20A at up to 300V circuits with no derating required for inductive lighting loads.

3. Each relay shall have an integral manual override switch with on/off status indication.

4. The relay shall have the following minimum ratings:

   a. 2000A inrush current

   b. 1500A short circuit current

   c. 5000V RMS isolation

   d. 60,000 mechanical operations

5. The panel shall be capable of switching all relays on or off at once, or in a user-selectable delay period of 0.1 to 60 seconds, in 0.1 second increments, per relay.

6. All line and neutral terminals shall accept up to12 AWG wire. The control wiring shall land on a removable header for easy contractor installation (On-board DMX, SmartLink and Emergency Input terminations).

7. A voltage barrier shall be available to separate relays carrying different voltages in the same panel. The barrier shall be capable of installation, without tools, between any two relays, and shall allow up to eight barriers per panel (4 per side).

E. Electronics

1. The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the 6-button keypad. Any dimmer may be patched to any DMX channel.

2. The panel shall send and receive SmartLink (Echelon LonWorks with LinkPower) control protocol. Any preset and/or sequence shall be available on the SmartLink network.

3. The relays shall respond to control changes (DMX or SmartLink) in less than 25 milliseconds. DMX512 update speed shall be 40Hz.

4. The panel shall allow an optional LinkPower supply card to be factory or field installed the use of remote button stations for preset and sequence recall, recording, and status monitoring.

5. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.

6. The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall respond to the contact input by switching selecting relays to “on”, while switching other relays “off”. Each relay can be selected for activation upon contact input.

7. From the control panel or optional button stations, it shall be possible to record up to 32 presets. Presets shall be programmable by recording current dimmer levels (as set by DMX), by entering dimmer levels on the face panel directly, manually selecting relay state on each relay, or a combination of both methods. Indication of an active preset shall be visible on the LCD display.

8. The presets may be recorded sequentially as a Sequence with programmable fade and hold times, which shall allow for stand-alone operation. Indication of an active sequence shall be visible on the LCD display and on optional button stations.

9. The unit shall always power-up in the last used mode and settings and shall be ready for use without user intervention. The Power Up Behavior setting

shall ensure the unit restores to its previous state (preset, sequence) when power is cycled.

10. Pack setup shall be user programmable. The control panel shall provide the following setup features:

    a. Set Menu Mode – Normal or Advanced

    b. Set language – English, French, German and Spanish

    c. Adjust LCD Contrast

    d. DMX Start Address (Normal Mode) or DMX Patching (Advanced Mode)

    e. DMX Loss Behavior – Hold Last Look, Wait and Fade, Fade to Preset

    f. Individual settings for DMX “on” and DMX “off” threshold level, per relay

    g. Allow Manual – allows the manual override switch to remain in the manual position or reset immediately to the controlled position.

    h. Station Record – allow Presets to be recorded from Station Buttons

    i. Station Master – designates which panel shall provide synchronization timing.

    j. Power Up Behavior

    k. Restore Defaults

2.04 LIGHTING CONTROL CONSOLE

A. General

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the Element2 – 6k with 2 - 22” LCD monitor as manufactured by Electronic Theatre Controls, Inc., Jands Vista i3 or Dot2-XL-F.

2. The control system shall be ETC Net3 native. The system shall also be able to control third party ACN devices directly. The system shall provide control of 3072 outputs/channels.

3. A maximum of 10,000 cues, 999 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros

and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.

4. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions at the operator's discretion.

5. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.

6. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four page-able high-resolution encoders shall be provided for control of other non-intensity parameters. Non-intensity parameters shall be controllable via the encoders or keypad controls, without the need of an external pointing device.

7. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.

8. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution DVI monitors, or one SVGA monitor, which may also be touch-screen(s). Only one display shall be required for operation.

9. The system shall direct user input through on-screen dynamic prompts and integral LEDs on console keys indicating current operating mode. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.

10. An optional, fully-functioning, detachable alphanumeric keyboard shall be provided. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.

11. A row of softkeys shall be provided, which change function based on the selection and context of the console. These softkeys shall be labeled via an adjacent LCD display that shows their current functions at all times. Systems using softkeys with no LCD display shall not be acceptable.

12. Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required.

13. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.

14. Show data may be created and modified on a personal computer, using either Windows XP or Vista operating systems, using a free offline editing

application. The offline editor may also run natively on Macintosh platforms using OS X.

15. A PC, using Windows 10 running a client software application shall be able to connect to a control system via the network and view or modify current show data in an independent display environment. Additional devices on the network shall also be able to act as clients to the main console.

16. Synchronized backup shall be provided via another full console on the network or by use of a remote processor unit. The backup unit (either full console or rack mounted Remote Processor Unit (RPU) shall maintain synchronized playback with the master and shall take over control of the lighting system upon loss of communication with the master. Use of two RPUs to service and backup system output is also supported. Systems that do not offer this kind of instant backup from multiple sources shall not be acceptable.

17. A maximum of four users may access and interact with show data simultaneously. Each user shall have an individual workspace and channel partitioning shall be supported.

18. The system shall allow remote control from external devices as follows: Client software running on a PC connected to the network, a remote video interface with keyboard, a purpose-built wireless remote focus unit (Radio Focus Remote). Universal fader wings may be attached to any of these devices for local fader control. Systems without these remote control devices shall not be acceptable.

19. The system shall support a Telephone remote control that allows basic functions to be controlled from a standard wireless phone producing touch-tone signals. This allows the use of a standard telephone for a low cost remote control. Systems that do not allow this function shall not be acceptable.

B. Controls and Playback

1. Manual Control and Programming Section

a. The console keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment functions, display navigation functions and controls.

b. Non-intensity parameters may be set numerically or via the encoders. This control shall be fully interactive. In either case the current parameter value shall be displayed on the console monitor and simultaneously on the console LCD display. Systems using only a local LCD or only a video monitor shall not be acceptable.

c. Only those parameters available for control in the active lighting system shall be displayed for control.

d. Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a “control channel” for accessing these functions shall not be required and systems requiring use of a control channel shall not be acceptable.

e. Fixtures with CMY or RBG color mixing may be set with direct CMY or RBG controls, as well as the Hue and Saturation encoders and/or color picker. Color may also be set directly to a gel match, normalized to 3200K.

2. Playback Section

a. The master fader shall consist of a 60mm Master Fader pair with associated Load, Go and Stop/Back buttons. Additional playback faders may be configured via the virtual fader module or on the Universal Fader Wings.

b. It shall be possible to instantaneously halt an active cue, go back to the previous cue, manually override the intensity fade or manually override the entire fade.

3. Grand Master

a. A dedicated grand master and blackout button are provided.

b. The grand master shall proportionally fade intensity values to zero. Blackout shall send all intensity outputs to zero. Non-intensity outputs shall not be affected. No additional configuration shall be required to withhold non-intensity values from Grand Master and Blackout control.

C. Display Controls

1. Format shall change the view of selected displays.

2. It shall be possible for the user to choose which parameter categories or parameters (s)he wishes to display.

3. Flexichannel shall change which channels are viewed in selected displays, based on a variety of different criteria.

4. Expand shall extend the selected view sequentially across connected displays.

5. Time shall display discrete timing data.

6. Data shall display absolute values of referenced data.

D. Operating Modes

1. Live Mode

a. Channel lists may be constructed using the +, - and Thru keys.

b. Levels may be set with the keypad, level wheel and non-intensity encoders. “Selected” channels shall be those last addressed and under keypad control.

c. Sneak shall be used to restore specified channels to background states, default values, or to send them to specified values, in user specified or default times.

d. Selected channels may be set at a level or held to current values while all other channels are set to zero using Rem Dim. Toggling Rem Dim shall restore all unselected channels to original levels. The Rem Dim level shall be user definable.

e. Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection order. The Offset function supports rapid creation of ordered groups, including reverse and random order.

f. Parameter settings may be stored to Intensity, Focus, Color and Beam Palettes and to Presets. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number. It shall be possible to store 1000 presets and 1000 of each palette type.

g. Any collection of channel data, as determined by the use of “Record”, “Record Only, selective store commands and/or parameter filters may be stored to palettes (as appropriate to the type) and presets.

h. The following conditions may be placed on a channel or channel parameter to be included with a cue record action.

    1) Discrete fade time and/or delay
    2) Block flag
    3) Assert flag
    4) Note

i. Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts. Parameters may be automatically assigned to specific parts or assigned when the part is created.

j. It shall be possible to record cues and cue parts with the following information:

    1) Any collection of channel data, as determined by the use of “Record”, “Record Only” or selective store commands, combined with parameter filters.
    2) Cue Level timing and delays for Intensity Up, Intensity Down, Focus, Color and Beam.
    3) Follow or hang time
    4) Link instruction
    5) Loop value
    6) Block, Assert, Allfade, preheat and/or Mark Flag

7) Curve

8) Label and note

9) Execute list to trigger other activity

k. Non-intensity channel parameters may be marked (preset), in two ways. Automark presets any parameters transitions in the cue just prior to intensity becoming active. Automark may be disabled on a cue or cue part basis, enabling a “live” move. Alternatively, non-intensity parameters may be marked to a specific cue with a single command instruction. It shall not be necessary to store these parameters directly into the cue in which the movement is to occur.

l. Any channel parameter may be stored with an effect instruction. These effects may contain relative offsets from current value, or absolute instructions. Effects may be progressive action or on/off states. Entry and exit behaviors shall modify the channel parameters activity when beginning and ending the effect.

m. Update may be used to selectively add modified parameter data quickly to that parameter’s current source. It shall be possible to update inactive record targets. It shall also be possible to update back to the current source of the move instruction without specifying that cue via Trace.

n. Recall From quickly pulls specified data from record targets into the current view.

o. Copy To quickly copies selected data to specified record targets.

p. Address and channel check functions shall be provided.

q. Channel parameters may be “parked” at levels. Output addresses may also be parted directly. Parked levels shall not be added to any live record operations, nor may they be changed until the parked element is “unparked”. Address Park shall also be provided.

r. About shall provide detailed status of selected channels or specified record targets, including utilization information. About shall also access lamp control functions to calibrate devices, strike and douse arc sources. Use of a luminaire control channel for these functions shall not be acceptable.

s. Live data may be displayed in a summary view or detailed table orientation.

t. Undo shall be used to sequentially step back through manual operations, record, update and delete actions. Redo functions shall be provided. Multiple undo commands may be executed at once.

u. Home shall set selected channels non-intensity parameters to their default values. User definable home, on a per channel basis, shall be provided.

v. Move shall allow all show data to move from one record target to another.

w. Highlight and Lowlight shall be provided. Presets may be written to modify default values on a per channel basis.

E. Interface Options

1. The console shall support a variety of local interfaces.

a. AC input.

b. USB (five ports for connecting devices such as an Alphanumeric keyboard, mouse, touch screens, USB Flash drive, fader wings) The desk shall provide four ports on the rear of the console and one on the control service itself.

c. Ethernet (one port) 802.3af compliant.

d. One Dual DVI video output connector, supporting a maximum of two DVI monitors at 1280x1024 resolution minimum.

e. One VGA output connector.

f. Up to six fader wings may be attached to the main console via internal or external USB connections. Systems that do not allow the addition of fader wings shall not be acceptable.

F. Accessories

1. Net3 Focus Remote Pad

2. Net3 Remote Video Interface

3. Net 3Gateways
   a. Net3/ETCNet 2 to DMX/RDM Gateways (one to four ports)
   b. MIDI/SMPTE Gateways
   c. I/O Gateway with 12 analog inputs, 12 SPDT contact outputs, RD232 interface.

G. Synchronized Backup

1. An optional Backup system shall consist of one of the following combinations of devices:

a. Two networked Consoles

b. One (or more) Console with one Remote Processor Unit (RPU)

c. One (or more) Consoles with two Remote Processor Units (RPUs)

H. Physical

1. All operator controls and console electronics for a standard system shall be housed in a single desktop console, not to exceed 19” wide, 19” deep, 5.5” high, weighing 20 pounds. Consoles that will not fit in a 19" rack shall not be acceptable.

2. Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.

2.05 REMOTE PLUG-IN-STATIONS

A. General

1. The Remote Plug-in Stations shall consist of the appropriate connectors required for the system in use. These stations shall be available with DMX input or output, Remote Focus Unit, ETCNet, or architectural control connectors. Custom control connectors shall be available.

B. Connector Options

1. The following standard components shall be available for Remote Plug-in Stations:

a. 5-Pin male XLR connectors for DMX input

b. 5-Pin female XLR connectors for DMX output

c. RJ45 connectors for ETCNet connections - Twisted Pair

2. Custom combinations and custom control connections shall be available.

C. Physical

1. Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat. Silk-screened graphics shall be white.

2. The station panel shall be mounted into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.

2.06 CONTROLS

A. Mechanical

1. Preset/Fader Stations

a. Unison Preset/Fader stations shall operate using up to twelve programmable buttons and sixteen programmable faders with integral LEDs.

b. Fader stations shall utilize standard 45-millimeter slide potentiometers.

c. All Preset and Fader stations shall be available with white, ivory, gray or black faceplates, fader knobs, and buttons. All faceplates shall be designed for flush or surface mounting.

d. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.

e. The manufacturer shall supply backboxes for flush mounted half gang stations and for all surface mounted stations.

2. LCD Stations

a. LCD stations shall consist of a backlit liquid crystal display (LCD) with a touchscreen interface. The LCD station shall operate using graphic buttons, faders and other images on up to 30 separate programmable control pages.

b. Flush or surface wall mounted stations shall be available with white, ivory, gray and black faceplates.

c. Station faceplates shall be constructed of ABS plastic and shall have no visible means of attachment.

d. The manufacturer shall provide backboxes for all LCD stations.

1) Flush back box dimensions shall be 5.25H x 8.5W x 3.25D.

2) Surface back box dimensions shall be 5.75H x 9.12W x 3.25D.

e. LCD stations shall be available in white and black portable desktop consoles with cable and connector.

f. It shall be possible to adjust LCD contrast and brightness. It shall also be possible to program the station to dim to any level during periods of inactivity.

3. Connector Stations

a. Unison connector stations shall provide an interface to a PC or portable Unison stations.

b. Unison connector stations shall be available in flush- or surface-mounted back boxes with white, ivory, gray or black faceplates.

c. All station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.

4. Unison Switch Interface

a. The Switch Interface assembly shall be designed to provide 8-dry-maintained or momentary contact input or output signals for interface to associated systems.

b. Switch Interface assemblies shall flush or surface mount in standard a 14"W x 11"H x 3"D back box. (Back box by ETC)

D. Electrical

1. Unison control station wiring shall be an Echelon® Link power network.

2. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).

3. LCD stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.

4. Network wiring may be bus, loop, home run or any combination of these.

5. Network insulation displacement connectors shall be provided with all stations.

E. Functional

1. The Unison Control System shall be designed to allow control of lighting and associated systems via Preset/Fader, LCD, IR or Astronomical time clock controls. System shall allow the programming of presets, macros and time clock events.

a. System presets shall be programmable via Preset/Fader, LCD or Light Manager software.

1) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.

2) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.

b. System macros (sequences) shall be programmable via Light Manager system software.

1) Macro sequence steps shall include preset selection, wall status change, station property change (template), zone property change, timed delay, jump to macro, and stop macro.

2) Macro sequences shall be activated by button, time clock event or Light Manager software.

c. System time clock events shall be programmable via Light Manager system software.

1) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.

2) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using daylight savings time.

2. Station (Preset/Fader, LCD or IR) control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via Light Manager, the Windows-based configuration program.

a. Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.

b. Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.

3. Stations (Preset/Fader, LCD and IR) shall allow programming of station and component electronic lockout levels via Light Manager. LCD stations shall also allow programming of page passcode and visibility levels.

4. LCD stations shall support import of bitmap images files to custom LCD control pages.

5. LCD stations shall support the control of DMX512 automated fixtures via graphic XY faders.

2.07 PROVIDE THE FOLLOWING: (ALTERNATE #1)

		Dimming
1	IQ-48	Sensor IQ48 relay panel, designed for 48 relays 3 phase 4 wire, plus ground. 120/208V AC
48	relays	20A relay modules
1	IQ-Tap Kit	Tap Kit for Emergency Sense
1	0-10 volt	0 to 10 volt control card for circuits 25 - 48
1	Door	Locking Door with filter
1	ELTS-01	5 circuit Discrete feed ELTS
1	EDBK	Emergency DMX Bypass Kit
1	Element2-6K	Element2 - 6k Lighting Control console
2	22"	22" Monitor DVI input with display port adapter
1	C-DC	Console Dust Cover
1	18-XR-LED	Console Littlelite
1	WAP	Wireless access Point
1	25-Net	Net Cable
1	NET/NET/COM	Console Plug-in Station (surface mount) with 3 Pin XLR for Clear-com
1	UPS	APC UPS 750 (console)
		House Light Control

1	ERn2-RM-120	ERn2 - Rack mount enclosure 120 volt – Mount in ER-01
1	P-ACP-3	Paradigm Architectural control Processor
1	P-SPM-E	Paradigm Link Connect station power supply
		House Light Control Stations
4	U10005	5 Button Station (Flush mount)
2	U10002	2 Button Entry Station (Flush mount)
2	P-TS7-4	Paradigm 7" Touch screen control station - Flush Mount

2.08 EQUIPMENT RACK

A. General

1. Shall be Constructed of 16 gauge steel with 1/8” thick laser cut corner braces. The entire assembly shall be UL listed.

2. The equipment described herein shall be contained in an enclosure. Submit a detailed drawing for approval prior to fabrication.

3. The Theater Equipment Contractor is responsible for wiring the entire assembly in a neat and orderly fashion.

B. PROVIDE THE FOLLOWING FOR THE AUDITORIUM; (ALTERNATE #1)

1	DWR-35-26	Mid Atlantic Black 19" rack with 35 rack units and quad power box.
1	VFD-35	Rack door
1	PDLT-615C-NS	Power Strip with 9' cord.
1	MS-702	Clear -com Main Station (from below list)
1	CBS350-24P-4G	24 port network switch with POE
1	03852 24-Port Cat5E	24 port net patch with write on labels
1	BR1	1U Brush Grommet
24	Net Patch	24" net patch cable
1	2 BL	Blank panel as needed to fill out rack.
2	RESP-4	Response 4 port output gateway
1	SS	Slide out writing surface
1	TD4LK	4 space high Drawer w/ key lock
1	SMART1500RMXL2UA	Triplite
1	Rigging Controller	Allow space in the rack for the QT-1 rigging controller
1	Rack Assembly	Rack Assembly

2.09 BACK STAGE COMMUNICATION SYSTEM (CLEAR-COM)

A. General

1. The Clear-Com back stage communication system shall be a single rack space mountable, two channel main station with the ability to monitor intercom activity on one or both channels. It shall support two intercom channels with up to 60 head-set stations or 20 speaker stations.

B. Main Station Features

1. The clear-com main station shall have the following features:

a. Supports up to 60 headset stations or 20 speaker stations on two channels

b. Separate short-circuit protection for each channel

c. Dual action electronic momentary/latching “talk” buttons

d. Program feed to both channels, with selectable “Program Interrupt”

e. Call signal buttons for each channel

f. Global “Remote Mic Kill”

g. Announce output relay

h. Separate Volume controls for each channel

i. Channels A & B “Link” switch

j. Built-in speaker

k. Microphone limiting

l. Optional gooseneck mic.

C. BELTPACKS

1. The belt packs shall be single channel, light weight, portable plug-in intercom station, designed to accept one headset and have loop though signal capability. It shall be designed for maximum speech intelligibility in high noise environments. The belt pack shall be constructed of aircraft grade aluminum, power-coated and HDS composite material. It shall have a remote microphone kill function, programmable, digitally controlled switching and visual “call” signaling with high intensity LED indicator. It shall attach via a nonmetallic belt clip.

D. SPEAKER STATION

1. The remote speaker station shall be a single channel flush, wall mount station. It shall have an integral speaker and flush mount electret microphone with mic limiter and a push-to talk button. The station shall be programmed via two internal dip switches to operate in four different modes, activated by other stations within the intercom system.

E. PROVIDE For the Auditorium; (ALTERNATE #1)

Quantity	Part Number	Description
1	MS-702	2-Channel Headset/Speaker Main station with rack mount kit
5	RS-701	1-Channel standard Belt pack
5	CC-300	Single-ear standard headset w/ 4 pin XLR female
2	KB-701	Single channel, push to talk, Speaker Station
4	WP	Com panels with single Channel outlets (can be built into AVP plates)
5	IC-25	25' mic Cable – 3-Pin XLR shielded cable

2.10 CONNECTOR STRIPS

A. GENERAL
1. The assembly shall be extruded aluminum, electrostatic painted finish in black.
2. Pigtails where indicated shall be 18" long and be rubber covered SO or ST and shall be secured to the plug strip or box by bushed strain relief clamps.
3. All circuits shall be labeled in white characters in correspondence with the circuit schedule.
   a. Connector Plug Strips in 2" characters above the receptacle.
   b. Pipe or Surface Mounting Boxes 3/4" characters above the receptacle.
   c. Wall or Floor pockets 3/4" characters below the receptacle.
4. The entire assembly shall be listed and labeled by Underwriters Laboratories.

B. CONNECTOR STRIPS (SL or BAL)
1. This assembly shall consist of a black extruded aluminum enclosure, either 2.5" x 3.375", or 3.75 x 4.75" in cross section and come in the lengths specified, containing terminal strips for feed conduit and wire extending to 20 Amp flush mount stage pin female connectors.
2. Housing shall be fabricated of .125" extruded aluminum alloy # 6063-T5. Cover sections shall be interlocking and formed of the same aluminum alloy. Housing shall be inherently rustproof.
3. The strip shall contain 125 degree C – XLP wiring of the proper sizes and quantities to connect the individual outlets to the terminal blocks in circuits of capacity as specified.
4. The terminal blocks shall be molded barrier type with screw lugs suitable for connecting multi-conductor feed cable or incoming wire.
5. BAL units shall accept 20, 30, 50, 60 and 100 amp, 2-pole, 3-wire devices in either flush or pigtail receptacles.
6. Strips shall be supplied with .125" thick by 1.5" steel C-channel mounting brackets. Brackets shall be custom manufactured to secure connector strip to beams positions as shown on the drawings.

C. SURFACE MOUNT BOX (SM)
1. This assembly shall consist of a black extruded aluminum enclosure, 3.75 x 4.75" in cross section and come in the lengths specified, containing terminal strips for feed conduit and wire extending to receptacles (flush mount or pigtail), as specified.
2. Housing shall be fabricated of .125" extruded aluminum alloy # 6063-T5. Cover sections shall be interlocking and formed of the same aluminum alloy. Housing shall be inherently rustproof.
3. The box shall be completely prewired at the factory, with ground lugs installed.

4. Finish shall be black matte enamel.

D. RECESS MOUNT BOX (RM)
1. This assembly shall consist of a 16 gauge, galvanized steel housing designed for recessed mounting in the wall. The unit shall be provided with a 16 gauge steel oversized face plate.
2. Each box shall contain one flush mount, 20 amp stage pin connector and one 520R duplex outlet.
3. The box shall be completely prewired at the factory, with ground lugs installed.
4. Finish shall be black matte enamel.

E. TORM LADDERS
1. This assembly shall be constructed of schedule 40 – 1-1/2" black steel pipe.
2. The Ladder shall consist of three rungs spaced 2 feet apart and be 30 inches wide.
3. At each corner weld one 12" standoff which shall have a 4" x 4"x ¼" thick flat steel plate welded at the end, predrilled with four holes each for bolting to wall surfaces.
4. Finish shall be painted black matte.
5. The entire assembly shall be welded construction.

F. PROVIDE
1. Provide custom mounting brackets, surface mounting brackets and back boxes as described or by the locations shown on the plans.
2. Provide complete submittal drawings detailing connector strip size, mounting bracket type and circuit numbering for approval prior to fabrication.

AUDITORIUM CIRCUIT DISTRIBUTION: (ADD ALTERANTE #1)

CS#	Type	Length	Circuit #
CS-A-01	FOH – Motorized Batten	40'-0"	1 – 8, and two-port gateway furnished with Rigging hoist
OB-A-01	RM w/DMX	2 circuit/DMX	9 - 10 and DMX-out
OB-A-02	RM w/DMX	2 circuit/DMX	11 -12 and DMX-out
CS-B-01	1st Elec.	50'-0"	13 – 18 and two port gateway
CS-B-02	2nd Elec.	50'-0"	19 – 24 and two port gateway
CS-B-03	3rd Elec.	50'-0"	25 - 30 and two port gateway
CS-C-01	4th Elec	50'-0"	31 - 33 and single port gateway
OB-C-01	Wall Box	3 circuit/DMX	34 - 36 and DMX-out
OB-C-02	Wall Box	3 circuit/DMX	37 - 39 and DMX out
	JB	Junction Boxes	Provide as required
	Cable	12 gauge Multi	Provide as required

2.14 ELLIPSOIDAL SPOTLIGHTS

A. General

1. The instrument shall be ETC ColorSource V spot as manufactured by Electronic Theatre Controls, Inc., Martin ELP CL, or Phoenix 2 by Altman Stage lighting.

B. Physical

1. The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black, high temperature epoxy paint. Tools shall not be required for either lamp alignment or cleaning the reflector or lens

2. The following shall be provided:
   a. Integral cable clamp for power leads
   b. 7 color LED array
   c. High impact, thermally insulated knobs and shutter handles
   d. Reflector secured with shock mounts
   e. Lens secured with silicone shock mounts
   f. Rotating shutter assembly - 50° rotation
   g. 20 gauge stainless steel shutters
   h. Insulated rear handle
   i. Interchangeable lens tubes for different field angles with Teflon guides for smooth tube movement
   j. Sturdy integral die cast gel frame holders with two accessory slots, and a top mounted, quick release gel frame retainer
   k. Rugged 3/16” x 1-1/4” steel yoke with two mounting positions allowing 300°+ rotation of the fixture within the yoke
   l. Positive locking, hand operated yoke clutch
   m. Slot with sliding cover for motorized pattern devices or optional iris

C. Optical

1. The optical train shall combine a compact filament lamp with a precision molded borosilicate, ellipsoidal reflector and aspheric lens to produce an optimum cosine field.

2. The unit shall provide, but not be limited to:
   a. Molded borosilicate reflector with multiple dichroic layers
   b. 95% of visible light shall be reflected while 90% of infrared light as heat shall be transmitted through the reflector
   c. Low gate and beam temperature
   d. Sharp imaging through a three plane shutter design
   e. Projector-quality, high contrast aspheric lens, with an anti-reflective coating to increase transmission

D. Performance

1. The unit shall be precision engineered to use an HPL lamp to deliver an even, intense field with cosine distribution.

2. The unit shall provide, but not be limited to:
   a. 5, 10, 19, 26, 36, and 50 degree field angles
   b. Projector-quality pattern imaging
   c. Sharp shutter cuts without halation
   d. Shutter warping and burnout in normal use shall be unacceptable
   e. Adjustable hard and soft beam edges

3. The unit shall be UL and cUL listed and so labeled.

2.15 THEATRE LED PAR

A. General

1. The instrument shall be the Color Source Par as manufactured by ETC., Martin ELP Par, or Chauvet Colordash Par H18X.

B. Physical

1. The Par shall be a purpose designed fixture designed for interior use, for stage, studio and display lighting applications. It shall be constructed from custom aluminium extrusions and die castings. All corners and edges shall be rounded and have no sharp edges. The finish is to be a low reflective, matt black, electrostatically applied, baked on epoxy powder coat.
2. Each fixture is to be fitted with a heat resistant rear grab handle.
3. The Par shall BE RGBL with a 16-degree beam spread and homogeneous light output. The beam will have a soft edge with minimal spill.
4. Tilt adjustment shall be by means of a disc locking system secured by a hand sized insulated handle. The fixture is provided with a formed steel yoke with a central hole for a ½ “suspension bolt set comprising ½ “ set screw, nut and two washers. The yoke suspension point is to be adjustable along the length of the luminaire to achieve the desired balance point.
5. A four-door rotatable Barndoor accessory with spring loaded hinges is to be available, fitting securely into the front frame mount provided on the fixture body.
6. The hinges are to be adjustable to allow re-tensioning of each masking flap should this be necessary at a later date. A safety chain anchor point is to be provided integral with the barndoor mounting plate.
7. The fixture shall be UL or ETL listed.

2.16 FIXTURES AND ACCESSORIES

A. GENERAL

1. Provide the following Stage Lighting Fixtures with C-Clamp, Male 20 amp Edison plug installed, and black safety cable.

B. PROVIDE THE FOLLOWING FOR THE AUDITORIUM: (ALTERNATE #1)

2	CS - Spot	ColorSource Spot V – 19 degree EDLT ellipsoidal w/ C-clamp and Powercon to Edison cable
24	426	ColorSource Spot V – 26 degree EDLT ellipsoidal w/ C-clamp and Powercon to Edison cable
12	436	ColorSource Spot V – 36 degree EDLT ellipsoidal w/ C-clamp and Powercon to Edison cable
8	450	ColorSource Spot V – 50 degree EDLT ellipsoidal w/ C-clamp and Powercon to Edison cable
18	CS-Par	Color Source Par w/ Powercon to edison cable and color frame
18	DMX-5P-10	DMX jumper Cable 10 feet
18	C-clamp	C-clamp
18	Safety	Black Safety Cable
18	SELRM-7.5	Medium round Diffusion with frame.
10	SpectaCyc100	Altman SpectraCyc 100 – RGBA – LED Cyc unit w/ Safety cable and Power con to Edison cable
10	Yoke	Yoke kit with C-clamp
10	DMX-5P-10	10 foot DMX Jumper Cable
8	PCN-10	Powercon 5’ jumper cable
10	Safety	Black Safety Cable
3	WL-90-3K-M-BK	Altman 90 Watt LED work light 3000k.
3	510	C-Clamp
3	5-15	Edison plug installed
	Accessories	
1	600 feet	Spool of Black Tie line - unwaxed
1	P724Wh	1” Console marking tape - White
2	P6652BLK	2” Black cloth Gaffer’s tape
18	400PH	Pattern holder for Source 4 fixture
50	DMX-10	5-Pin DMX jumper cables 10 foot length
5	5-SO-515	5’ extension cable with Edison Male and Female ends 15A
25	PCN-5	Powercon or True1 - 5 foot jumper cables
10	PCN-10	Powercon or True 1 - 10 foot jumper cables

C. PROVIDE THE FOLLOWING FOR THE BAND ROOM (ALTERNATE #1)

8	436	ColorSource Spot V – 36 degree EDLT ellipsoidal w/ C-clamp and Powercon to Edison cable
7	APM22XA10	Amaran COB 200X S with edison cord and safety cable
5	ATMINIDOME II	Light Dome Mini II - Aperture
7	MB429754	5 – 10’ Telescoping Hanger w/ Pipe clamp and Stir-up
7	M429618	Baby Pipe Clamp
3	CS-Par	Color Source Par w/ Powercon to edison cable and color frame
18	DMX-5P-10	DMX jumper Cable 10 feet
11	C-clamp	C-clamp
11	Safety	Black Safety Cable
3	SELRM-7.5	Medium round Diffusion with frame.
3	SELRN-7.5	Narrow round Diffusion with frame.
3	2488	4 – way Barn door for Par.
1	CS – 20	Color Source 20 lighting console
1	Road Case	Pelican – Road case for CS-20
1	DMX 5P-25	DMX jumper Cable 25 feet
1	ECPB DMX input	DMX input face plate black
1	RSM DMX 4	DMX opto splitter mounted in Din Rail box 4 way
3	ECPB DMX out	Pipe mount DMX output box with pipe clamp.

1. Hang, DMX address, patch and focus the stage lighting fixtures. Provide light plot and hook-up for approval by the Architect. Attach safety cable to all fixtures.

2.17 FOH MOTORIZED HOIST (ALTERNATE #1)

A. GENERAL

1. Prodigy Low Profile Hoist, as manufactured by Electronic Theatre Controls (ETC), shall be purpose-designed and fabricated for overhead lifting. The systems shall incorporate mechanical, electrical and safety features that shall be inherent to this equipment and shall provide an engineered, efficient device for overhead lifting. The mechanical, electrical and safety features of this hoisting and control system shall establish the standard of quality, performance and safety by which hoisting systems of other manufacture shall be evaluated.

2. Each wire rope lift line shall adhere to a design factor of 10:1 with an ultimate strength of 4200 pounds. All load path components between the building

structure and the batten shall exceed the breaking strength of the wire rope. The motor brake shall be rated at least at 150% of the motor torque.

3. Prodigy Hoist standard configurations:

   a. P1500E electrics hoist capable of lifting 1500 pounds net Working Load Limit (WLL) suspended from the batten and shall incorporate the Prodigy Cable Management system. Each Powerhead shall measure 16.13” wide, 14.53” high , 48.5” long and weigh approximately 475 pounds. The Powerhead shall be equipped with a 1.5 horsepower gearmotor. Provide one (1) P1500E hoists, sizes per TL plans. Provide with Prodigy cable management.

4. The standard hoist shall consist of the following major components: 1) Powerhead, 2) Compression Tube with beam clamps, Cable Management system on “--E series” hoists, loft blocks, lift lines terminated at the Powerhead and reeved through the loft blocks, lift line terminations including one Right Angle Cable Adjuster (RACA), oval compression sleeve and thimble per lift line, 3) pipe batten and 4) power/control distribution strip on --E series hoists.

5. Any hoisting system that requires the use of a cable reel to manage electric power to a raceway mounted on an –E series hoist shall not be acceptable for this project.

6. Each hoisting system shall include the following features:

   a. A cover enclosing all moving parts and electronics included in the Powerhead.
   b. A Powerhead containing the gearmotor, motor brake, Load Brake, limit switches operating electronics, load sensor, slack line detector and wire rope.
   c. A Compression Tube/Beam Clamp structure that prevents any additional lateral forces transferring to the building. Hoists or hoisting systems that impose additional lateral load on the building structure shall not be acceptable for this project.
   d. The Powerhead shall incorporate a built-in load cell that reports the load profile to the QuickTouch controller and provides as alert in the event of an underload/overload condition.
   e. The Powerhead shall incorporate a built-in slack line sensor that reports a slack line condition to the QuickTouch controller.
   f. The Powerhead shall incorporate the emergency contactor.
   g. The Powerhead shall incorporate the following local controls
      a. Limit Switch setting devices
      b. Up/Down operational switch
      c. LED indicators for Power, Communication, Activation and Fault status
      d. Limit Switch Status

7. The hoist shall be manufactured from UL Listed components and shall be UL Listed and tested as a complete system (not just UL listed parts).

B. POWERHEAD

1. The Powerhead shall be a fully enclosed sheet metal housing that shall prevent contact with moving and electrical parts and shall provide protection

against dirt, dust and debris collecting on the operating parts of the machine, the electrical and electronic components and the wire rope lift lines on the lifting drum.

2. The Powerhead housing shall be fabricated from powder coated sheet metal. It shall be punched and formed to enclose and support the gearmotor, motor brake, Load Brake, limit switch assembly, limit switch adjustment system, reversing contactor, emergency contactor, wire rope drum, wire rope (cable) keeper, load cell, slack line detector and motor electronics.

3. The rear hinged cover of the Powerhead shall support connectors, switches and LED lights for the following functions: local operating switch, power cable and control connector outlet, indicator lights for operating mode, limit switch indicator, limit switch override buttons, indicators for power, status and communication. Each of these functions shall be clearly labeled to identify their purpose.

C. WIRE ROPE DRUM.

1. The Prodigy Hybrid Drum™ shall allow the lift lines to be wrapped in a compact manner that prevents wire rope damage.
2. The Prodigy Hybrid Drum™ shall be mounted on the motor shaft on the opposite side of the drum from the Load Brake. Up to eight 3/16” dia. 7 x 19 wire ropes, ASTM Specification 81023/A1023M-02, commonly referred to as galvanized aircraft cable, shall be wrapped on that drum.

3. No wire ropes shall cross over other wire ropes, nor lie vertically on top of another wire rope nor be allowed to stack in a single pile as on a yoyo drum.

4. The drum shall have been tested for wear, durability, strength, service and integrity by an independent testing lab. Testing certificates shall be available for review at the manufacturer’s office.

5. The sloped drum shall be capable of safely wrapping up to eight 3/16” diameter wire rope lift lines.

6. A wire rope (cable) keeper shall assure that the lift lines wrap appropriately on the drum without crossing over or stacking.

D. LIMIT SWITCH

1. The limit switch assembly shall be mounted within the Powerhead. The limit switch shall establish firm “normal” end of travel limits and firm over travel limits for movement in either direction. In addition, software shall establish resettable “normal up” and “normal down” end of travel limits, typically redundant for the normal end of travel limits. This combination of firm limits and soft limits shall provide each hoist with a total of three “up” and three “down” limits to assure that the hoist does not exceed the maximum allowable travel in either direction.
2. The position information for the hoist and the soft limits shall originate from absolute position sensors. Any system utilizing relative position sensors (e.g., incremental encoders) shall not be acceptable.

3. A requirement to “re-home” to “zero out” the encoders after power loss or power disconnect shall not be acceptable.

4. The firm end of travel limits shall be set or adjusted at the time of installation via a screw adjustment on the bottom of the Powerhead cover.

5. Two indicator lights shall be located on the bottom panel of the Powerhead cover next to the limit switch adjustment screws. When the batten is positioned at low trim the green indicator light shall illuminate when the limit switch setting screw is adjusted to the current position of low end of travel. When the batten is positioned at high trim the blue indicator light will illuminate when the setting screw is adjusted to the current batten position.

6. Any system that indicates that the limit has been set by audible or tactile means only shall not be acceptable.

7. It shall be possible at the Powerhead to override the limit switches to permit testing the over travel limit switches. It shall also be possible to override the over travel limit switch to escape an over travel limit condition without having to change the limit position setting.

8. An actuation of the override buttons shall be automatically logged by the controls system with a date and time stamp of this action.

G. LOAD SENSOR/LOAD PROFILING

1. A load sensor shall be built into the Powerhead. It shall be possible to create a profile of the actual load on the hoist as it travels through its normal cycle. The profile may be changed by “re-training” the Load Profiling system whenever the suspended load is changed on the batten by activating a key-switch operated training cycle located on the control panel. The load sensor shall continuously monitor the load and report it to the Controller where it shall be indicated in the LCD display.

H. SLACK LINE DETECTOR

1. A slack line detector shall be built into the hoist. When a slack line condition develops, the slack line detector shall prevent hoist movement downward. Slack line sensor circuitry and movement prevention shall be executed via hardware. A software-only solution for this function shall not be acceptable. The slack line detector shall report slack line conditions to the Controller where a fault condition shall be noted in the LCD display.

I. CABLE MANAGEMENT

1. The load circuits and control wiring shall be fed to the hoist by a built-in Cable Management system that allows the flat feeder cable to fold and store along the top of the connector strip.

2. At high trim, the entire system shall be stored in no more than 30” of vertical space from the bottom of the mounting steel to the horizontal centerline of the batten.

3. The Cable Management system shall be integral to the hoist system.

4. Cable Management systems requiring a greater vertical storage space shall not be acceptable for this project.

5. Hoisting systems utilizing Cable Management systems from third-party vendors shall not be acceptable for this installation.

J. COMPRESSION TUBE AND BEAM CLAMPS

1. The Compression Tube shall be a continuous channel of extruded aluminum engineered so as not to add horizontal forces on the building when used in combination with the slip fit beam clamps.

2. The tube shall support the loft blocks mounted within the spacing limits of the system.

3. Compression Tube sections shall be joined into a continuous assembly by a pair of dedicated splicing plates at each Compression Tube joint.

4. The Compression Tube shall be installed only by means of dedicated beam clamps that allow the Compression Tube to snap-into place and move horizontally to neutralize additional lateral forces on the structure.

5. Beam clamps shall be capable of attaching to horizontal beams, joist flanges or flat steel plates measuring from .25” thick up to 1” thick and from 4.25” wide up to 14” wide.

6. Hoist systems that add lateral forces to the building shall not be accepted for this project.

7. The compression tube shall permit positioning of loft blocks anywhere along its length.

K. LOFT BLOCKS

1. Each loft block shall be an assembly of steel side plates, a wire rope idler, sheave support hardware and an assembly to prevent the loft block from sliding horizontally. Each loft block shall be inserted into a slot on the bottom of the Compression Tube.
2. Loft blocks sheaves shall measure 5.25” in diameter and contain a pair of press fit sealed ball bearings. Lift lines shall travel in a groove shaped and sized for 3/16” diameter wire rope per the latest edition of the Wire Rope Users’ Manual as published by the Wire Rope Technical Board. The loft block sheave shall be concentric about the hub and shall be evenly balanced for ease of rotation.

3. An idler shall be incorporated into the top assembly of the loft block to guide and support lift lines as they pass the loft block.

4. Hoisting systems requiring the loft blocks to be mounted directly to the facility steel shall not be accepted for this project.

L. RACEWAY/DISTRIBUTION CHANNEL HANGERS

1. Raceway hangers shall support the wire rope termination hardware and secure the raceway and the pipe batten.

M. LIFTLINE TERMINATIONS

1. Each lift line shall be terminated at the factory to a hardened steel rod inside the drum at the Powerhead.

2. Lift lines shall be terminated at the load hanger with a low profile Right Angle Cable Adjuster (RACA)™, standard thimble, and copper oval compression sleeve. The RACA and cable terminations shall be installed at the time of hoist installation.

3. The batten trim shall be adjustable up to 6” via the RACA.

4. Systems utilizing turnbuckles or chain to trim the batten shall not be accepted for this installation.

N. CONNECTOR STRIP--DISTRO

1. Power to the connector strip shall be fed via flat cable especially designed and fabricated for this system.

2. The flat cable shall include one ground wire and one data cable plus an individually insulated hot and an individually insulated neutral conductor for each of six 120 volt circuits.

3. The connector strip shall be built to the length specified with outlets or pigtails located as specified or as shown on the construction drawings.

4. The flat cable shall pass through a strain relief and enter a terminal box at the designated end of the raceway. Within the raceway the wiring shall be attached to a terminal block at the factory. The wiring and all components shall meet UL requirements and appropriate National Electrical Codes.

O. PIPE BATTEN

1. The pipe batten shall be I ½” (nom.) schedule 40 grade A, seamless pipe fabricated in the largest possible lengths without splices, typically 21’-0” long. Battens longer than a single length of pipe length shall be spliced by means of .120 x 1 9/16 dia. DOM tube 18” long with 9” of tube inserted into each half of the splice.

2. The tight fitting splice tube shall be held in place by a pair of 3/8 x 2 ½” grade 5 hex bolts on each side of the joint. The bolts shall pass through the pipe at an angle of 90° to each other. There shall be two bolts on each side of the joint spaced 1” and 7” from the joint. Alternatively, one pair of bolts on one side of the joint may be replaced with either plug welds or tight fitting steel rivets.

3. Pipe shall be straight, 40 feet in length and painted flat black for the FOH hoist.

4. A safety-yellow vinyl batten cap shall be installed at each end of each pipe batten.

P. POWER AND CONTROL DISTRIBUTION

1. Each hoist shall be connected to electrical power via an 8’-0” long cable extending from the rear of the Powerhead to the source outlet in the Power and Control Distribution box.
2. The control circuit shall be attached to the Powerhead via a separate control wire that is also 8’-0” long and shall be connected to the Powerhead via a Circular Pin Connector at the Powerhead and at the Power and Control Distribution box.

3. The receptacles shall be installed in a sheet metal junction box and shall include a power and control outlet.
   a. The distribution box shall include an 8 amp 3 phase motor rated breaker.
   b. The wiring and connectors shall be barriered between high and low voltage.
   c. The Power and Control Distribution box shall be UL listed for this application.
   d. Control wiring terminations shall be made via an IDC style connector.
   e. Hoists shall connect to the control panel via a single CAT-5e style cable.
   f. The Control Panel shall operate on low voltage power supplied via the control cable that connects the control circuit to the power and control distribution box.
   g. A centralized contactor cabinet with individual multiple wire connecting to each hoist shall not be acceptable for this installation.

2.18 QUICK TOUCH CONTROLLER

A. GENERAL

1. The entire hoisting system shall be operated by an ETC Quicktouch-1 rigging control system.

2. Hoist controller to have a hand-held remote control with minimum 30 foot tether.

3. Provide one Remote E-Stop.

B. It shall be purpose-designed and fabricated to manage and operate hoists specifically designed for overhead lifting. The System shall incorporate mechanical, electrical and safety features that shall be inherent to this equipment and shall provide an engineered, efficient device to control the equipment. The mechanical, electrical and safety features of this control system shall establish the standard of quality, performance and safety by which hoisting systems of other manufacture shall be evaluated. The controller shall be capable of controlling up to 48 hoists. The controller shall provide two connections for hoist communication, supplying up to 24 hoists per connection.

1. The QuickTouch control system shall consist of a surface or panel mounted primary controller and up to six optional external E-stop stations.

2. The controller shall be UL Listed and shall be fabricated from UL Listed components.

3. The Emergency Stop and Hold-To-Run (Deadman) signals between the control station and the motor starters or drives in the hoists shall be hard wired 24 Volt signals.

4. Systems that rely on software and bus communications to transmit any of these signals shall not be acceptable.

5. Only physical, industrial heavy-duty pushbuttons shall create a “deadman” Signal. The "deadman" operation is required, so that the operator must be at the console and pressing a button to initiate and continue motion.

6. For safety, no movement shall be permitted to be initiated from the touch screen.

7. Systems that allow hoists to run without an operator actively present at the console shall not be permitted.

8. The system shall not contain any permanently moving components (like hard drives or fans) and shall be maintenance free and completely quiet during operation.

C. E-STOP

1. The E-stop button on the QuickTouch controller shall be an NFPA-79 compliant mushroom head button with an illuminated ring surrounding the button.

2. During normal operation the E-stop button shall be in the out position. An E-stop can be activated via this button by firmly pressing the button in.

Part 3. EXECUTION

3.01 INSTALLATION (ALTERNATE #1)

A. The Theatrical Equipment Contractor shall deliver the lighting equipment and controls to the job site. Coordinate delivery with the General and Electrical Contractor.

B. All Equipment shall be stored in a clean, dry space.

C. The Theatrical Equipment Contractor shall furnish, deliver install and terminate all system control wires.

D. The Theatrical Equipment Contractor shall provide and install all system control devices.

E. The installation shall conform to the plans and specifications.

F. The Theatrical Equipment Contractor shall specifically coordinate the placement and sizes of conduit relating to work of this section and shall specifically review and approve the conduit rough-in.

G. If any conflicts or omissions occur as a result of the Theatrical Equipment Contractor's unsuccessful coordination of the above mentioned work, it shall be the Theatrical Equipment Contractor's responsibility to correct, provide and install any additional material that may be required.

H. Backbone or steel support other than what is shown on the plans shall be provided by the Theatrical Equipment Contractor.

3.02 ELECTRICAL CONTRACTOR SERVICES

A. It shall be the responsibility of the Electrical Contractor to receive and store the necessary materials and equipment for installation of the dimmer system. It is the intent of these specifications and plans to include everything required for proper and complete installation and operation of the dimming system, even though every item may not be specifically mentioned.

B. The electrical contractor shall be responsible for field measurements and coordinating physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.

C. The electrical contractor shall install all lighting control and dimming equipment in accordance with manufacturer's approved shop drawings.

D. All branch load circuits shall be live tested before connecting the loads to the dimmer system load terminals.

3.03 MANUFACTURER'S SERVICES

A. Upon completion of the installation, including testing of load circuits, the contractor shall notify the dimming system manufacturer that the system is available for formal checkout.

B. Notification shall be provided in writing, two weeks prior to the time factory-trained personnel are needed on the job site.

C. No power is to be applied to the dimming system unless specifically authorized by written instructions from the manufacturer.

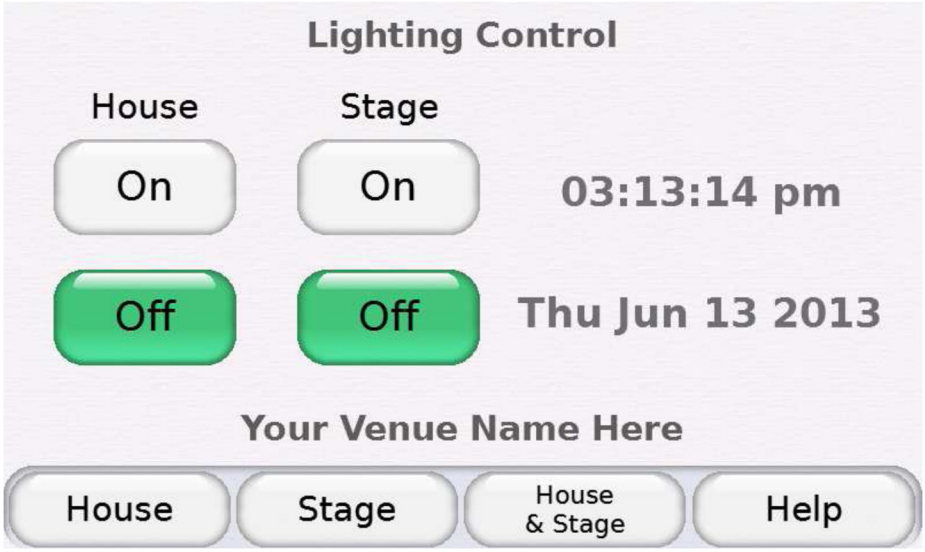
D. The purchaser shall be liable for any return visits by the factory engineer as a result of incomplete or incorrect wiring.

E. Upon completion of the formal check-out, the factory engineer shall demonstrate operation and maintenance of the system to the owner's representatives. Training shall not exceed four working hours. Additional training shall be available upon request.

3.04 HOUSE LIGHT STATION PROGRAMMING

A. The Theater Systems Integrator shall furnish two (2) separate four hour design and programming sessions with the End User to first determine the layout of the Touch-screen master station and second to test and refine the station layout. This process shall be performed for Each room with a touch screen station.

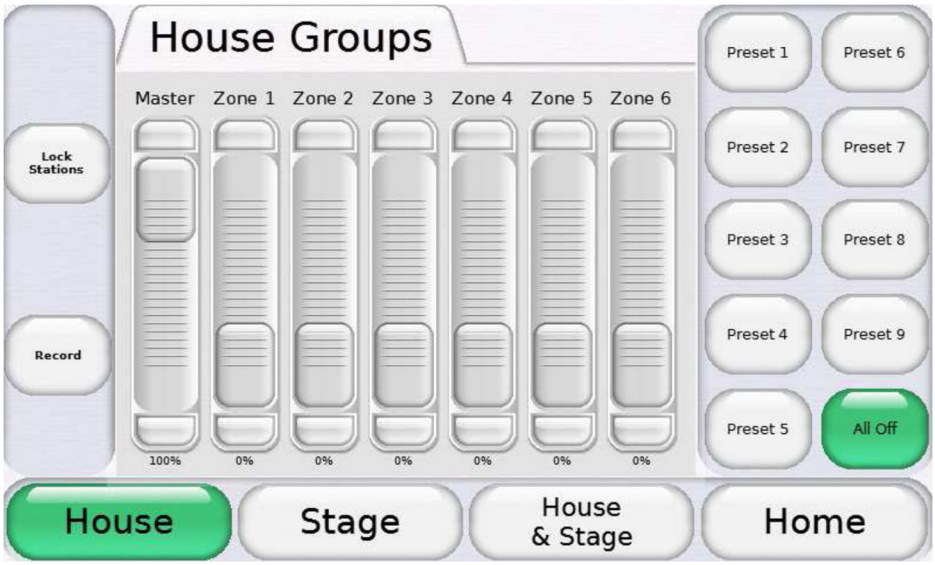
1. Basic Touch-screen station layout shall mimic the two screen shots below and must be loaded into the Touch-screen master station prior to the first discussion with the End User on station programming and needs.



2. The second Screen which may be accessed by a user authorization code shall include up to but not exceed.

   a. 48 virtual sliders
   b. 24 Preset scene selections
   c. Access to the color picker when and LED fixture is selected.
   d. 2 user profiles
   e. One lockout

3. If multiple touch-screen stations are part of the installation, then they must share or match configurations.



3.05 TRAINING AND INSTRUCTION

A. The Theatrical Equipment Contractor shall furnish two (2) separate on site four hour training sessions in addition to the training provided by the Manufacturers service technician at the time of system turn-on. The first training session shall not take place until the Owner has taken possession of the building and prior to the grand opening of the facility. The first training session shall include;

3. A review of the lighting console operations

4. A review of the operation of the Dimming System control processor, and House lighting control processor. Trouble shooting tips and factory 800 service number procedures.

5. A review of the lighting system, explanation of the light plot and review of focus areas and DMX – out locations and operation.

6. How to maintain the stage lighting fixtures and change lamps.

B. The second training session shall be devoted to advanced console training and review house light control station operation and lock-out procedures. This session shall take place at the convenience of the Owner and be scheduled within 90 days of the first session.

C. Prepare four identical copies of Owners Manuals. Deliver two to the Owner and two to the Architect.

3.06 WARRANTY

A. The Theatrical Equipment Contractor in cooperation with the Manufacturers shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two years from date of delivery.

B. Warranty shall cover repair or replacement of such parts determined defective upon inspection. Replacement parts are to be furnished and installed by the Theatrical Equipment Contractor within three days.

C. Warranty does not cover any product or part of a product subject to accident, negligence, alteration, abuse or misuse. Warranty does not cover any accessories or parts not supplied by the manufacturer.

D. Warranty shall not cover any labor expended or materials used to repair any equipment without manufacturer's prior written authorization.

3.07 FINAL ACCEPTANCE

A. The following conditions must be met before final billing and final acceptance of the stage lighting and dimming system may be submitted.

1. Inventory of all equipment both fixed and portable verified by the Architect and Owner.
2. The Architect or his representative has signed off acceptance of the dimming system.
3. Satisfactory completion of all punch list items

Part 4. PERFORMANCE AUDIO SYSTEM: (PARTS 4.01 – 4.05 ALTERNATE #1)

4.01 GENERAL

A. This portion of the specification covers the fabrication, furnishing, delivery, and installation of the Performance Audio System. The General Conditions and the project drawings are considered to be parts of these specifications.

B. It is the intent of these specifications and plans to include everything required for the proper and complete installation and operation of the Performance Audio Systems, even though every item may not be specifically mentioned.

C. The Theatrical Equipment Contractor shall provide all items necessary for a complete, safe, fully functional system as described herein, including all tools, scaffolding, labor, and supervision, even though they may not be specifically enumerated. Any errors, omissions or ambiguities do not relieve the Contractor of this responsibility, but must be included in the price and brought to the attention of the Owner for clarification.

D. Verify and existing conditions. Refer to the Owner for coordination and clarification before bid date of any discrepancies concerning existing conditions. Clarify with the Owner all locations including conduit and cable routings.

E. Furnish and install all low voltage wire and cable required for Performance Audio and Video system installation.

F. Parts 4.01 through 4.05 of this section are part of Alternate #1

4.02 INSTALLATION

A. The Theatrical Equipment Contractor shall deliver the Performance Audio equipment and controls to the job site. Coordinate delivery with the Owner.

B. All Equipment shall be stored in a clean, dry space.

C. The Audio Systems Integrator shall furnish, deliver and terminate all system control wires.

D. The installation shall conform to the plans and specifications.

E. The Theatrical Equipment Contractor shall specifically coordinate the placement and sizes of conduit relating to the work of this section and shall specifically review and approve the conduit rough-in.

4.03 PERFORMANCE AUDIO VISUAL EQUIPMENT

A. The system shall provide the following functions:

1. Reinforcement of speech and music from wired microphone receptacles and wireless microphone systems to listeners in the auditorium.
2. Reinforcement of audio signal to listeners in the Auditorium through a center cluster with the ability to add additional Rear Room speakers.
3. Operator controlled mixing of the microphone signals using a mixing console.
4. Manual mixing of sixteen (16) microphone receptacles and one wireless microphone system (lavaliere and handheld), stereo CD player, and I-pod input jack.
5. Built-in ability to connect monitor speakers at stage level.
6. Hearing assistance using portable wireless FM receivers.
7. Provide loudspeaker receptacles and wiring located in and around the stage for portable speakers.
8. Production Intercom system, for cueing of technical personnel with wired headsets, for locations throughout the Auditorium. Provide and Install dressing room and reception area clear-com stations. Connect to system installed by the Theatrical Equipment contractor.
9. Dressing room and Reception area Clear-com and program speaker systems for communication with back of house areas.

B. Furnish and Install were specified the following equipment. See plans for rack layouts and riser for connection plan.

4.04 Band Room - Audio System. – Furnish and install the following speakers and equipment. Mixer, amplifier, recorder and wireless microphones to be assembled in Cabinet rack.

1	Mid Atlantic	CFR-14-16	14SP 16 in. DRK CONFIG W/SP,FRONT DR,RAP,(3)SHELVES,(3)PNLS
1	Surge-X	SEQ-1U	Sequencing Surge Eliminator and power conditioner
1	Mid Atlantic	D2	2SP anodized Drawer, black
1	Custom	AP-5	See AP detail drawings.
1	Allen & Heath	QU-PAC32	32 Mon + 3 Stereo Channel Digital Mixer
1	Allen & Heath	AB-168-RK19	Optional Rack mount kit
1	QSC	CX-Q 2K4	4 X 500 watts/CH Q-SYS amplifier

1	QSC	QIO-ML4i	Q-SYS peripheral 4 mic/line inputs
1	QSC	QIO-L4o	Q-SYS peripheral 4 mic/line outputs
2	Fulcrum Acoustic	DX896	Dual 8 inch Coaxial Loudspeaker
2	Fulcrum Acoustic	YK-DX8	DX896 Yoke Bracket
2	Yamaha	CBR10	Compact 10" portable loudspeaker
1	TASCAM	SD-20M	Solid State Digital audio recorder.
1	QSC	unD6IO-BT	4x2 Channel 2 Gang US, Dante/AES67 Wall Plate w/Bluetooth, RCA, 3.5 mm
2	Sound tools	RSS-WC121-B	Wall Mounted Audio Transport - Female Black
4	Sound tools	RSS-SCTMX-RJ45	etherCON Breakout to Four Male XLR cables
1	Shure	ULXD4D-G50	Dual Digital Wireless Receiver with internal power supply, ½ wave antenna and rack mount hardware
2	Shure	ULXD1-G50	Digital Wireless bodypack transmitter with Mini 4 Pin
2	Shure	WL-93	Omnidirectional Condenser Lav. mic.
2	Shure	ULXD2/SM58	Handheld transmitter with SM58 head
2	Shure	SM58-LC	SM58 Vocal microphone
2	Shure	SM57-LC	SM57 Instrument microphone
2	Shure	SM81-LC	Cardioid Condenser with 10dB attenuator 3 position low-cut filter with foam windscreen.
2	Shure	VP82	Short shotgun Microphone with threaded adapter and mic clip.
1	Apple iPad	iPad 9.7”	Wifi only- grey with Case.
1	Crestron	TSW-770-W-S	7 in. Wall Mount Touch Screen, White Smooth
1	Netgear	NETGSM4230PX 100NAS	M4250 10G2XF PoEplus AV Switch
1	Netgear	WAC730	ProSafe Wireless Access Point 802.11g
1	Netgear	AXM761-10000S	PROSAFE 10GBASE-SR SFP+ LC GBICCPNT
2	K&M	26010-500-55	Microphone Stand with Cast Iron Base
4	K&M	21090.500.55	Microphone Stand with Boom (Black)
2	K&M	20150.500.55	Extra-Tall 3-Section Mic Stand (10.6 ft)
2	K&M	25680	One Hand Microphone Stand - Black
1	Radial Eng.	R800 1010	Passive direct Box for Acoustic, bass and keyboard.
1	Radial Eng.	ProAV2	Passive DI for audio video, 2-channel with RCA 3.5mm and XLR input
2	CBI	25’ speakon cable	4 Pole Speakon Cable' 25' Speakon cable with NL-4 Speakon Ends
4	CBI	MLN-10	22ga Mic Wire - Very Flexible and Durable, 10 ft.
4	CBI	MLN-25	22ga Mic Wire - Very Flexible and Durable, 25 ft.
4	CBI	MLN-50	22ga Mic Wire - Very Flexible and Durable, 50 ft.

A. Chorus Room Audio System. – Furnish and install the following speakers and equipment. Mixer, amps recorder and wireless microphones to be assembled in Rolling rack.

1	Mid Atlantic	CFR-14-16	14SP 16 in. DRK CONFIG W/SP,FRONT DR,RAP,(3)SHELVES,(3)PNLS
1	Surge-X	SEQ-1U	Sequencing Surge Eliminator and power conditioner

1	Mid Atlantic	D2	2SP anodized Drawer, black
1	Custom	AP-5 and AP-6	See AP detail drawings.
1	Allen & Heath	QU-PAC32	32 Mon + 3 Stereo Channel Digital Mixer
1	Allen & Heath	AB-168-RK19	Optional Rack mount kit
1	ProX	XC-PWCE-14-25	25’ Edison to Power con cable.
1	QSC	CX-Q 2K4	4 X 500 watts/CH Q-SYS amplifier
1	QSC	QIO-ML4i	Q-SYS peripheral 4 mic/line inputs
1	QSC	QIO-L4o	Q-SYS peripheral 4 mic/line outputs
2	Fulcrum Acoustic	DX896	Dual 8 inch Coaxial Loudspeaker
2	Fulcrum Acoustic	YK-DX8	DX896 Yoke Bracket
2	Yamaha	CBR10	Compact 10" portable loudspeaker
1	TASCAM	SD-20M	Solid State Digital audio recorder.
1	QSC	unD6IO-BT	4x2 Channel 2 Gang US, Dante/AES67 Wall Plate w/Bluetooth, RCA, 3.5 mm
2	Sound tools	RSS-WC121-B	Wall Mounted Audio Transport - Female Black
2	Sound tools	RSS-SCTMX	etherCON Breakout to Four Male XLR cables
1	Shure	ULXD4D-G50	Dual Digital Wireless Receiver with internal power supply, ½ wave antenna and rack mount hardware
2	Shure	ULXD1-G50	Digital Wireless bodypack transmitter with Mini 4 Pin
2	Shure	WL-93	Omnidirectional Condenser Lav. mic.
2	Shure	ULXD2/SM58	Handheld transmitter with SM58 head
2	Shure	SM58-LC	SM58 Vocal microphone
2	Shure	SM57-LC	SM57 Instrument microphone
2	Shure	VP82	Short shotgun Microphone with threaded adapter and mic clip.
1	Apple iPad	iPad 9.7”	Wifi only- grey with Case.
1	Crestron	TSW-770-W-S	7 in. Wall Mount Touch Screen, White Smooth
1	Netgear	NETGSM4212PX 100NAS	M4250 10G2XF PoEplus AV Switch
1	Netgear	WAC730	ProSafe Wireless Access Point 802.11g
1	Netgear	AXM761-10000S	PROSAFE 10GBASE-SR SFP+ LC GBICCPNT
2	K&M	26010-500-55	Microphone Stand with Cast Iron Base
4	K&M	21090.500.55	Microphone Stand with Boom (Black)
2	K&M	20150.500.55	Extra-Tall 3-Section Mic Stand (10.6 ft)
2	K&M	25680	One Hand Microphone Stand - Black
1	Radial Eng.	R800 1010	Passive direct Box for Acoustic, bass and keyboard.
1	Radial Eng.	ProAV2	Passive DI for audio video, 2-channel with RCA 3.5mm and XLR input
2	CBI	25’ speakon cable	4 Pole Speakon Cable' 25' Speakon cable with NL-4 Speakon Ends
4	CBI	MLN-10	22ga Mic Wire - Very Flexible and Durable, 10 ft.
4	CBI	MLN-25	22ga Mic Wire - Very Flexible and Durable, 25 ft.
4	CBI	MLN-50	22ga Mic Wire - Very Flexible and Durable, 50 ft.
1	Lot	Interconnect cables	Cables to connect all devices together in rack.

4.05 Theater/Auditorium - Audio System. – Furnish and install the following speakers and equipment. Mixer, amplifier, recorder and wireless microphones and AV system.

1	Mid Atlantic	SR-40-32	SR series large pivoting wall rack 40 space 32” deep
1	Mid Atlantic	VFD-40	Front door Assembly
1	Mid Atlantic	DWR-FK32	DWR fan kit
1	Mid Atlantic	PD-920R-SP	Rack power Strip
1	Mid Atlantic	PD-2415SC-NC	24 outlet, 1 x 15A circuit w/ cord
1	Mid Atlantic	DWR -RR40	Rear rack rail kit
1	Mid Atlantic	FC-2-215-1CA	Fan Thermo Control kit
1	Tripplite	Smart 1500 LCD	UPS Back-up Power supply 2RU 1500 Va. 900w. All microphones and equipment, but not Amps to be on the UPS.
1	Netgear	NETGSM4212PX100NAS	M4250 10G2XF PoEplus AV Switch
1	Netgear	GSM4248PX100NAS	M4250 40G8XF POE plus MNGD SW
1	Netgear	WAC730	ProSafe Wireless Access Point 802.11g
2	Netgear	AXM761-10000S	PROSAFE 10GBASE-SR SFP+ LC GBICCPNT
3	BirdDog	BDP400B	Eyes P400 4K 10-Bit Full NDI with Sony Sensor
3	BirdDog	BDPWM	Wall Mount for P100 / P200 / P400 Cameras
1	BirdDog	BDPTZKEY	PTZ Keyboard controller w/NDI, VISCA, RS-232 & RS422
1	BirdDog	BDMVPRO	Multiview Lite - NDI Multiviewer Pro. Create up to six 4x4 output
1	BlackMagic	HYPERD/ST/DG4P	Hyperdeck Studio 4K Pro-Video Recorder
1	Crestron	C3RY-8	3 – Series Control Card – 8 relay ports
1	Mid-Atlantic	D2	2 Space Rack drawer, brushed finish
1	Mid-Atlantic	D3	3 Space Rack drawer, brushed finish
1	Mid-Atlantic	Blank Plates	Lot of blank plates
1	Creston	AM3200-WF	AirMedia Series 3 Receiver 200 with Wi-Fi Network Connectivity
1	Apple	Apple TV4K 64G	Apple TV 4K w/ 64G memory
1	OFE	Signage Player	Digital Signage Player; HDMI Output; Network Unit
2	Creston	DM-TX-4KZ-100-C-1G-B-	DigitalMedia 8G+ 4K60 4:4:4 HDR Wall Plate Transmitter, Black

2	Creston	DMF-CI-8	DigitalMedia Card Chassis for DM-NVX-C & DMCF, 8 Slots
2	Creston	DM-NVX-E760C	4K60 4:4:4 HDR Network AV Encoder Card with DM Input
7	Creston	DM-NVX-E30C	4K60 4:4:4 HDR Network AV Encoder Card
4	Creston	DM-NVX-D30C	4K60 4:4:4 HDR Network AV Encoder Card
1	Creston	DM-NVX-363	4K60 4:4:4 HDR Network AV Encoder/Decoder with Downmixing and Dante Audio
2	Creston	HD-RX-101-C-1G-E-B-T	DM Lite Receiver for HDMI Signal Extension over CATx Cable, Wall Plate, Black Textured
2	Crestron	HD-TX-101-C-E	Lite Transmitter for HDMI Signal Extension over CATx Cable
1	Apple	IPad	Apple 9.7” iPad space grey, Wifi only
1	Creston	TS-1070-B-S	10.1 in. Tabletop Touch Screen, Black Smooth
1	Crestron	TSW-1070-B-S	10.1 in. Wall Mount Touch Screen, Black Smooth
1	FSR	SMWB-3G-BL	3 Gang Surface Mount Gang Box - Black
1	Creston	USB-NX2-LOCAL-1G-	USB over Ethernet Network Endpoint Wall Plate with Routing, Local, Black
1	Lot	STP 201	Individually Shielded cat-6 cabling and connectors
1	QSC	ıun6IO-BT	4x2 Channel 2 Gang US, Dante/AES67 Wall Plate tooth, RCA, 3.5 mm
2	QSC	ıun6IO	4x2 Channel 2 Gang US, Dante/AES67 Wall Plate tooth, RCA, XLR
4	Sound tools	RSS-WC121-B	Wall Mounted Audio Transport - Female Black
4	Sound tools	RSS-SCTMX-RJ-45	etherCON Breakout to Four Male XLR cables
2	Shure	ULXD4Q-G50	Quad Digital Wireless Receiver with internal power supply, 1/2 Wave Antenna and Rack Mounting Hardware
2	Shure	UA864US	Active Directional Antenna with Gain Switch 470-698 MHz
2	Shure	QLXD2/SM58-G50	Hand held wireless transmitter with SM-58 head ULX-D Digital Wireless System (rack mounted)
8	Shure	ULXD1-G50	Digital Wireless Bodypack Transmitter with Miniature 4-Pin Connector
8	Shure	WL93	Omnidirectional Condenser Miniature-Lavalier Microphone–Black
8	Shure	ULXD8-G50	Wireless gooseneck microphone base for ULXD
8	Shure	MX410LPDF/C	10” Shock mounted Gooseneck, Green/Red LED ring, dual flexible, Cardioid.
1	Allen & Heath	AH-M-SQ-SDANTE64-A	64 X 64 SQ Dante Card 96kHz / 48kHz

1	Allen & Heath	AH-SQ-7	48 Input Channels, DEEP Processing, 33 Faders / 6 Layers, 32 onboard preamp,12 Stereo mixes+LR, 3 Stereo Matrix, 7â€□ capacitive touchscreen
1	Allen & Heath	DT-168	116x8 Dante I/O Expander
1	Allen & Heath	AB-168-RK19	Optional Rack Mount Kit
2	Litllelite	With base	Audio Console work lights
1	Tascam	SD-20M	Solid state Digital Audio Recorder
1	QSC	QIO-ML2 x 2	Q-SYS peripheral 2 mic, 2 line inputs
1	QSC	QIO-L4o	Q-SYS peripheral 4 mic/line outputs
3	QSC	CX-Q 2K4	4 X 500 watts/CH Q-SYS amplifier
1	custom	Cable	I-Pad Lightning connector to ¼” TRS – 6 feet
2	InnovoxAudio	HLA-950P-blk	Hybrid Array 9 X 3.5 mid, 9 x ribbon HF, 2 X 12” dipole LF, remote 2 X 800 watts + DSP
2	InnovoxAudio	SB-312 blk	Compact 3 X 12” subwoofer, 3000 watts.
2	InnovoxAudio	HLA-SBA-16 F/B bl	Fly hardware – SBA-115 behind HLA-16
5	InnovoxAudio	HLA-Stage Lip 50 blk	Precise front fill, 4 x 3.5 in. mid, 6 in. ribbon HF 50 deg vertical
4	Yamaha	CBR-10	Compact 10” portable loudspeaker
2	K&M	26010-500-55	Microphone Stand with Cast Iron Base
4	K&M	21090.500.55	Microphone Stand with Boom (Black)
2	K&M	20150.500.55	Extra-Tall 3-Section Mic Stand (10.6 ft)
2	K&M	25680	One Hand Microphone Stand - Black
1	Radial Eng.	R800 1010	Passive direct Box for Acoustic, bass and keyboard.
1	Radial Eng.	ProAV2	Passive DI for audio video, 2-channel with RCA 3.5mm and XLR input
4	CBI	25’ speakon cable	4 Pole Speakon Cable' 25' Speakon cable with NL-4 Speakon Ends
4	CBI	MLN-10	22ga Mic Wire - Very Flexible and Durable, 10 ft.
4	CBI	MLN-25	22ga Mic Wire - Very Flexible and Durable, 25 ft.
2	CBI	MLN-50	22ga Mic Wire - Very Flexible and Durable, 50 ft.
1	Shure	VP-88	M-S Stereo Microphone with Internal Matrix
2	Shure	SM-57-LC	Cardioid Dynamic Microphone
2	Shure	SM-58-LC	Cardioid Dynamic Microphone
1	Shure	SM-81-LC	Cardioid Condenser with 10dB attenuator and 3 position low cut Filter w/ windscreen
3	Shure	PCC-160	Stage floor Microphone
1	SHURE	MX-418C	Goose neck Microphone with flange mount.
1	LISTEN	LS-55-216	iDSP Prime Level-3 SRF System
8	LISTEN	LR-4200-216	iDSP RF Receiver Package(216 MHz)
8	LISTEN	LS-401	Universal Ear Speaker

3	Rapco	Custom	10” x 10” Stage plate, see drawings.
1	Panasonic	PT-MZ16KLBU7	WUXGA 1920 X 1200 16000 LMNS LCD LASER PROJECTOR NO LENS
1	Panasonic	ET-EMT800	Power Zoom Lens (4.147.40:1)
1	Custom	Wall mount Shelf	Anti-Vibration wall mount shelf for Projectors 53-72 lbs (Black)
1	Dalite	Pro. Electrol 14209	Projection Screen 177.5” x 284” Matt white screen and LV control kit.
1	Dalite	Remote Switch 40973	LV Remote Switch for Creston operation of projection screen.
Lot	Wire	Various	All wire shall be West Penn or Belden, no equal, low impedance speaker wire #227, microphone wire, #452, 70 volt speaker wire # 224 and Intercom wire # 430.
Lot	Wall Plates	Custom	Custom wall plates per drawings
Lot	Mid-Atlantic	Various	Blank plates to fill racks
1	HSA	Custom	Custom Modified Dual Inspire roll top desk, 98” coordinate size, installation and color selection with Architect.

PART OF THE BASE BID

4.06 Gymnasium - Audio System. – Furnish and install the following speakers and equipment. Mixer, amplifier, recorder and wireless microphones and AV system.

1	Mid Atlantic	DRW-28-24	Wall mount equipment rack
1	Mid Atlantic	VFD-28	Front door Assembly
1	Mid Atlantic	PD-920R-SP	20A RCKMOUNT PWR Distro
1	Mid Atlantic	D4	4SP Anodized Drawer
1	Tripplite	Smart 1500 LCD	UPS Back-up Power supply 2RU 1500 Va. 900w.
1	Netgear	GSM4230PX100NAS	M4250 26G4XF POE plus MNGD SW
1	Netgear	AXM761-10000S	PROSAFE 10GBASE-SR SFP+ LC GBICCPNT
1	Crestron	TSW-1070-B-S	10.1 in. Wall Mount Touch Screen, Black Smooth
1	Crestron	TSW-TP10W	Table Top touch screen with 15” cable.
1	Shure	ULXD4D-G50	Dual Digital Wireless Receiver with internal power supply, 1/2 Wave Antenna and Rack Mounting Hardware
2	Shure	QLXD2/SM58-G50	Hand held wireless transmitter with SM-58 head ULX-D Digital Wireless System (rack mounted)
2	Shure	ULXD1-G50	Digital Wireless Bodypack Transmitter with Miniature 4-Pin Connector
2	Shure	WL93	Omnidirectional Condenser Miniature-Lavalier Microphone–Black
2	Shure	UA864US	Wall mounted Wideband Antenna

1	QSC	unD6IO-BT	4x2 Channel 2 Gang US, Dante/AES67 Wall Plate w/Bluetooth, RCA, 3.5 mm I/O, PoE
3	QSC	unDX2IO+	4x2 Channel 2 Gang US Dante/AES67 Wall Plate 2 Mic/Line In x 2 Out (XLR), Phoenix I/O, PoE
4	JBL	CBT 70J-1	Two-way line array column speaker - White
4	JBL	CBT 70JE-1	Extension line array for CBT70J-1 speaker, white
3	JBL	Control 28 w/ yoke	Two-way 8” speaker with 28-UB-1 yoke white.
3	QSC	CX-Q 4K4	4-Channel 1000W/CH Q-SYS Network Amplifier, Lo-Z, 70V, 100V direct drive
2	CBI	MLN-10	22ga Mic Wire - Very Flexible and Durable, 10 ft.
2	CBI	MLN-25	22ga Mic Wire - Very Flexible and Durable, 25 ft.
1	SHURE	MX-418C	Goose neck Microphone with flange mount.
1	Shure	SM57	Shure Handheld cardioid dynamic microphone
1	Shure	SM58	Shure Handheld cardioid dynamic microphone
2	K&M	21090.500.55	Microphone Stand with Boom
2	Radial	ProAV2	Passive DI for audio video, 2 channel
1	LISTEN	LS-55-216	iDSP Prime Level-3 SRF System
8	LISTEN	LR-4200-216	iDSP RF Receiver Package(216 MHz)
8	LISTEN	LS-401	Universal Ear Speaker
Lot	Wire	Various	All wire shall be West Penn or Belden, no equal, low impedance speaker wire #227, microphone wire, #452, 70 volt speaker wire # 224 and Intercom wire # 430.

PART OF THE BASE BID

4.07 Student Commons - Audio System. – Furnish and install the following speakers and equipment. Mixer, amplifier, recorder and wireless microphones and AV system.

1	Mid Atlantic	ERK-35-25	35SP/25D Equipment Rack
1	Mid Atlantic	VFD-35	Front door Assembly
1	Mid Atlantic	PD-920R-SP	20A RCKMOUNT PWR Distro
1	Mid Atlantic	D4LK	4SP Anodized Drawer with Lock
1	Tripplite	Smart 1500 LCD	UPS Back-up Power supply 2RU 1500 Va. 900w.
1	QSC	unD610-BT	4x2 Channel 2 Gang US, Dante/AES67 Wall Plate w/Bluetooth, RCA, 3.5 mm I/O, PoE
1	QSC	unDX2IO+	4x2 Channel 2 Gang US Dante/AES67 Wall Plate 2 Mic/Line In x 2 Out (XLR), Phoenix I/O, PoE
23	JBL	Control 47HC	Premium High Ceiling Coax w 6.5 in.
1	QSC	CX-Q 2K4	4-Channel 500W/CH Q-SYS Network Amplifier, Lo-Z, 70V, 100V direct drive

1	Shure	ULXD4Q-G50	Quad Digital Wireless Receiver with internal power supply, 1/2 Wave Antenna and Rack Mounting Hardware
2	Shure	UA874US	Active Directional Antenna with Gain Switch 470-698 MHz
2	Shure	QLXD2/SM58-G50	Handheld wireless transmitter with SM-58 head ULX-D Digital Wireless System (rack mounted)
1	RF Venue	Combine4	4 zone Antenna Combiner
1	Crestron	TSW-1070-B-S	10.1 in. Wall Mount Touch Screen, Black Smooth
1	Crestron	CEN-IO-RY-104	Wired Ethernet Module with 4 relays
1	OFE	Signage Player	Digital Signage Player; HDMI Output; Network Unit
1	Crestron	DM-TX-4KZ-100-C-1G-B-T	DigitalMedia 8G+ 4K60 4:4:4 HDR Wall Plate Transmitter, Black
1	Crestron	DMF-CI-8	DigitalMedia Card Chassis for DM-NVX-C & DMCF, 8 Slots
1	Crestron	DM-NVX-E760C	4K60 4:4:4 HDR Network AV Encoder Card with DM Input
1	Crestron	DM-NVX-E30C	4K60 4:4:4 HDR Network AV Encoder Card
1	Crestron	DM-NVX-363	4K60 4:4:4 HDR Network AV Encoder/Decoder with Downmixing and Dante Audio
1	BirdDog	BDP400B	P400 Black. 4K 10-Bit Full NDI with Sony Sensor
1	BirdDog	BDPWM	BirdDog Wall Mount for P100 / P200 / P400
1	Apple	Apple TV4K 64G	Apple TV 4K w/ 64G memory
1	Crestron	AM-3200-WF	AirMedia Series 3 Receiver 200 with Wi-Fi
1	Listen Tech	LS-55-216	iDSP Prime Level-3 SRF System
1	LISTEN	LS-55-216	iDSP Prime Level-3 SRF System
8	LISTEN	LR-4200-072-P1	iDSP RF Receiver Package(216 MHz)
8	LISTEN	LS-401	Universal Ear Speaker
1	Audinate	ADP-DAO-AU-0X1	Dante AVIO 1 – channel analog output adapter
1	Netgear	GSM4248PX100N AS	M44250 10G2XF PoEplus AV Switch
1	Netgear	AXM761-10000S	PROSAFE 10GBASE-SR SFP+ LC GBICCPNT
2	K&M	2560	One hand Microphone stand - black
1	Custom	AVP and AP panels	See detail drawings.
1	Lot	Interconnect cables	Cables to connect all devices together in rack.
1	Custom	AVP and AP panels	See detail drawings.

Lot	Wire	Various	All wire shall be West Penn or Belden, no equal, low impedance speaker wire #227, microphone wire, #452, 70 volt speaker wire # 224 and Intercom wire # 430.

A. Include the following services as part of a complete Installation:

1. Complete System Engineering Design and Documentation
2. Control system Commissioning and Training, Minimum 8 hours.
3. Operator controlled mixing of the microphone signals using a mixing console.
4. Complete Initial System programming in consultation with the end use personnel
5. Rack assembly and testing of components
6. Project management and Site Coordination.
7. Production Intercom system, Installation and wiring for cueing of technical personnel with wired headsets. Connect to system installed by the Theatrical Equipment contractor in the Theatre on Channel B.

B. Furnish and Install were specified the following equipment. See plans for rack layouts and riser for connection plan.

PART OF THE BASE BID

4.08 IDF Closet 321B - Furnish and install the equipment.

1	Netgear	XSM4316S-100NES	M4300-8X8F MANAGED SWITCH
6	Netgear	AXM761-10000S	PROSAFE 10GBASE-SR SFP+ LC GBICCPNT Note: Fiber run provided in electrical spec terminations are by the Theatrical Equipment Contractor
2	QSC	Core 610	Network Core for AV&C processing.
2	QSC	SLMST-610-P	Network Core for AV&C processing.
2	QSC	SLDAN-128-P	Network Core for AV&C processing.
2	Crestron	VC-4-PC-3	Computer with Crestron Virtual Control server software
6	Crestron	VC-4-ROOM	Creston Virtual Control Server Software

A. The Theatrical Equipment Contractor shall furnish two (2) four hour training sessions per room in addition to the training provided by the service technician at the time of system turn-on. The training session shall not take place until the Owner has taken possession of the building and prior to the opening of the facility. The first training session shall include;

1. A review of the Audio console operations, Instruction in operation of all microphone and dressing room paging equipment
2. A review of the operation of the Audio System control processor, troubleshooting tips and 800 service number procedures.
3. How to maintain the Audio system.

B. The second and third training session shall be devoted to advanced systems operation. This session shall take place at the convenience of the Owner and take place no later than 90 days after initial installation.

C. Install laminated placards on the inside door of all sound system equipment racks and at Audio booth desk detailing how to 1.) power the system on, 2.) how to source and speaker zone selection, 3.) how to make microphone and system volume adjustments, and 4.) power off procedures. Also include Instructions on how to use the assisted listening system and wireless microphone use and care.

5.00 **STAGE RIGGING AND CURTAINS: (ALTERNATE #1)**

5.01 SCOPE

A. This portion of specification covers the fabrication, furnishing, delivery, and installation of the stage rigging system. The form of contract, general conditions, and the project drawings are considered to be parts of these specifications.

B. The Theatrical Equipment Contractor shall provide all items necessary for a complete, safe, fully functional system as described herein, including all tools, scaffolding, labor, and supervision, even though they may not be specifically enumerated. Any errors, omissions or ambiguities do not relieve the Contractor of this responsibility, but must be included in the price and brought to the attention of the Architect for clarification.

C. The work of this section shall include, but not necessarily be limited to the following:

1. Seventeen (17) – Dead hung lines sets complete with battens, #280 traveler track and curtains as specified. (4) Stage Electrics, including installation of circuit distribution raceway, and (3) scenic tracks one of which is the cyc.
2. Assemble, hang/attach (1) Front of House batten Hoist, including installation of circuit distribution raceway. Set all limits and trim pots.
3. Provide and install curtain tracks in locations shown on plans for the Auditorium.
4. Stage curtains, Furnish and install in the Auditorium as specified.
5. Furnish and Install Unistrut to support the FOH hoist motor and back bone
6. Coordinate Rigging with Stage Dimming and Lighting from section 2 and 3.

D. Related work which is not included in this section:

1. Gridiron, head and loft block beams, and all other structural steel and miscellaneous metals not specifically called out as part of this section.
2. Galleries, ladders and catwalks.
3. Stage flooring.
4. Electrical connections, conduit, boxes and wiring of any type.

5.02 GENERAL REQUIREMENTS

B. Field Conditions: All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation shall be allowed for any labor or item the bidder could have been fully informed of prior to the bid date

C. Safety: The systems shall conform to all applicable code requirements and shall be in conformance with industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the users to arrange and operate a safe assembly and working environment for audience and user personnel.

D. Insurance: the Theatrical Equipment Contractor shall maintain injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for Contractor's employees. Limits from previous sections apply here.

E. Motorized battens: shall be supplied from a Rigging Manufacturer that has been fabricating and delivering motorized hoists for a minimum of five (5) years.

5.03 SUBMISSIONS

A. Drawings: Submit component and installation drawings and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. They shall be approved by the Architect before beginning any fabrication, installation, or erection. Such approval does not relieve the Stage Lighting Contractor of the responsibility of providing equipment in accordance with the specifications.

B. Catalog Cuts: In lieu of drawings, the Contractor may submit catalog cuts for standard equipment items. These must contain full information on dimensions, construction, applications, to permit proper evaluation. In addition, they must be properly identified as to their intended use. Any options or variations must be clearly noted.

C. Schedule: Prior to the commencement of the installation work, the Theatrical Equipment Contractor shall submit an outline of the proposed schedule and requirements for approval.

D. Instructions: Upon completion of the work, the Theatrical Equipment Contractor shall submit 4 copies of a detailed Operating and Maintenance Manual including as-built shop drawings, equipment descriptions, and parts lists. The Stage Lighting Contractor shall go through the manual with personnel designated by the owner to demonstrate and explain the maintenance and operation of the systems. In addition, provide one four (4) hour training session at the convenience of the Owner either 90 days from the date of completion or 30 days after the building is occupied by the teaching staff. This Option to be decided by the teaching staff and relayed through the architect.

5.04 WARRANTY

A. The Theatrical Equipment Contractor shall provide a two year written guarantee against defects in materials or workmanship starting from the date of acceptance of equipment by the Owner's representative. The guarantee shall not cover damage due to normal wear and tear, acts of God, neglect, or improper use of equipment. Any required maintenance or replacement shall be provided by the Theatrical Equipment Contractor within thirty days of notification by the Owner except for safety related items, which shall be corrected within 48 hours of notification. Subsequent to the expiration of the guarantee period the Stage Lighting Contractor agrees to furnish repair and maintenance service, at the Owner's expense, within thirty days of request for such service.

5.05 MANUFACTURERS

A. Due to the highly specialized nature of theatrical rigging equipment, and the safety requirements of the equipment, all equipment must be built by the following approved manufacturers:

Stage Decoration & Supplies, Inc.
3519 Associate Drive
Greensboro, NC 27405

Automatic Devices Company
2121 South 12th Street
Allentown, PA 18103

B. Other equipment manufacturers seeking acceptance must submit the following information at least 10 days prior to the bid opening date. Approval of manufacturers will be by addenda. Failure to submit any of the required information will automatically disqualify the manufacturers from consideration of approval.

1. Evidence that the manufacturer has been in business for a minimum of ten years manufacturing stage equipment.
2. A listing of 10 equivalent installations including:
   a. Name, address and telephone number of Owner;
   b. Name, address and telephone number of architect;
   c. Scope of work.
3. A brief written description of the manufacturer's operation including facilities, financial capabilities, and experience of key personnel.
4. A statement from an insurance company indicating that the manufacturer carries a primary product and general liability insurance of $2,000,000 each, and excess liability of $10,000,000.
5. A product testing program, including determination of recommended working loads for products based on destructive testing by an independent laboratory and review by an independent licensed engineer. Manufacturers seeking approval must submit details of their test program and methods along with the names and telephone number of the independent test lab and independent licensed professional engineer performing the product testing and review.

5.06 GENERAL

B. Recommended Working Load: This specification calls for minimum recommended working loads for many hardware items. The manufacturer's recommended working load is the maximum load which the manufacturer recommends be applied to properly installed, maintained, and operated new equipment. Manufacturer's recommended working loads shall be determined by calculations by a Licensed Professional Engineer and destructive testing by an independent testing laboratory. These calculations and reports shall be available for review.

C. Pipe Battens – Dead Hung

1. All battens shall be pipe Battens consisting of one 1-1/2" inside diameter, schedule 40 pipes in lengths as shown on the drawings.
2. All joints shall be spliced with 18" long sleeves with 9" extending into each pipe and held by two 3/8" hex bolts and lock nuts on each side of the joint.
3. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inches in length.
4. Pipe Battens shall be 52 feet long.

5.07 STAGE AND STUDIO CURTAIN SPECIFICATIONS: (ALTERNATE #1)

A. Description and Sizes: Curtains shall be as made in accordance with the following:

Description	Qty	Height	Width	Fullness	Fabric	Color
Main Valance	1	3'-0"	48'-0"	50%	Charisma	Standard
Main Traveler	2	18'-6"	28'-0"	50%	Charisma	Standard
Border	2	6'-0"	52'-0"	50%	Crescent	Black
Border	1	5'-6"	52'-0"	50%	Crescent	Black
Legs	4	18'-6"	10'-0"	50%	Crescent	Black
Mid Traveler	2	18'-0"	28'-0"	50%	Crescent	Black
Rear Traveler	2	18'-6"	28'-0"	50%	Crescent	Black
Cyc	1	19"-0"	46'-0"	flat	Muslin	Natural
Band	2	18'-0"	16'-0"	50%	Crescent	Black
Band	1	18'-0"	16'-0"	flat	RB Cloth	Green

B. Fabric Types

1. KM Fabrics "Marvel" Velour, 21 ounce cotton, Flame treated. Standard color as selected by owner's representative.
2. Rose Brand Fabrics "Charisma" Synthetic matt Velour 27oz. IFR Heavy weight Trevira CS
3. KM Fabrics "Crescent" Synthetic Velour 21oz. IFR Medium weight brushed, Avora Polyester
4. Dazian's, Seamless Muslin 100% cotton, Color Natural, Flame treated.
5. Rose Brand RB cloth Chroma-key Green, IFR.

C. Cotton fabrics and other flammable fabrics must be chemically mill treated for flame retardancy according to the requirements of the National Fire Protection Association's NFPA #701.

D. See above for the fullness of each curtain.

0% = Flat, no extra material.

50% - 100% = additional fabric to be included, exclusive of turn-backs and hems.

E. Seams between strips shall be single stitched without puckers using thread of matching color. All fabrics with a grain or pile shall have all strips running in the same direction.

F. Pleats shall be box type on 12" centers. Valances and borders are to have their pleats arranged to conceal the seams.

G. Top Finish shall be 3-1/2" heavy jute webbing double stitched to the top of the curtain with 1" of face fabric turned under the webbing.

1. Brass rustproof grommets shall be inserted in pleat centers (12" centers on flat curtains). Grommets shall be used as follows:
   #2 grommets - muslin, lightweight fabrics.
   #3 grommets - unlined velour, medium weight fabrics.
   #4 grommets - lined velour, heavy weight fabrics.
2. Track-mounted curtains shall be supplied with plated wire S-hooks or CCF-2 curtain to carrier snap hooks. Batten-mounted curtains are to be supplied with 36" braided #4 cotton tie lines. Tie lines shall be black or white to best match the curtains with the center line in alternate color to aid in hanging curtains.

H. Bottom Hems

1. Valances and borders shall have 4" bottom hems.
2. All full height curtains shall have 6" bottom hems complete with separate interior chain pockets filled with #8 plated jack chain. Chain pockets shall be stitched so that the chain will ride 2" above the finished bottom edge of the curtain.
3. Scrims, drops and cycloramas shall have an additional pipe pocket sewn to the back of the hem and shall be furnished with a 3/4" sch 40 steel, pipe batten, threaded and coupled every 10 feet.

I. Side Hems

1. House (Main) Curtain shall have 1/2 width of face fabric turned back at the leading edge.
2. All lined traveler curtains shall have 1/2 width of face fabric turned back at the leading edge.
3. All other side hems shall be 2".

5.08 TRAVELER TRACK: (ALTERNATE #1)

A. Stage Curtain Track

1. Track shall be of 14 gauge galvanized construction, entirely enclosed except for the slot in the bottom. Each section of track less than 20 feet shall be in one continuous piece. Splice clamps shall be permitted for section lengths over 20 feet.
2. Carriers shall be constructed of nylon, supported from two heavy-duty polyethylene wheels held in the ball bearing by a nickel-plated steel rivet. Each carrier shall be equipped with a free-moving swivel and sufficient trim chain to accommodate a curtain S-hook. Each carrier shall have a back-pack. Rubber washers shall be provided between each carrier to reduce noise.

3. The Master Carrier block shall be constructed of plated steel having two cable clips to clamp the cord to the carrier. Four wheels in pairs identical to the single carrier above shall support the block.
4. Live and dead end pulleys shall be adjustable, equipped with oil-impregnated sleeve bearing wheels on adequately guarded plated steel housings. End stops at each track end and one adjustable, demountable floor pulley shall be furnished. Stretch-resistant, fiberglass center operating cord shall be 3/8" in diameter.
5. Three (3) tracks shall be rigged for bi-parting operation CWANA with a 24" center overlap. Each carrier shall be furnished with a minimum of 3” of trim chain. Hanging clamps will be provided for suspension at six foot maximum intervals.
6. Two (2 Tracks shall be rigged for one way travel CWANA, including master carrier, track carriers with a minimum of 3” of trim chain ea. and floor block with hand line. Hanging clamps will be provided for suspension at six foot maximum intervals.
7. Supply one 284 walk along track for Band room with wall mount angle brackets, supply 3 master carriers and 48 single track carriers. Supply 3 – pull cords with ball to allow for curtains to be pulled across track.
8. Track assemblies for the theater shall be Automatic Devices Company Silent Steel Model # 280 track- 52 ft. in length. Band room track shall be 36 ft. in length.
9. Provide a complete traveler track assembly where indicated on the line set schedule and on the drawings.

5.09 BAND ROOM PIPE GRID: (ALTERNATE #1)

1. All Pipe shall be Schedule 40, 1½" Black Steel Pipe (1.9" O.D.) fully cleaned and painted black. Pipe wall thickness shall be uniform, and exhibit concentricity. Pipe shall be free from defects.

2. All pipes greater than 21'-0" in length shall be provided with an internal splice of the same diameter as the inside of the pipe. This sleeve shall be not less than 18" in length with a side wall thickness of 1/8" or more. The sleeve shall be held in place by (4) bolts, or Ramset nails.

3. Pipe Hanger Spacing shall not exceed 8'-0" and each pipe end shall not be cantilevered more than 3'-0" from a pipe support. The Pipe Grid shall be supported at every pipe intersection on the grid perimeter, and every other pipe intersection on the grid interior, or more frequently, if required. Each Pipe Hanger shall be constructed from 3/8" plated all thread rod and Kindorf C149 1-1/2 pipe hanger. Each Pipe Hanger will be rated for a 300 pound per point load.

4. Grid Brackets shall be provided for every pipe intersection on the pipe grid perimeter, and every other pipe intersection on the pipe grid interior. Brackets shall be; Pipe grid cross clamp #015-100; Rigging Innovators 1-1/2” x 1-1/2” Grid Overlap Bracket, the Roto lock by Upright Scaffolding.

5. Provide all hardware, fittings, and accessories required to safely and adequately rig the Pipe Grid as specified. The bidder shall ensure that all equipment provided is of great enough capacity to bear the equipment loads with a factor of safety as is proper for this type of installation.

6. Band Room Grid shall include, but may not be limited to the following:
    a. A minimum of 240 feet of Schedule 40, 1½" I.D., Black Pipe - sufficient to provide square grid and one hanging pipes as shown on the plans.
    b. A minimum of three (5) Pipe Sleeves (Splices) for continuous lengths of pipe over 21'-0"
    c. Furnish and install eighteen (18) Pipe Hangers
    d. Furnish and install grid, pipes and torms as shown on plans.

6.00 EXECUTION

6.01 INSTALLATION

A. The Theatrical Equipment Contractor shall be responsible for storage of stage equipment, tools, and equipment during the period of the installation.

B. All specified equipment shall be installed by fully trained superintendents and workmen. Equipment shall be installed in a workman like manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.

C. Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).

D. Mule blocks, cable rollers and guides shall be installed, to provide proper alignment, to maintain specified fleet angles, and to prevent contact with other surfaces.

E. All equipment shall be securely attached to the building structure.

F. Finishes:

1. All welds must be touched up to match disturbed finishes.
2. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

6.02 CLEAN UP

A. The Contractor shall be responsible for cleanup, including removal of packing materials and the protection of surfaces or equipment provided by other contractors.

6.03 INSPECTION AND TESTING

A. During the installation of equipment the Theatrical Equipment Contractor shall arrange for access as necessary for inspection of equipment by the Owner's representatives.

B. Special Testing: If specifications, the Architect's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Stage Lighting Contractor shall give the Architect timely notice of its readiness for inspection, and of dates of inspections to be made by other authorities.

C. Upon completing the installation of all equipment specified under this section, the Contractor shall notify the Architect, who will schedule an inspection. At the time of inspection, the Theatrical Equipment Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Owner's representative. Any equipment, which fails to meet with approval, shall be repaired or replaced with suitable equipment and the inspection shall be re-scheduled under the same conditions as previously specified. At the time of these inspections, no other work shall be performed in the auditorium and stage areas. All temporary bracing, scaffolding, shall be removed to permit full operation of, and access to, all equipment. Final approval will be withheld until all systems have been thoroughly tested and found to be in first class operating condition in every particular.

End Section

Section 11 66 23

GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:
   1. Wall padding.
   2. Folding mats.
   3. Volleyball System
   4. Batting cage.
   5. Suspension training mounting bar and anchors.

B. Furnish volleyball system (standards, nets and related accessories) to Owner prior to Substantial Completion of Contract.
   1. Furnish sleeves for volleyball standards to Section 09 64 66 – Wood Athletic Flooring for installation.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Set floor sleeves for volleyball standards.

D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
   1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM F2440 - Standard Specification for Indoor Wall/Feature Padding.
   3. NFPA 255 - Surface Burning Characteristics of Building Materials.

4. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
5. NFPA 701 - Methods of Fire Tests for Flame-Resistant Textiles and Films.
6. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:
1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:
1. Field Measurements
a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets for wall padding and volleyball system.
2. Manufacturer’s certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
4. Shop drawings: Installation details showing mounting conditions, clearances, dimensions.
5. Manufacturer’s installation instructions.
6. Sustainable Design Submittals: As required by NE CHPS.
7. Qualification Submittals:

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Operation and Maintenance Data:
2. Bonds and Warranty Documentation:

a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

3. Sustainable Design Submittals: As required by NE CHPS.

C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.

1. Spare Parts.
2. Tools.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Porter Athletic Equipment Company, Schiller Park, IL.
2. Performance sports systems, Anderson, IN.
3. AALCO Manufacturing Company, Louis, MI.

2.2 WALL PADDING

A. Wall padding wainscot: Prefabricated wall-mounted panels, equal to Porter Nos. 90348-326, 90350-226 and 90350-326, in compliance with Class A flame spread and smoke in accordance with ASTM E84, and the following requirements:

1. Size: 2 feet wide by 6 feet tall, with cutouts made in field to fit job conditions.
2. Thickness: Manufacturer's standard 1-1/2 or 2 inches as applicable to referenced products.
3. Covering: flame-retardant 14-ounce non-tear vinyl laminated material, mildew and rot resistant, fungicide treated, color to be selected by Architect from manufacturer's full range.
4. Backing: 3/8 inch thick backing board
5. Mounting: 1 inch nailing margin at top and bottom of each panel.
6. Locations and quantities as shown on drawings.

B. Corner wall pad: Prefabricated L-shaped foam corner pads equal to Porter No. 00355-600, in compliance with Class A flame spread and smoke in accordance with ASTM E84, and the following requirements:

1. Size: 6 inches by 6 inches by 6 feet tall, thickness matching adjacent wall panels.
2. Filler: 1-1/4" Ethafoam.
3. Covering: flame-retardant 14-ounce non-tear vinyl laminated material, mildew and rot resistant, fungicide treated, color to be selected by Architect from manufacturer's full range.

4. Mounting: Velcro strips attached to the two long sides of the pad; two 6 foot long strips of self-adhesive Velcro for attachment to wall.
5. Locations and quantities as shown on drawings.

C. Molded inserts: Single and double gang flame-retardant rubber molded inserts, equal to Porter “0034 Series”. Color: Graphite gray.
1. Coordinate insert sizes with Electrical Drawings.

2.3 VOLLEYBALL SLEEVES

A. Volleyball sleeves: 3-1/2” diameter floor sleeves equal to Porter No. 00870-100 for each standard.

B. Locations and quantities as shown on Drawings.

2.4 BATTING CAGE

A. Batting cage: Ceiling suspended; metal framed batting cage equal to Porter No. 90920-100 meeting the following requirements:
1. Frame Size 12 feet by 12 feet by custom length of 68 feet.
2. Framing: 1-7/8 inch OD heavy wall electroplated tubing with cross spreaders at 14 foot centers for cable attachment and tee fittings at all junctions.
3. Cabling: 1/8 inch diameter galvanized vandal proof cable with a minimum breaking strength of 2,100 pounds.
4. Netting: 1 inch square knotless nylon mesh netting.
a. Curtain height: 14’-0”.

B. Winch:
1. Motor: 3/4 horsepower, 115 AC, 60hz, capacitor type 60 cycle, 115 volt, single phase electric motor with automatic thermal overload protection Porter model 910060XX Single Output Winch. The motor shall drive the winch by means of a connecting V-belt and sprockets.
a. Cast iron cased, worm gear type, designed to hold equipment at any position when raising or lowering.
b. Output shaft shall be mechanically interconnected to a special rotary counting Up-Down limit switch assembly, which shall be mounted and pre-wired to motor as an integral part of the winch. Limit switch shall be furnished in a special, extruded aluminum housing. Adjustment of said limit switches designed to be easily made without the use of tools. Winch shall be pre-wired with a 6'-0" lg. neoprene covered cable with a twist-lock grounded type plug attached.
c. Curtain raises or lowers at a rate of approximately 7'-6" / minute.
2. Provide manufacturer’s standard audible alarm; intermittent warning tone is activated when curtain is raised or lowered into position.
3. Remote controller: Equal to Porter “Sportsonic II Receiver” No. 2002, complying with the following:
a. Range: 100 feet minimum.

b. Operation: Capable of controlling up to 99 devices.

c. Quantity: One (1).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of project conditions.

C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

D. Inspect prefabricated padding prior to installation.

3.2 INSTALLATION

A. Install padding in accordance with manufacturer's instructions for each type.

1. Fasten pads and mounting strips to wall level and plumb; shim as required to keep panels flat.

B. Install volleyball system in accordance with manufacturer’s instructions.

1. Coordinate installation of floor sleeves with other trades.
2. Install floor sleeves to accommodate standards plumb and at equal height.

C. Install mat hoist in accordance with manufacturer’s instructions.

1. Coordinate installation of mat hoist with other trades.
2. Ensure that required structural framing is in place, and ready to receive required loads.

3.3 CLEANING

A. After completion of the work of this Section, clean all walls, partition, and floor areas free from materials installed under this Section.

1. Remove labels and temporary protective coverings.

B. Clean gymnasium equipment promptly after installation in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect pad covering materials from damage during fabrication, shipping, storage, and erection; advise the Contractor of protective treatment and other precautions required through the remainder of construction.

End of Section

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Section 11 66 25

BASKETBALL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install backstops, including motorized lift units, remote control devices, backboards and goals.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Structural steel.

D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

E. Section 09 91 00 –PAINTING: Field finish painting backstop support assembly.

F. Division 26 - ELECTRICAL: Electrical connections to motor unit, empty conduit from motor to control.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements

a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets for backstop, including mounting system, motor and electrical characteristics. backboard, goal and netting.
2. Manufacturer’s installation instructions.
3. Manufacturer’s certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
5. Shop drawings: Installation details showing mounting conditions, clearances, dimensions, and electrical connections.
6. Sustainable Design Submittals: As required by NE CHPS.
7. Qualification Submittals.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Operation and Maintenance Data:
2. Bonds and Warranty Documentation:

a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

1.6 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

B. Provide manufacturer's 10 year warranty year for backboard. Warranty is in addition to and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Porter Athletic Equipment Company, Schiller Park, IL., 900 series center strut backstops.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Porter Athletic Equipment Company, Schiller Park, IL.
2. Draper, Inc., Spiceland, IN.
3. Performance Sports Systems, Anderson, IN.

2.2 BASKETBALL BACKSTOPS

A. Backstops (all): Side folding, adjustable ceiling-mounted backstops, each with single mast drop frame, electrically operated, conforming to the latest NCAA and NFSHSA recommendations, equal to Porter model 955, and be in compliance with the following requirements.

1. Support framing: ASTM A500 steel tubing, 6-5/8 inch diameter, 11 gauge single mast with 4 inch diameter, 11 gauge top member and 2-1/4 inch diameter, 14 gauge diagonal side bracing.
    a. Provide main mast with offset pivot for positive locking position.
        1) Pivot point: 1-1/4 inch diameter solid steel shaft and 1/2 inch steel plate hangers
    b. Completely weld frame components with full surface welds, tack welding is not acceptable.
2. Folding side brace: Jackknife type, fully adjustable, self-locking in down position constructed from 2-1/2 inch diameter, 13 gauge outer tube and 2-1/4 inch diameter, 14 gauge inner tube.
3. Manufacture framing to permit backboard vertical field adjustment of 6 inches.
4. Manufacture framing to permit variable goal height adjustment from 8”-0” to 10”-0” above finished floor.
5. Fittings: Malleable iron castings and heavy gage steel stampings
6. Frame finish: Shop primed and finished, with one coat primer and two coats of glass paint in color to match sample provided by the Architect.
7. Winch: Electric 1 horsepower worm gear-type winch with heavy formed steel main frame designed to hold backstop at any position during raising and lowering, equal to Draper “Model A503085 Motorized Winch”.
    a. Lifting cable: 1/4 inch diameter 7 by 19 galvanized aircraft cable, having not less than 7,000 pound ultimate breaking strength.
    b. Control Station: One key operated spring return to center flush mounting wall switch.
8. Mounting brackets for 3-1/2 inch outer diameter pipe.

2.3 BACKBOARDS

A. Backboards and goals:

1. Backboard: Extruded aluminum frame rectangular glass backboard, Official size 72 by 42 inches.

a. Glass: 1/2 inch thick safety glass, ASTM C 1048 FT, fully tempered, complying with Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.

b. Border and target markings: Fired vitreous white enamel

2. Goal Height Adjuster: Center strut height adjuster, for direct-mount center pole attachment system with 600 pound thrust capacity to raise and lower the goal height electrically. Motor shall draw 1.4 amps under full load. Integral limit switches shall provide automatic shut off at 8' and 10' goal heights. The motor shall be controlled by Porter No. 2500 or 2550 Powr-Touch R Gymnasium Control Systems.

a. Provide compatible wall mounted control panel.

3. Goal: Breakaway goal designed to withstand shock loads from player slam dunking or hanging on rim conforming to NCAA and NFSHSA specifications for movable rims, high quality enamel finish, furnish with nylon net, equal to Porter Model 245600 – “Ultra-Flex Goal”.

a. Rim shall deflect down when 230 pounds (104 kg) static load is applied and return to playing position when load is removed. Ring shall have rebound characteristics identical to those of non-moveable ring. Factory set proper flex and rebound requirements.

b. Ring: Fabricated from 5/8 inch (16 mm) diameter steel rod formed into 18 inch (457 mm) ring. Provide with 12 no-tie net attachment clips welded to ring. Rigidly brace with die cut steel braces welded to rim.

c. Anti-whip net: Top half of net fabricated from durable fibers encased in nylon to prevent net from whipping up on rim, lower half all nylon. Color white.

d. Mounting plate: Heavy duty steel plate bracket with mounting holes and designed to position inside of ring 6 inches (152 mm) from backboard.

1) Provide direct goal attachment to framing to transfer goal stress to mast pipe.

e. Backboard safety padding: 2 inch thick bolt-on foam padding with molded in steel track for bottom edge and corners of backboard to provide safety protection to meet NCAA and NFHSA requirements; equal to Draper “Model A0142 Safe-Edge Padding”. Padding shall cover bottom edge of backboard and extend 15 inches (381 mm) up sides.

2.4 ACCESSORIES

A. Universal Grid System:

1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Unistrut Corporation, Itasca IL.

a. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.

1) Unistrut Corporation, Itasca IL., product “Unistrut”

2) Cooper US, Inc., Houston TX., product “Cooper B-Line”.

3) Gleason Partners, LLC., Grand Rapids, MI., product “Strut Channel Systems”.
4) Thomas & Betts Corporation, Memphis TN, product “Kindorf Superstrut”.

b. There are no other manufacturers of this product type available in the United States, fabricators may choose to fabricate grid system components using structural steel shapes, with submittal and approval of complete engineering Drawings and calculations as a substitution.

2. Finish:
   a. Rust inhibiting acrylic enamel paint applied by electro-deposition, after cleaning and phosphating, and thoroughly baked. Color is per Federal Standard 595a color number 14109 (dark limit V-). Finish to withstand minimum 400 hours salt spray when tested in accordance with ASTM B 117.
3. All channel members shall be fabricated from structural grade steel confirming to the following ASTM specifications:
   a. ASTM A 653 Grade A
4. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications:
   a. ASTM A 36, A 575, or A 576.
5. All materials shall be stamped and identifiable by manufacturer and part number (where appropriate). Materials that appear damaged, distressed, unidentifiable or rusted shall not be used and will not be accepted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install basketball backstops in accordance with manufacturer's instructions. Secure units level and plumb.

B. Adjust each unit for operating positions, accurately establish lowered position in place.

End of Section

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Section 11 66 53

GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install gymnasium dividers including all supporting channels and suspension rods, motorized lift unit and remote control devices.

1. Universal grid system for support of overhead work required as part of this Section 11 66 53.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 05 31 00 – STEEL DECKING: Restrictions on attachment of work to metal decking.

D. Section 10 14 00 – SIGNAGE: Providing graphics for printed image on gymnasium dividers.

E. Division 26 - ELECTRICAL: Electrical connections to motor unit, empty conduit from motor to control.

1.3 REFERENCES

A. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets for mounting system, including electrical characteristics.
2. Manufacturer’s installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
3. Manufacturer’s certificates: Certify that Products provided under this Section meet or exceed specified requirements.

4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
5. Shop drawings: Installation details showing mounting conditions, clearances, dimensions, and electrical connections.
6. Selection samples: Sample card indicating Manufacturer's full range of fabric colors available for selection by Architect.
7. Verification samples: 12 by 12 inch samples of vinyl fabric and netting, illustrating material and finish.
8. Sustainable Design Submittals: As required by NE CHPS.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer’s warranty.
2. Maintenance information for curtain raising mechanism, and cleaning information for vinyl cloth and netting material.

1.5 WARRANTY

A. Provide manufacturer's standard 2-year warranty which shall include coverage of divider surfaces from discoloration. Warranty is in addition to and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Porter Athletic Equipment Company, Product: “2080 Series Center Roll“.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Porter Athletic Equipment Company, Schiller Park, IL.
2. Draper, Inc., Spiceland, IN.
3. Performance Sports Systems, Anderson, IN.
4. AALCO Manufacturing Company, St. Louis, MI.

2.2 DESIGN CRITERIA

A. Gymnasium curtain when in ‘stored position’, bottom edge of curtain shall be no lower than 23’-0” above finished floor.

2.3 CENTER ROLL DIVIDER CURTAINS

A. Center Roll Gymnasium Divider, overhead supported, motorized center-roll torque arm single motor driven divider curtain meeting the following requirements:

1. Motor: Drive pipe power mechanism shall consist of a compensating type winch,115 volt 60 cycle single phase reversible capacitor start motor capable of providing 28 feet/minute curtain operation, lubed-for life bearings, reversing magnetic contactor for remote control, .
2. Control Station: One standard keyed three button momentary contact type; 24 volt circuit; recess mounted.
3. Cables: 1/8 inch diameter galvanized steel aircraft cables which terminate in individual storage drums.
4. Curtain:
    a. Bottom 8 feet of curtain is 18 ounce per square yard nylon or polyester reinforced vinyl, equal to Porter “Flexivide”, with edge hems double welds, seams 1-1/2 inch full contact sealed seam. Sewn construction will not be permitted. Fabric shall be rot and mildew resistant and show minimum results of 300 pounds per inch tensile strength when tested in accordance with FS 191 and, have 100 pounds inch tear strength. Fabric shall have a Class I flame spread rating when tested in accordance with ASTM E84. Color shall be as selected from manufacturer’s full available range.
    b. Upper curtain: Vinyl coated polyester mesh approximately 50 percent open weave and weighing 9 ounces per square yard, equal to Porter “Fleximesh”. Fabric shall have a minim tensile strength of 100 pounds/inch and be fire retardent. Color as selected by the Architect from the manufacturer’s full available range of colors.
5. Top and bottom of Curtain batten: Rigid-coupled 1-5/16 inch diameter tubular steel batten.

2.4 ACCESSORIES

A. Universal Grid System:

1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Unistrut Corporation, Itasca IL.
    a. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.
        1) Unistrut Corporation, Itasca IL., product “Unistrut”
        2) Cooper US, Inc., Houston TX., product “Cooper B-Line”.
        3) Gleason Partners, LLC., Grand Rapids, MI., product “Strut Channel Systems”.
        4) Thomas & Betts Corporation, Memphis TN, product “Kindorf Superstrut”.
    b. There are no other manufacturers of this product type available in the United States, fabricators may choose to fabricate grid system components using structural steel shapes, with submittal and approval of complete engineering Drawings and calculations as a substitution.
    c. Finish:

1) Rust inhibiting acrylic enamel paint applied by electro-deposition, after cleaning and phosphating, and thoroughly baked. Color is per Federal Standard 595a color number 14109 (dark limit V-). Finish to withstand minimum 400 hours salt spray when tested in accordance with ASTM B 117.

2. All channel members shall be fabricated from structural grade steel confirming to the following ASTM specifications:
   a. ASTM A 653 Grade A
3. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications:
   a. ASTM A 36, A 575, or A 576.
4. All materials shall be stamped and identifiable by manufacturer and part number (where appropriate). Materials that appear damaged, distressed, unidentifiable or rusted shall not be used and will not be accepted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install suspension framing, channels and hanging rods.

B. Install gymnasium dividers in accordance with manufacturer's instructions. Secure units level and plumb.

C. Adjust each unit for operating positions, accurately establish lowered position in place.

End of Section

Section 11 68 00

PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following sections contain requirements that relate to this section.
1. Section 03 30 00 – Cast-In-Place Concrete
2. Section 31 00 00 – Earthwork
3. Section 32 13 13 – Concrete Paving
4. See Item 1.6 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings or as specified herein.

B. The principal work of this section includes, but may not be limited to the following:
1. Basketball Court Equipment
2. Track and Field Equipment

C. **This item may be affected by Add Alternates – refer to Plans for further information.**

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. National Federation of State High School Associations (NFHS)
2. International Association of Athletics Federations (IAAF)
3. American Sports Builders Association (ASBA)
4. Manufacturers Data and Recommended Installation Requirements

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 for all manufactured/fabricated items. All submittals must be prior to fabrication and/or field installation work.
1. Shop drawings shall include plans, details, elevations and specifications and shall indicate profiles, sizes, dimensions, connection attachments, size

and type of fasteners, accessories, and color and finish as indicated in these specifications and the plans.

2. Submit manufacturers printed product literature, specifications and data sheets.
3. Clearly indicate on the shop drawings any deviations from the plans and specifications.

B. Submit Contractor Qualifications as required under Quality Assurance section stated herein.

C. Submit warranty information of all manufactured/fabricated items as required under Warranty section stated herein.

D. Submit samples showing texture, finish and range of colors of all materials. Samples will establish the standard by which materials provided will be judged.

E. Submit drawings and instructions of manufacturers/fabricators installation requirements.

F. Submit stamped shop drawings by a Structural Engineer currently registered in the state where the project is located for footings for all work in this Section. Drawings shall indicate approved materials in this Section.

G. Submit material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated herein, based on comprehensive testing of current materials.

H. Sustainability Submittals if applicable.

1.5 DELIVERY, STORAGE AND HANDLING

A. All equipment, unless otherwise indicated, shall be furnished, assembled and installed by the contractor.

B. Deliver to site, store and protect products under provisions of Division 1.

C. Installation Documentation, Packing List and Maintenance Kits shall be supplied by the manufacturer for each component.

D. Do not store paint, paint additives or cleaners at site

1.6 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”

1. The Construction Manager is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 Any manufacturer’s names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that “or equivalent” applies to all products denoted herein. It is understood that all manufacturers will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an equivalent. It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

2.2 BASKETBALL EQUIPMENT

A. Basketball system post shall be adjustable height steel, single post, minimum 6” square O.D., 6’ offset with internal adjustment mechanism. Backboard shall be 72” tempered glass. Target shall be white, Goal shall be Double Rim, and net shall be Nylon. Post padding shall be provided for each post. Quantity of four (4).
1. Acceptable manufacturers include the following:
a. Goalrilla DC72E1
b. Goal Setter Model No. SS46072
c. Bison BA873-BK
d. Or equivalent

2.4 ATHLETIC FIELD EQUIPMENT

A. Dual Pad Discus/ Hammer cage- Quantity (1) College dual pad discus/hammer cage. Shall be model# Sportsfield Specialties TFDDHCCOLL or equivalent.

B. Shot put / Hammer Throw Ring – Quantity (2) 2”x2’ Angled aluminum ring for depressed pad installation of shot put or hammer. Shall be model# Sportsfield Specialties TRSPHAA.

1. Acceptable Manufacturers include the following:
   a. Sportsfield Specialties
   b. Sports Edge
   c. AAE
   d. Or Equivalent

C. Shot put toe board

1. Quantity (1) High School Shot Put Toe Board for recessed concrete pad installation. Shall be model# SportsField Specialties SPTBCARHS or equivalent
2. Acceptable Manufacturers include the following:
   a. Sportsfield Specialties
   b. Sports Edge
   c. AAE
   d. Or Equivalent

PART 3 - EXECUTION

3.1 GENERAL

A. Field stake location of all improvements in conformance with the drawings for approval of Owner. Owner may make field changes before approving layout at no additional cost.

B. Installation of all prefabricated equipment shall conform to the manufacturer's recommendations.

C. Notify Owner to be present at time of field staking and installation.

3.2 INSTALLATION OF NEW EQUIPMENT

A. Assemble and install all prefabricated equipment in accordance with the manufacturer’s recommendations.

B. Footings: Locate post footing holes accurately. Make dimensions in accordance with drawings or approved shop drawings. Excavate and remove loose and foreign materials from sides and bottoms of holes.

C. Set components in proper alignment and elevation and secure.

D. Pour concrete in accordance with Section 03 30 00.

E. Protect equipment until completely installed and safe for use.

End of Section

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Section 11 95 13

KILNS

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section consists providing electric kilns where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following:

1. Furnish and install electric kilns where indicated on the Drawings.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Kiln ventilation systems, complete with ductwork, hangers, and insulation.

E. Division 26 - ELECTRICAL: External wiring, not integral with the equipment furnished under this Section.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. UL: Approved individual equipment, and component, listings and standards.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder clearly indicating configurations, sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.
2. Manufacturer’s installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.

3. Manufacturer’s certificates:
4. Certify that Products installed under this Section meet or exceed UL and specified requirements.
5. Manufacturer's sample warranties.
6. Sustainable Design Submittals: As required by NE CHPS.

B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Operation Data for all installed and furnished equipment.
2. Manufacturer’s warranties: Include coverage of installed equipment.
3. Maintenance Data: Include periodic maintenance requirement schedules.

1.5 QUALITY ASSURANCE

A. Kiln manufacturer specializing in producing the work of this Section with a minimum of 5 years documented successful experience.

B. Perform work to the following certification standards:
1. Electrical wiring and components: Conform to UL standards.

1.6 REGULATORY REQUIREMENTS

A. Provide and install the work of this Section in conformance with all applicable federal, state and municipal codes, laws and regulations regarding utilities, health, fire protection and safety.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with interfacing work. Ensure that the work performed is acceptable to respective trades responsible for interfacing work.

1.8 WARRANTY

A. Additionally provide manufacturer’s standard warranties under the provisions of Section 01 78 00 - CONTRACT CLOSEOUT that exceed the one year period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Skutt Ceramic Products, Inc., Portland, OR, product “Easy Fire”, model Nº. KMT-1027.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Skutt Ceramic Products, Inc., Portland, OR.
2. L & L Kiln Manufacturing, Inc., Swedesboro, NJ.
3. Olympic Kilns, by Haugen Manufacturing, Inc., Flowery Branch, GA.

2.2 KILNS

A. Kiln: UL listed, multi-sectional, modular, ceramic kiln 23 inch interior diameter by 27 inches deep with a 7 cubic foot firing chamber with reversible lid and floor slabs and 3 inch firebrick walls.
   1. Power requirements: 3 phase, 208 volt.
   2. Electrical rating: 39.8 amps, 14,340 watts.
   3. Temperature rating: Cone 022 to Cone 10.
   4. Thermocoupling: Type K.
   5. Control features: Touch pad type with digital readout with integral temperature scale selector, firing program review and preprogrammed cone tables having the following characteristics:
      a. Delayed firing start controls: Delay up to 99 hours, 99 minutes.
      b. Adjustable temperature alarm.
      c. Cone firing mode: Programmable by Cone Number with cone range of Cone 022 to Cone 10.
      d. Ramp/hold mode: Manual entry by temperature, allowing creation of custom programs from 1 to 8 segments with ability to specify the rate of heating or cooling within each segment and optional hold feature up to a maximum temperature of 2400˚ Fahrenheit.
      e. Firing speeds: Slow, medium or fast settings for heating
      f. Memory capacity: Store up to six firing programs.
      g. Safety features: Power failure detection, thermocouple failure detection, microprocessor fault detection.

B. Kiln Venting System having the following characteristics and components:
   1. Materials: Stainless steel plenum, duct and blower housing.
   2. Power: 115 volt household current.
   3. Motor: 115 volt, 1.1 amp, 0.18 hp.
   4. Total airflow: 60 to 80 cfm.
   5. Provide 8 feet of 3 inch diameter flexible aluminum intake duct.
   6. Provide mounting plates for either floor mount or wall mounting allowing for field adjustment and drilling of mounting plate.
   7. Automatic control of kiln exhaust fan based on kiln operation.
   8. Provide fan proving switch for interlock to HVAC system.

C. Provide rough-in hardware, supports and connections, attachment devices, and accessories.

PART 3 - EXECUTION

1.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.

B. Verify clearances required for equipment.

C. Verify ventilation outlets, service connections, and supports are correct and in required location.

D. Verify that electric power is available and of the correct characteristics.

E. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

A. Install each product in accordance with manufacturers' instructions.

B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

C. Anchor equipment using standard devices provided by the manufacturer appropriate for equipment, substrate and expected usage.

3.3 ADJUSTING

A. Adjust work under provisions of Section 01 73 00 - EXECUTION. Adjust equipment and apparatus to ensure proper working order and conditions.

End of Section

Section 12 24 00
WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the following:
   1. Chain driven manually operated or motorized roller-screen system with vinyl-coated glass fiber fabric for interior shading, and AV blackout including all supplementary items required for shade installation.
      a. Provide manually operated roller-screens at exterior windows.
      b. Provide manually operated blackout roller-screens where indicated.
      c. Provide motorized roller-screens with low voltage option output for control from local sound rack where indicated.
      d. Provide shades at all exterior windows, except as otherwise specified herein below, refer to plans, interior and exterior elevations for sizes. Field verify all openings.
      e. Do not provide shades at the following locations:
         1) All corridors, stairs, gymnasium and vestibules.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 06 10 00 - ROUGH CARPENTRY: Blocking for window shade systems.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
   1. NFPA 701 - Standard Methods of Fire Tests for Flame-resistance Textiles and Films.
   2. UL 214 - Standard for Tests for Flame Propagation of Fabrics and Films.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:
   1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 PERFORMANCE REQUIREMENTS

A. Fire performance characteristics; shade material tested in accordance with NFPA 701- Vertical Burn Test, rated “FR”.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
    a. Provide additional information required for fabric, including: Size limitations, fire resistance information. Identify available shade cloth colors and materials.
2. Maintenance Information: Fabric maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
4. Certifications:
    a. Manufacturer shall submit notarized certificate indicating compliance with requirements of specifications and that specified warranty will be provided without restriction.
    b. Certification of compliance with current building code and environmental regulations: Manufacturer shall certify that materials proposed for use comply with applicable building code and environmental regulations.
5. Shop drawings:
    a. Dimensioned 1/4 inch scale drawings, bearing dimensions of actual measurements taken at the project, where practical.
    b. Include complete fabrication details and erection drawings.
6. Selection Samples:
    a. 3 by 5 inch size shade cloth and liner sample swatches indicating Manufacturer's full range of colors and patterns available for initial selection.
    b. Provide additional shade cloth and liner samples, of size requested by Architect, to aid in the Architect’s selection.
7. Verification Samples:
    a. 12 by 12 inch samples of blind fabric illustrating material and color.
    b. 12 inch lengths of roller assembly.
8. Sustainable Design Submittals: As required by NE CHPS.

1.6 QUALITY ASSURANCE

A. Obtain shade operators and fabric products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of operator.

B. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

C. Provide 6 separate full size classroom mock-ups of different fabric color and density for review and approval by architect prior to installation. Coordinate locations of mockup with architect prior to installation.

1.7 QUALIFICATIONS

A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Do not deliver shades to the project until all concrete, masonry, plaster and other wet work has been completed and is dry.

C. Deliver prefabricated shades to site in labeled protective packages, uniquely identified for each intended location. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.

D. Store materials in manner recommended by shade manufacturer, inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

E. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of window shades, and maintain until Owner’s Final Acceptance.

1.9 FIELD MEASUREMENTS

A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.10 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 WARRANTY

A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

B. Manual operating components: Manufacturer’s 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provisions that installation shall remain operational without fault and include all operating parts, except for the bead chain which is not warranted.

C. Shade cloth: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provision that shade cloth will not fade, deteriorate, sag or warp for the warranty period.

1.12 EXTRA MATERIALS

A. Provide to Owner, 1 percent extra shade fabric for each size, color and type installed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on products from Draper Shade and Screen Co., Spiceland IN as follows:

1. Typical shades: Draper, product: "FlexShade" shades, manually operated.
2. Dual roller shades: Draper, product: "Dual Roller FlexShade" shades, manually operated.
3. Blackout shades: Science prep, Science classrooms, Art Computer Lab, Drama Theater Classroom, Language Laboratory and Project Team Rooms (where indicated): Draper, product: "Lightbloc" shades, manually operated.
4. Blackout shades: Lecture Hall: Draper, product: "Lightbloc" shades, electrically operated with Draper "Intelliflex" control system.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Draper Shade and Screen Co., Spiceland, IN.
2. Levolar Corporation, Sunnyvale, CA.
3. MechoShade, Long Island City, NY.

2.2 SHADE COMPONENTS

A. Rollers: Removable, 1-1/2 inch or larger diameter, extruded aluminum alloy 6063-T5 or alloy 6063-T6 tube with a minimum wall thickness of 0.065 inch.

1. Shade mounting spline: Extruded vinyl spline, enabling shade cloth to be removed without having to remove the tube from retainer brackets or without removing brackets from wall
2. Tube Support: Delrin cover plate shall provide protection from tube dislocation. In the event the tube is pushed out of place, the delrin end of the mounting plates shall contain the tube preventing the tube from falling out of the bracket.

B. Mounting Brackets: Zinc chromate finished 16 gage steel in manufacturer's standard configuration for head or wall mounting.

C. Roller idler assembly: Type 6/6 injected molded nylon or high-strength glass-fiber - reinforced polyester outside sleeve, with zinc plated steel pin.

D. Typical shade fabric: 63 percent PVC coated fiberglass and 37 percent fiberglass yarn, woven into a 2 inch by 2 inch non-directional basket weave with Microban

Protection. Draper Series: SW 2000 or approved equal meeting the following minimal requirements:

1. Openness Factor: 5 percent in accordance with ASHRAE 74.
2. Minimum weight: 14.26 ounces per square yard.
3. Minimum thickness: 0.019 inch.
4. Flame retardant treated certified in conformance with NFPA 701 and UL 214.
5. Color: As selected by Architect from full manufacturer's available range.
6. Seamless up to 72 inch width.
7. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
8. Locations: All North oriented openings scheduled or indicated to receive work of this Section.

E. Typical shade fabric: 63 percent PVC coated fiberglass and 37 percent fiberglass yarn, woven into a 2 inch by 2 inch non-directional basket weave with Microban Protection. Draper Series: SW 2400 or approved equal meeting the following minimal requirements:

1. Openness Factor: 3 percent in accordance with ASHRAE 74.
2. Minimum weight: 14.26 ounces per square yard.
3. Minimum thickness: 0.019 inch.
4. Flame retardant treated certified in conformance with NFPA 701 and UL 214.
5. Color: As selected by Architect from full manufacturer's available range.
6. Seamless up to 72 inch width.
7. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
8. Locations: All South, East, and West oriented openings scheduled or indicated to receive work of this Section.

F. Blackout shade fabric: Glass-fiber yarn coated with vinyl, close woven. Draper Series: SB9100 or approved equal meeting the following minimal requirements:

1. Minimum weight: 12 ounces per square yard.
2. Minimum thickness: 0.013 inch.
3. Flame retardant treated certified in conformance with NFPA 701 and UL 214.
4. Maximum open in weave: 0 percent.
5. Color: As selected by Architect from full manufacturer's available range.
6. Seamless up to 72 inch width.
7. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.

2.3 MANUAL OPERATION

A. General: Bi-directional clutch and beaded chain mechanism with adjustable brake to permit dynamic mode with predetermined stop positions or, static mode with infinite stop positions.

1. Sprocket: One piece injection molded high density Delrin, capable of full engagement with ball chain.

2. Control loop chain shall endless nickel-plated brass bead chain; plastic bead chain is not acceptable.
3. Brake mount: Shake-proof steel and nylon vibration-resistant locking nut to maintain selected braking friction
4. Self-Adjusting linear disc brake (flat steel backing plate is not acceptable as a substitution) with concealed tension adjustment device.
    a. System shall consist of a compression spring with two friction-absorbing nylon washers on a 1/4" steel shaft which provides continuous uniform compensating brake pressure on the one-piece sprocket brake drive component with a braking surface of not less than 2.89 square inches.
    b. Provide a compression spring which also acts as a vibration absorber.
5. Flexible offset drive, where required, with universal joint permitting up to 12 degree angle between any two shades with a single operator.

2.4 ELECTRIC OPERATION

A. Motor: 110 VAC, single phase, 60 HZ, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches. Tubular motor concealed inside each shade roller tube.
    1. Controls: Equal to Draper “Intelliflex Wall Switches” low voltage switch to provide control via bus cable or dry contacts.

2.5 MOUNTING SYSTEM

A. Mounting: Wall, jamb, or overhead mounted as indicated, brackets made of 1/8 inch sheet steel to which drive assembly, idle end assembly and center support systems are attached.
    1. Furnish center support brackets to meet span or weight requirements.
    2. Components of brackets shall be interchangeable or replaced without removing bracket from wall or ceiling, inside or outside mount.
    3. Metal support brackets cadmium plated steel. Custom color as selected by the Architect.

2.6 ACCESSORIES

A. Fascia: One-piece extruded aluminum 6063-T5 alloy with average thickness of 0.062 inches, snap-loc clipped to the brackets without the use of glue, magnetic strip or screws, concealed fastening.

B. Black-out side and sill channels; extruded aluminum with polybond edge seals, and snap-loc mounting brackets;
    1. Manual shade jamb channels, 1-15/16 inched wide by 1-3/16 inches deep; double jamb channels 2-5/8 inches wide by 1-3/16 inches deep.
    2. Electric shade jamb channels, 2-1/2 inches wide by 1-3/16 inches deep; double jamb channels 5 inches wide by 1-3/16 inches deep.

C. Recessed housing, for acoustical plaster ceilings with removable closure plate for access.

D. Guide cables provide where recommended by manufacturer.

2.7 FABRICATION

A. Fabrication: Fabricate units to completely fill existing openings, from head-to-sill and jamb-to-jamb. Do not commence fabrication of shade units until field measurements are confirmed.

B. Fabric shall hang straight and flat without buckling or distortion. Fabric edges shall be straight and without ravels.

2.8 FACTORY FINISHES

A. Aluminum: PPG Duracron baked enamel in standard colors.

B. Steel parts, cadmium plated, satin finished, or bonderized prior to painting with baked enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Ensure that supporting substrate is adequate.

B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

A. Install units to comply with manufacturer's instructions for type of mountings and operations required. Provide units plumb and true, securely anchored in place with recommended hardware and accessories to provide smooth, easy operation.

3.3 TOLERANCES

A. Maximum variation of gap at window opening perimeter: 1/4 inch.

B. Maximum offset from level:1/8 inch.

3.4 ADJUSTING

A. Adjust units for smooth operation. Replace any units or components which do not operate smoothly and without hindrance.

End of Section

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Section 12 30 00
CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This section specifies all work and materials for manufactured casework of types and sizes shown on the Drawings, as specified herein, and as required for a complete and proper installation.

B. Furnish and install the following:

1. Wood veneer base and wall cabinets and including wiring troughs, aluminum linear bar grilles, filler panels, rigid insulation, and blank electrical boxes and other accessories as needed for a complete and proper installation.
2. Shelving systems including metal supports.
3. Plastic laminate countertops and splashes, for casework provided under this Section 12 30 00 where indicated.
    a. Provide back and side splashes at countertops abutting wall construction and return to edge of countertop at all conditions.
    b. Provide edge banding at all plastic laminate countertops unless otherwise indicated.
    c. Provide PVC edge banding at all plastic laminate countertops unless otherwise indicated.
    d. Provide extruded aluminum “T” trim where indicated on Drawings.
4. Epoxy resin laboratory shelving countertops with splashes and integral sinks where indicated.
    a. Resin sinks and basins including overflows, plugs, strainers and tailpieces that occur above the floor and required for mounting in the equipment. Furnish fittings unattached and unassembled, properly tagged and identified with installation information.
    b. Provide back and side splashes at countertops abutting wall construction and return to edge of countertop at all conditions.
5. Stainless Steel countertops and backsplashes.
6. Science area plumbing and gas fixtures and fittings, including
    a. Nipples and locknuts, required for mounting in or on the equipment.
    b. All fixtures delivered unattached and unassembled, properly tagged and identified with installation information.

C. Place. install and build-in, as work progresses, the following products and materials furnished under the indicated Sections:

1. Countertop support brackets furnished by Section 06 20 00 – FINISH CARPENTRY.

D. Make all cutouts within casework items to accommodate sinks, piping, conduit, and other mechanical and electrical work, from templates provided by the respective mechanical and electrical trades.

E. Furnish and provide all materials and services as may be additional or separately described under other Sections of this Specification.

1. No attempt is made in this Section to list all elements of casework required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

F. Remove all debris, dirt and rubbish accumulated as a result of this installation, and leave the premises clean and ready for use. This shall include cleaning equipment interiors, exteriors, and worktops.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 06 40 00 - ARCHITECTURAL WOODWORK:

1. Custom casework.
2. Plastic laminate countertops for work under Section 06 40 00.

E. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: 4-inch vinyl base installed in toe space.

F. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING: Return air ductwork.

G. Division 26 - ELECTRICAL: All electrical work related to items in this Section.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with

other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board.
2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM D523 - Standard Test Method for Specular Gloss.
4. ASTM D1037 – Standard Test Methods of Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
6. AWI (Architectural Woodwork Institute) Quality Standards, Eighth Edition.
7. FSC (Forest Stewardship Council): “FSC Certification Program”.
8. APA Grades and Specifications.
9. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
10. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
    a. PS-1 - Construction and Industrial Plywood Standard.
    b. PS-20 - American Softwood Lumber Standard.
11. Scientific Equipment and Furniture Association: SEFA 8 Standards – Wood Casework.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

C. Definitions:

1. “Barrel Hinge” is a hinge composed of two plates attached that are attached to abutting surface.
2. “Concealed hinge” is any hinge that has no components visible from the outside of the cabinet.
3. “Concealed Portions of Casework” surfaces that are not visible after installation; Bottoms of cabinets that are less than 24 inches above finished floor; Tops of cabinets that are 80 inches or more above finished floor (and are not visible from an upper level); Stretchers, blocking and/or components that are concealed by drawers; Corners that are created by tall, wall, or base cabinets and shall be considered concealed.

4. “Exposed surfaces” are surfaces that are visible when: Drawer fronts and doors are closed; Cabinets and shelving are open; Bottoms of cabinets are seen 42 inches or more above the finished floor; Tops of cabinets that are below 80 inches above finished floor, or are visible from an upper floor or raised area after installation.
5. "False Fronts" are nonfunctional fronts attached to particular units that mimic drawer box fronts to create an uninterrupted visual image of an elevation.
6. “FSC” is the term used for Forest Stewardship Council, required to achieve the NE-CHPS credit for certified wood.
7. “Full Flush Overlay” is casework design that requires the AWI reveal of 1/8” between all individual door and drawer components within a cabinet. There is a 1/16” reveal at the edge of door and drawer components to the edge of the cabinet to maintain a 1/8 reveal on adjacent cabinets.
8. “Laboratory Casework Contractor/Manufacturer” is defined as the manufacturer and/or manufacturer’s representative that is to provide and install the laboratory casework, equipment, and accessories listed under the specifications, laboratory equipment schedule and/or illustrated on drawings.
9. “NAUF” is the term used for “no added urea formaldehyde”. This is required when no part of the wood product or any product on the entire can contain added urea formaldehyde in the production of the products. This is critical to NE-CHPS point criteria.
10. “Square edge” is a 90 degree angle with an eased edge on the door and drawer front. Square edge requires the adjusting of the drawer head to align the individual cabinets in an elevation (during installation).
11. “Reveal” is the measurement between individual door and drawer components on the face of a cabinet.
12. “Semi-exposed” surfaces that are visible when: Opaque doors are open or drawers are extended on door/drawer combination cabinets; Bottoms of cabinets more than 24 inches and less than 42 inches above finished floor.
13. “Service Fixtures” are laboratory gas, air, and vacuum cocks; hot, cold and reagent water faucets; remote control valves, electrical receptacles (with necessary flush mounting hardware), fluorescent and/or incandescent light fixtures , light switches and/or motor switches for fume hoods and other items which serve as an operational part of the equipment.
14. “Service Lines” are the necessary piping and drain lines for laboratory gas, air and vacuum as well as hot, cold and reagent grade water that conveys the respective services from building roughing through floors or walls through equipment to the previously defined service fixtures. Also includes conduits, junction boxes, conduit fittings, wire disconnect switches and fuse or circuit breakers necessary to conduct electrical services from building roughing in floors or walls through equipment to service fixtures.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner or designated representative, Architect, General Contractor, Casework Installer's Project Superintendent, casework manufacturer's representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:

a. Division 22 - PLUMBING.

2. Agenda:

a. Scheduling of casework operations.

b. Review of site access, use, staging and material storage locations.

c. Coordination of work by other trades.

d. Installation procedures for ancillary equipment.

e. Substrate conditions.

f. Protection of completed Work.

g. Establish weather and working temperature conditions to which Architect and Contractor must agree.

h. Emergency rain protection procedures.

i. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

C. Sequencing:

1. Field dimensions: The casework vendor is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.

a. The Contractor shall acknowledge the casework vendor's need for accurate field dimensions prior to custom fabrication.

b. The Contractor and the casework vendors shall cooperate to establish and maintain these field dimensions.

c. The casework vendor shall verify confirm all dimensions at the Project site relative to casework, all, and bring any significant discrepancies to the attention of the Architect prior to casework fabrication.

2. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
2. Materials schedule: A complete schedule of casework components, coordinated with the Contract Drawings.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
4. Selection samples:
    a. Plastic laminate chips for initial color selection by Architect.
    b. Sample card indicating Manufacturer's full range of wood veneer stains, colors of laminate, edging or other surfacing material, available for selection by Architect.
    c. Provide additional samples as requested by Architect for initial selection of colors and finishes.
5. Verification samples:
    a. Complete stained and finished sample base cabinet unit of each type specified, 24 inches wide, with countertop and at least one door with specified hardware including lock, and one drawer with specified hardware and slide. Sample shall show full construction of all joints in casework and sample joint in worktop. Reviewed and accepted sample will be used for the purpose for establishing a quality control standard, and may not be incorporated into the work.
    b. Sample of each type of hardware in specified finish.
6. Test data on chemical resistance of plastic laminate, and wood finish.
7. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
    a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC standards.
        1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor’s chain of custody number and identify each chain of custody certified product on a line-item basis. A “vendor” is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
    b. Composite Wood and Agrifiber Products: Include certification indicating compliance with the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale

Environmental Chambers, including 2004 Addenda for all composite wood and agrifiber products.

8. Sustainable Design Submittals: As required by NE CHPS.

1.6 QUALITY ASSURANCE

A. Quality Standards:

1. Quality Standards: All materials, workmanship and finishes shall meet AWI/AWMAC/WI *NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS* (NAAWS), version 3.1, as amended by published errata, for the following Quality Grades:

a. All work to receive transparent finishes: Premium Grade.

b. All plastic laminated cabinetry work: Premium grade.

c. Plastic laminated countertops: Custom grade.

2. Structural Integrity, Comply with Scientific Equipment and Furniture Association SEFA 8 Standards – Wood Casework Standards, except where specifically specified otherwise.

B. Sustainability Standards Certifications:

1. Chain of Custody wood products: All wood products furnished under this Specification Section shall be “FSC certified” according to the rules of the Forest Stewardship Council (FSC).

a. FSC Certification includes the following certification bodies of forests and forest products:

1) Certification Systems.

2) SmartWood.

3) SGS Qualifor.

4) Soil Association.

b. Wood products lacking acceptable documentation for chain of custody will be rejected and their removal required.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. General: The casework manufacturer, casework installer and the Contractor are jointly responsible to make certain that manufactured casework is not delivered until the building and storage areas are sufficiently dry so that the casework will not be damaged by excessive changes in ambient humidity and relative moisture content. As a minimum, the following site conditions are required prior to delivery of casework on Site:

a. Building must be enclosed (windows and doors sealed and weather-tight);

b. Concrete, masonry, plaster, veneer plaster, tile, terrazzzo, stone setting/polishing and other similar wet work shall be completed and dry before delivery, storage and installation of casework items.

c. Painting, utility rough-ins and related activities shall be completed where casework is to be installed.

d. Ceiling, overhead ductwork and lighting must be installed; where casework is to be installed.

e. An operational HVAC system that maintains temperature and humidity at prescribed levels must be in place; Relative humidity must be regulated and stable as specified under “SITE CONDITIONS” before products are brought on site, and maintained through Project Substantial Completion and Owner Occupancy.

f. NOTE: In the event that any of the specified requirements for installation are not present at the time of requested delivery, the General Contractor, Construction Manager, or Owner must provide the casework manufacturer with a letter of deviation that releases the manufacturer from any responsibility or liability from any damage to the products resulting from the unfavorable building conditions.

2. Deliver materials under protective cover.

3. Sequence deliveries to avoid delays and to minimize on-site storage.

B. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable an recyclable.

2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

C. Storage and Handling Requirements:

1. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

D. Protection: Use all means necessary to protect materials of this Section during transition, before, during, and after installation and to protect installed work and materials of all other trades.

1. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes.

2. Delivery of the casework should only take place after painting, utility rough-ins and related activities are completed that could otherwise damage, soil or deteriorate casework in installation areas.

3. Acceptance at Site: Casework will not be delivered or installed until the conditions specified under Part 3, Installation section of this document have been met.

E. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect, at no change in Contract Sum.

F. Damaged material: Remove all damaged materials from job site immediately, unless Architect specifically authorizes correction thereof and usage on project.

1.8 SITE CONDITIONS

A. Temperature: Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, and during installation of architectural woodwork; maintain temperature after installation until Owner's Final Acceptance.

B. Relative Humidity: Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, and during, installation of architectural woodwork: maintain relative humidity after installation until Owner's Final Acceptance.

1.9 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

1. Warranties shall be effective starting from Date of Project Substantial Completion and are effective for specified term lengths.

B. Manufacturer Warranty:

1. Furnish a written warranty that Work performed under this Section shall remain free from defects as to materials and workmanship for a period of three (3) years from date of acceptance. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner. Defects include, but are not limited to:

a. Ruptured, cracked, or peeling veneer

b. Discoloration or lack of finish integrity

c. De-lamination of components or edge banding.

d. Slippage, shift, or failure of attachment to wall, floor, or ceiling

e. Warping or unloaded deflection of components

f. Failure of hardware.

2. The warranty specifically does not cover any product or hardware, which has been incorrectly installed, including poor climate conditions, exposed to excessive loads or abuse.

3. The warranty is in effect while the product is being used as it was intended and owned by the original purchaser of the products and services covered.
4. All non-casework items supplied, but not manufactured at the casework manufacturers factory location shall be covered under the original manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Casework specified manufacturer (wood veneer base and wall cabinets): To establish a standard of quality, design and function desired, Drawings and specifications have been based on CiF Lab Solutions, Vaughan, ON, by NEIS. production line modular casework. Manufacturer's that are listed as basis of design or approved equilavents are obligated to hold ALL specification requirements as called out in this document.

1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   a. CiF Lab Solutions, Vaughan, ON, by NEIS. (Basis of Design).
   b. Kewaunee Scientific Corporation, Statesville, NC.
   c. Diversified Casework, Suring, WI.

2.2 SYSTEM DESCRIPTION

A. General Cabinetry: Full Flush overlay with 1/8" reveal between intra-cabinet doors and drawers and 1/16" reveal at cabinet edge for offset of the hinge around the door and 1/8" reveal on adjacent cabinets. All door and drawer fronts will be adjusted to maintain these tolerances.

1. Particleboard for cabinet construction is not acceptable.
2. No exposed fasteners are allowed without prior approval of the Architect.
3. Cabinet elevations will be built in symmetrical sizes as required to fill the area.
4. Maximum filler size is 4 inches and must be balanced and on each end of wall to wall elevations.
5. Doors and drawer fronts are to be slightly eased at all edges.
6. Banded edges (cabinet faces, frames, end panels, tops, bottoms and shelving): Band all exposed edges with stick stock 5mm hardwood Edge banding. 3mm rolled edge banding is not acceptable.

B. Performance Requirements for Cabinet Finishes::

1. Performance Tests: Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4" dia. watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton

ball saturated with reagent on the surface to be tested and covering with an inverted 2-ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77° ±3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

2. Test Evaluation: Evaluation shall be based on the following rating system:
   a. Level 0 – No detectable change.
   b. Level 1 – Slight change in color or gloss.
   c. Level 2 – Slight surface etching or severe staining.
   d. Level 3 – Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.
   e. After testing, panel shall show no more than three (3) Level 3 conditions.
3. Reagents Used:

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	Cotton ball & bottle
2.	Acetate, Ethyl	Cotton ball & bottle
3.	Acetic Acid, 98%	Watch glass
4.	Actetone	Cotton ball & bottle
5.	Acid Dichromate, 5%.	Watch glass
6.	Alcohol, Butyl	Cotton ball & bottle
7.	Alcohol, Ethyl	Cotton ball & bottle
8.	Alcohol, Methyl	Cotton ball & bottle
9.	Ammonium Hydroxide, 28%	Watch glass
10.	Benzene	Cotton ball & bottle
11.	Carbon Tetrachloride	Cotton ball & bottle
12.	Chloroform.	Cotton ball & bottle
13.	Chromic Acid, 60%.	Watch glass
14.	Cresol	Cotton ball & bottle
15.	Dichlor Acetic Acid	Cotton ball & bottle

16.	Dimethylformanide	Cotton ball & bottle
17.	Dioxane	Cotton ball & bottle
18.	Ethyl Ether	Cotton ball & bottle
19.	Formaldehyde, 37%	Cotton ball & bottle
20.	Formic Acid, 90%	Watch glass
21.	Furfural	Cotton ball & bottle
22.	Gasoline	Cotton ball & bottle
23.	Hydrochloric Acid, 37%	Watch glass
24.	Hydrochloric Acid, 48%	Watch glass
25.	Hydrogen Peroxide, 3%	Watch glass
26.	Iodine, Tincture of	Watch glass
27.	Methyl Ethyl Ketone	Cotton ball & bottle
28.	Methylene Chloride	Cotton ball & bottle
29.	Mono Chlorobenzene	Cotton ball & bottle
30.	Naphthalene	Cotton ball & bottle
31.	Nitric Acid, 20%	Watch glass
32.	Nitric Acid, 30%	Watch glass
33.	Nitric Acid, 70%	Watch glass
34.	Phenol, 90%	Cotton ball & bottle
35.	Phosphoric Acid, 85%	Watch glass
36.	Silver Nitrate, Saturated	Watch glass
37.	Sodium Hydroxide, 10%	Watch glass
38.	Sodium Hydroxide, 20%	Watch glass
39.	Sodium Hydroxide, 40%	Watch glass
40.	Sodium Hydroxide, Flake	Watch glass
41.	Sodium Sulfide, Saturated	Watch glass
42.	Sulfuric Acid, 33%	Watch glass
43.	Sulfuric Acid, 77%	Watch glass
44.	Sulfuric Acid, 96%	Watch glass
45.	Sulfuric Acid, 77% and Nitric Acid 70% equal parts	Watch glass
46.	Toluene	Cotton ball & bottle

47.	Trichloroethylene	Cotton ball & bottle
48.	Xylene	Cotton ball & bottle
49.	Zinc Chloride, Saturated	Watch glass

* Where concentrations are indicated, percentages are by weight.

4. Heat resistance: Hot water (190° F to 205° F) shall be allowed to trickle (with a steady stream at a rate not less than 6 ounces per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.
5. Moisture resistance: A cellulose sponge (2 inch by 3 inch by 1) shall be soaked with water and placed on the finished surface for a period of 100 hours. The sponge shall be maintained in a wet condition throughout the entire test period. At the end of the test period, the surface shall be dried and no visible effect shall be shown on the finish.
6. Impact resistance: A one-pound ball (approximately 2" diameter) shall be dropped from a distance of 12 inches onto the finished surface of a 3/4" thick plywood panel supported underneath by a solid surface and onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close eye-ball examination.

C. Sustainability Cabinet and Casework Area Design: (NE-CHPS certification requirements): Cabinet and all components included in this section are subject to specific NE CHPS, Owner’s and Architect’s requirements for environmental and or health goals. The owner requires that all manufacturers follow the criteria required for NE CHPS certification, which includes:

1. Certification of recycled content.
2. Chain-of-Custody Certification of wood products (FSC).
3. Certification of all composite wood and agrifiber products.
4. Certification of VOC’s compliance for field-applied sealants and adhesives.

2.3 CASEWORK MATERIALS

A. Wood materials:

1. General Requirements: In general, all materials shall be the best of their respective kinds for the purpose intended and all methods used in construction shall conform to the best practices of the Scientific Equipment and Furniture Association, including any specialized materials required.
   a. Sustainable Forest Certification: All wood shall be “Chain-of-Custody” certified as FSC Certified.
   b. Woods Used: All woods shall be carefully and thoroughly air-dried, then kiln dried by the manufacturer in his own humidity-controlled kilns to a moisture content of 4-1/2 percent. All kiln dried lumber shall then be

tempered to a moisture content of 6 percent before use. This moisture content shall be maintained throughout production.

c. Exposed Surfaces: All exterior casework surfaces exposed to view after installation, and the exposed interior ends, top and bottom of open cases shall be AA grade, plain sliced slip matched. Backs shall be printed hardboard finished to match interior. The solid woods used for all surfaces exposed to view after completion of installation shall be clear, with color and graining in conformance with the normally accepted standards. The finished installation must provide an attractive and harmonious appearance.

d. Direction of wood grain: Vertical grain match on door and drawer faces, end panels and exposed backs, drawer faces, aprons and top rails unless otherwise selected by Architect.

2. Wood Species: White Maple (Acer saccharum), Plain Sliced.

a. Exposed wood scheduled for transparent finish, meeting NAAWS Premium Grade Standards (as installed).

3. Exposed Plywood: Plywood shall be minimum 7-ply (3/4 inch) veneer core plywood or 7-ply (3/4 inch) combination core plywood and shall be compliant with ANSI/HPVA HP-1 2004 with White Maple veneer.

a. Exposed surface: 1/45 inch thickness veneer of highest grade hardwood selected as to grain and color.

4. Hardboard meeting or exceeding Commercial Standards CS 251 and Federal Specifications LLL-B-00810. Tempered hardboard 1/4 inch thick - smooth both sides.

5. Fiberboard to be of uniform density and meet the following minimum standards:

a.	Screw Holding, Face	355 lbs.
b.	Screw Holding, Edge	300 lbs.
c.	Modulus of Rupture	4,500 psi.
d.	Modulus of Elasticity	500,000 psi.
e.	Internal Bond	100 psi.

6. Framing and blocking at mechanical grille enclosures: Nominal 2x framing, American Softwood Lumber Standard PS 20-70 and with specific grading requirements of SPIB: Kiln dried (KD15), Structural Light Framing, Nº. 2 grade, free of warping and large knots.

B. Stainless Steel for countertops and splashes: Alloy 18-8, Type 302/304 in accordance with AISS Specifications. All exposed surfaces except as otherwise noted shall be finished with No. 4 satin finish.

2.4 CASEWORK CONSTRUCTION, GENERAL

A. General: The cabinet shall be radius lip, semi-overlay. The door and drawer fronts shall occupy a plane extending 5/16 inch past the plane of the front of the cabinet body. Edges of door and drawer fronts shall be radiused. All cabinet end panels shall be finished for the purpose of future relocation unless cabinet is selected with the “unfinished end” option. The exposed grain for doors shall run vertical; exposed grain for drawer fronts shall run horizontal unless otherwise selected by the Architect.

1. Quantities, sizes and configurations as shown on Drawings.
2. Joint construction:
    a. Blind, not extended to faces of cabinets.
    b. Acceptable joinery methods: multiple dowel or stopped tongue and groove.
    c. Reinforcement: Screws, cleats, hot glue and stapled pins.
3. Drawer fronts and hinged doors are to overlay the cabinet body. Maintain a maximum 1/8 inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.

B. Base Cabinets:

1. End Panels, Bottoms and Shelves:
    a. All cabinet end panels shall be ¾ inch thick White Maple veneer core plywood edge banded on exposed edges. End panels shall be multiple doweled, glued, and screwed to top frame members, intermediate rails, and bottoms. Cupboard bottoms shall be ¾ inch thick White Maple veneer core plywood edge banded on exposed edge. All cupboard base cabinet shelves shall be full-width adjustable, ¾ inch thick White Maple veneer core plywood edge banded on exposed edge.
    b. Adjustable shelves shall be set on double pin, seismic plastic polycarbonate locking shelf supports at 1-1/4 inch spacing (32mm).
        1) Edge band all four edges of adjustable shelves, and front edge of fixed shelves.
        2) Shelves shall be full depth in standard cupboards and full depth in open units.
        3) Shelf Thickness:
            a) All shelving in open cabinets: 1 inch thick (regardless of cabinet size)
            b) Adjustable shelves in cabinets 36 inches width and smaller: 3/4 inch thick.
            c) Adjustable shelves in cabinets over 36 inch wide: 1 inch thick.
            d) Full height cabinets, fixed middle shelf shall be 1 inch thick (regardless of cabinet size).
    c. Integrally joined parts shall result in a totally enclosed cabinet

2. Backs:
    a. Cabinet backs shall be ¼ inch thick hardboard, dadoed into end panels and securely fastened to cabinet bottom and top panels. Backs that are attached to end panels with cleats shall not be acceptable.
3. Full Top Frame: The cabinet top frame shall consist of a front rail, a back rail and two side rails. The front rail shall be 3-1/8 inches by 1 inch hardwood with 3mm White Maple facing. The back rail shall be 2-1/2 inches by ¾ inch hardwood plywood. The side rails shall be 1-3/4 inch by ¾ inch hardwood and shall be screwed to end panels and front and back rails.
    a. Manufacturer's Alternative Stretcher Rail Construction in lieu of full top frame is also acceptable:
        1) "Cabinet top construction to be full stretcher frame consisting of the following:
        2) Front top horizontal rails shall be ¾'' x 3 ¾'' veneer core plywood with edge banding and fastened to cabinet ends with fluted dowels.
        3) Rear top vertical support rail to be ¾" x the drawer height plus 2" on cabinets with a drawer and ¾" x 3 ¾" on cupboard door cabinets. Rear bottom vertical support rail to be ¾" x 3 ¾" on all cabinets. All rear support rails to be fastened to cabinet ends with fluted dowels
4. Intermediate rails when specified shall be 3-1/4 inch by ¾ inch hardwood plywood with 1/8 inch thick White Maple facing on exposed edge. Rails shall be screwed to end panels. Intermediate rails shall be mounted at the front between the drawers and between all drawers and doors.
5. Drawers: Box construction, machine, squared and held under pressure while glued and pinned together.
    a. Drawer fronts (separate from the 4 sided box): 3/4 inch thick Combination core White Maple, glued dovetail joint.
        1) Drawer front will be affixed to drawer body by screws
    b. Drawer Construction: Drawer box back, front and sides to be of ½'' Baltic Birch, 9 ply hardwood plywood and shall be finished with the same laboratory grade finish as applied to the cabinet. Use dovetail joinery on all four joints. Drawer bottom shall be ¼'' white thermo-fused melamine faced MDF and shall be grooved into all four sides of the drawer box and glued into position. Drawer body will be affixed to drawer front by screws.
    c. Drawer Suspension: All drawer suspension assemblies shall be rated at 100 pounds. They shall consist of two sections providing a quiet, smooth operation on nylon rollers. Case channels shall maintain alignment of drawer and the drawer shall be removable without the use of tools.
6. Doors:
    a. Swinging doors: Swinging doors shall be 3/4 inch, White Maple, core banded combination core plywood, mounted on cabinet with 1 pair of offset hinges and shall be latched with a roller catch. Double doors shall have a roller catch on each door and a White Maple astragal mounted to the left-hand door. Each door shall have one pull mounted vertically.

Locks, when required on double doors, shall be mounted on the right-hand door.

7. Sink cabinets: Provide with supplementary sink mount supports.
8. Dimensions: Manufacturer's standard sizes unless otherwise indicated on Drawings.
    a. Heights of base cabinets are indicated on Drawings as height to finished countertop. Fabricator is responsible to coordinate fabrication height of base cabinets with thickness of the various countertop types.

C. Wall Cabinets:

1. All cabinet end panels shall be ¾ inch thick White Maple veneer core plywood edge banded on front and bottom edge. Tops and bottoms shall be 1 inch thick White Maple veneer core plywood edge banded on exposed edge, multiple doweled into end panels, and secured with glue and countersunk screws. Shelves shall be 1 inch thick White Maple veneer core plywood edge banded on exposed edge. Shelves shall be adjustable on 32mm centers utilizing shelf support clips. The backs in open and glazed door cases shall be ¼ inch White Maple composite or veneer core plywood while the back not exposed to view shall be ¼ inch hardboard. Case interior shall be flush.
2. Swinging Doors:
    a. Panel doors shall be 3/4", White Maple, core banded, combination core plywood. Each door shall have one pull mounted vertically.
    b. Doors shall latch with a roller catch. Double doors without locks shall have a roller catch on each door and a White Maple astragal mounted to the left-hand door. Double doors with locks shall have an elbow catch and White Maple astragal mounted to the left-hand door and the lock and a roller catch mounted on the right-hand door.
3. Dimensions: Manufacturer's standard sizes as indicated on Drawings.

D. Full Height Storage Cabinets:

1. All cabinet end panels shall be 3/4 inch thick White Maple veneer core plywood, edge banded on front edge. Tops shall be 1 inch thick White Maple veneer core plywood, edge banded on exposed edge, multiple doweled into end panels, secured with glue and countersunk screws. Shelves shall be 1 inch thick White Maple veneer core plywood, edge banded on exposed edge. To assure a completely rigid case, the center shelf shall be multiple doweled into end panels, secured with glue and countersunk screws. All other shelves shall be adjustable on 32mm centers utilizing shelf support clips.
2. Adjustable shelves shall be set on double pin, seismic plastic poly-carbonite locking shelf supports at 1-1/4 inch spacing (32mm).
    a. Edge band all four edges of adjustable shelves, and front edge of fixed shelves.
    b. Shelves shall be full depth in standard cupboards and full depth in open units.

c. Shelf Thickness:

1) All shelving in open cabinets: 1 inch thick (regardless of cabinet size)

2) Adjustable shelves in cabinets 36 inches width and smaller: 3/4 inch thick.

3) Adjustable shelves in cabinets over 36 inch wide: 1 inch thick.

4) Full height cabinets, fixed middle shelf shall be 1 inch thick (regardless of cabinet size).

3. Cabinet bottoms shall be 3/4 inch thick White Maple veneer core plywood, edge banded on exposed edge, multiple doweled and glued securely to end panels. A ¾ inch by 4 inch hardwood veneer core plywood toe space rail on 22 inch deep cabinets shall be offset 3 inches from face to form a 4 inch high totally enclosed toe space. 12 inch and 16 inch deep cabinets shall have a 3/4 inch by 4 inch hardwood veneer core plywood toe space rail mounted flush with the face of the cabinet. The backs in open and glazed door cabinets shall be 1/4 inch White Maple composite or veneer core plywood while the back not exposed to view shall be ¼ inch hardboard. Cabinet interior shall be flush.

4. Doors:

a. Panel doors shall be 3/4 inch, White Maple, core banded composite core plywood.

b. Each door shall be hung on 1-1/2 pair of offset hinges.

c. Doors shall latch with a roller catch. Double doors shall have an elbow catch and White Maple astragal on the left-hand door and a roller catch on the right hand door. Locks on double doors shall be mounted on the right-hand door.

5. Dimensions: Manufacturer’s standard sizes as indicated on Drawings.

E. Filler Panels: Flush panels fabricated from 3/4 inch White Maple plywood with sliced White Maple veneer to match adjacent casework; sizes as determined in field.

2.5 PLASTIC LAMINATE FACING

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Ralph Wilson Plastics Co. (Wilsonart), Temple TX.

2. Formica Corp., Cincinnati, OH.

3. Laminart, Elk Grove Village, IL.

4. Pioneer Plastics Corp. (Pionite), Auburn ME.

5. Nevamar Corp., Odenton MD.

B. Sole Source: Manufacturer for plastic laminate clad work of this Section shall be same as providing plastic laminate specified in Section 06 20 00 – FINISH CARPENTRY and Section 06 40 00 – ARCHITECTURAL WOODWORK.

C. Plastic laminate for countertops and backsplashes: General Purpose, Grade HGS high-pressure plastic laminate conforming to NEMA LD3.1 -2005 Grade HGS, nominal 1.2mm thickness ±.0.12mm, (0.048 inch, ±0.005 inches) in up to four (4) colors selected by the Architect from full range of manufacturer's price groups.

1. Performance criteria:
    a. Wear Resistance (cycles): 400 minimum.
    b. Ball impact resistance: 1,250 mm minimum.
    c. Dart impact resistance: 500 mm minimum.
    d. Boiling Water Resistance: No effect.
    e. High Temperature Resistance: Slight effect.
    f. Radiant Heat Resistance (coil method): 125 seconds minimum.
    g. Stain Resistance 1-10 : No effect.
    h. Light Resistance: Slight effect.

D. Plastic laminate for back panels of open cabinets: General Purpose, Grade VGP conforming to NEMA LD3-2005 Grade VGP, nominal 0.71 mm, plus 0.03 mm, minus 0.004 mm (nominal 0.028 inch, +0.001 and -0.004 inch) thickness, in up to ten (10) standard matte finish colors selected by the Architect from full range of manufacturer's price groups.

1. Performance criteria:
    a. Wear Resistance (cycles): 400 minimum.
    b. Ball impact resistance: 1,250 mm minimum.
    c. Dart impact resistance: 500 mm minimum.
    d. Boiling Water Resistance: Slight effect.
    e. High Temperature Resistance: Slight effect.
    f. Radiant Heat Resistance (coil method): 805 seconds minimum.
    g. Stain Resistance 1-10 : No effect.
    h. Light Resistance: Slight effect.

E. Countertop backing: EWA C-C PLUGGED EXT, fir plywood, sanded.

F. Adhesive for installation of plastic laminate: Rigid bond polyvinyl acetate (PVA) type only. Contact cements are only permitted at countertops with sinks or similar "wet condition" areas.

G. Plastic Laminate Colors and patterns as scheduled on Drawings or as subsequently selected by Architect.

2.6 STAINLESS STEEL COUNTERTOPS AND BACKSPLASHES

A. Stainless steel: ASTM A 167, non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy) polished to a Nº 4, brushed finish to all exposed to view surfaces, except where specified otherwise.

1. Countertops and splashes: 14 gauge throughout.

B. Countertops: One piece, where practicable, with welded corners, channel shaped exposed edges and reinforced with three (3) full length hat shaped galvanized channels. Back and/or end splashes shall be integral with top and coved at point of turn up to a 3/8 inch radius. After fabrication, a moisture proof sound deadening mastic shall be applied to the underside of the top.

C. Fabrication:

1. Fabricate each product in accordance with NSF recommended guidelines.
2. Shop assemble work where possible. Fabricate units to accommodate for site installation of other services or equipment.
3. Fabricate sheet material for work surfaces, of straight lengths in one continuous sheet when less than12 feet in length. Weld metal joints for lengths over 12 feet. When counters are constructed of more than one piece, they shall be continuously butt-welded, ground and polished smooth.
4. Weld and form edges, ends, and joints, weld by electric process, with all welded joints ground and polished smooth. Perform all welding so that no mark of any kind shall be noticed on top of finished surfaces. Welds and adjoining components shall be homogenous, non-porous, free from pits, cracks, imperfections or discoloration.
5. Hammer and peen flush with adjoining surface wherever materials have been depressed or sunken by a welding operation, and, if necessary re-weld and grind to eliminate low spots.
6. Excessive distortions caused by welding will not be acceptable and shall be cause for rejection and removal from Site.
7. Exercise care in grinding operations to avoid excessive heating of metal and discoloration. Use iron-free abrasives, wheels and belts on stainless steel; do not use the same abrasives, wheels or belts for both steel and stainless steel. Provide a uniform and smooth final polishing with a uni-direction grain for total length of materials. Cross grains and random polishing will not be acceptable and shall be cause for rejection.
8. Provide a general finish consistent throughout the work of this Section.
9. Brake ends free of open texture or orange peel appearance. Where brake work mars the finish of the materials, remove marks by grinding, polishing and finishing.
10. Shear edges free of burrs, projection or fins to eliminate all danger of laceration.

11. Neatly finish mitre joints and bullnosed corners with under edge of the material neatly ground to a uniform condition and in no case will overlapping materials be acceptable.
12. Marine edge: bumped up 1/2 inch at 45 degrees and turned down 1-1/2 inch and in 1/2 inch at 45 degrees, corners welded and square.
13. Backsplash (standard): Cove up backsplash 4 inches, turned back to wall 1-1/2 inches at 45 degrees and turned down 1/2-inch.
    a. Coat the underside of all sink basins with a sound deadening material, applied in a manner that no dirt or debris will collect or adhere thereto, and the surface shall be non-absorbent and easily cleanable.

2.7 EPOXY RESIN COUNTERTOPS AND BACKSPLASHES

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. The Durcon Company, Inc., Austin, TX.
   2. American Epoxy Scientific, Mountain Home, AR.
   3. Kewaunee Scientific Equipment Corporation, Statesville NC.

B. Countertops: 1 inch thick molded modified epoxy resin tops that has been especially compounded, oven cured and possess high resistance to mechanical and thermal shock.
   1. Tops shall be a uniform mixture throughout their full thickness and not depend upon a surface coating for chemical or stain resistance.
   2. Countertops 10 feet or less in length shall be seamless. When length of top exceeds 10 feet, seams may be provided parallel to the short dimension (Locate as shown on reviewed and accepted shop drawings). Limit seams to absolute minimum number.
   3. Color: Equal to Durcon's "Graphite" or as otherwise selected by the Architect from full range of available colors.
   4. Sealant, for joints between countertops and dissimilar materials: Joint Sealer Type 'SM' as specified in Section 07 92 00 - JOINT SEALANTS.

C. Sinks, General: Molded of same material as countertops, size as indicated on Drawings, with all inside corners coved and bottom pitched to drain outlet.
   1. Construction: Drop-in type sink with tapered side of sink and inside corners radiused. Pitch bottom of sink to drain. Provide undermount for sinks that exceed constraints for drop-in sinks and as otherwise indicated on Drawings.
   2. Provide modified epoxy resin outlets. Seal around the drain with epoxy sealant as recommended by the sink manufacturer.
   3. Apply sink basins to countertops and ship as integral one piece unit.
   4. Provide sink supports as required for specified sinks.

5. Provide one overflow for each sink.
6. Size: Refer to Drawings.

2.8 HARDWARE

A. Hinges:

1. Concealed Hinge for full overlay cabinet doors: Self closing concealed hinge having maximum 110 degree angle of opening, 3 way adjustment. Hinges shall be equal to Blum “Soft-Close BLUMotion Clip-Top Overlay Hinge” with straight arm, model Nº. 71B3550.
    a. Specified hinge is exception to SEFA requiements.
    b. Number of hinges: Provide number of hinges indicated in Drawings, or if not indicated, provide number recommended by manufacturer for size and weight of door.
2. Base plates for maintaining 1/8" reveals between door/drawers within the same cabinet, and between doors of adjoining cabinets.
3. Hinge mounting: Flathead screws so applied to door and cabinet as to withstand a weight load of 150 pounds minimum.

B. Pulls: Linnea “Satin Finished Stainless Steel Bar” or approved equal with large end posts provide 12 inch pulls except where 6 inch is indicated on the Drawings.

C. Catches:

1. Base and wall cabinets: Spring-tension nylon roller catch with steel strike plate; one catch for each door required at double doors without locks.
2. Tall cases: One pair of heavy-duty spring tension rubber roller catches for each door; positive catch and lower type latch installed on left hand door.

D. Locks: Heavy duty, cylinder-type lock with five-disc tumblers equal to Illinois Lock Company. Positive tumbler operations shall be accomplished by cam action without the aid of springs.

1. Locations: All drawers and hinged doors on casework.
2. Keying: All casework locks keyed alike within each room; Masterkey all casework in Project. No two rooms shall be keyed alike unless otherwise directed by Owner’s Representative. Provide 4 keys for each room, and 6 masterkeys (total).
    a. The lock system shall guarantee security which restricts the duplicating of keys to registered locksmiths.
    b. Removable Cores:
    c. Locks: 5 disc tumbler cam locks with offset cam and removable core. Exposed face chrome plated.
3. Framed Glass Hinged Doors: Locks shall be as specified in above.

4. Sliding Framed Glass Doors: Locks shall be plunger type sliding showcase locks.
5. Sliding Unframed Glass Doors: Locks shall be ratchet type sliding showcase locks.
6. Strike plates: Finish 26D.

E. Drawer Slides: Side-mounted, epoxy powder coated to match drawer body color, full-extension, soft-closing design with positive in-stop. Out-stops designed to permit easy removal of drawer, but to prevent inadvertent drawer removal. Captive nylon rollers, both front and rear, with adjuster cam to regulate body side sway.

1. Standard Drawers: Equal to Accuride model 3832EC, 100 pound capacity, with clear zinc finish.
2. File Drawers and Deep Drawers (greater than 12 inches deep): Equal to Accuride model 4034, 150 pound capacity, with clear zinc finish.

F. Adjustable shelf supports: Manufacturer's standard, adjustable seismic shelf supports shall be double pin, bio-carbonate/plastic locking type, able to accommodate both ¾" and 1" thick shelves. These clips work in conjunction with row-bored holes in cabinet side panels.

1. Shelf adjustment on 32mm centers.

G. Leveling Devices:

1. Provide leveling devices at all open frame tables adaptable to table legs.
2. Device construction: 1/2 inch diameter bolt threaded through a 1/2 inch tee nut securely screwed to bottom of leg, or to 1-5/8 inch U-shaped 12 gauge metal bracket with leveling bolts mounted at the four bottom corners of a base cabinet.
3. Bolts: cadmium plated steel with a hexagonal head to provide bearing against a 12 gauge flat steel floor plate, installed so as to be accessible for adjustment through cupboard bottoms and drawer openings when installed on base cabinets.

H. Wire management grommets and covers: 3 inch diameter, as manufactured by Doug Mockett & Company, Manhattan Beach CA., model number "ED". Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.

1. For counters 6 feet or less provide 2 wire grommets and covers.
2. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.

I. T edge finish molding ¾ inch panel: Extruded 3/64 inch thick aluminum trim with anodized finish 27/32 inch wide exposed face with a 1/8 inch thick barb equal to Richelieu Corporation, Saint-Laurent QC, model number: "31941210".

1. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    a. Richelieu Corporation, Saint-Laurent QC.
    b. Outwater Plastics, Woodridge NJ.
    c. Eagle Moldings, Minneapolis, MN.

J. Hardware Finish: Satin finish stainless steel US32D, unless otherwise noted.

K. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises for leaf concealment. Turn screws to flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.

2.9 FABRICATION OF PLASTIC LAMINATE COUNTERTOPS

A. Except as otherwise specified hereunder, fabricate plastic laminate clad items in strict accordance with the details on the Drawings, the approved shop drawings, and workmanship standards set forth in the NAAWS for Custom Quality Grade.

B. Shop fabricate all plastic laminate clad items. Adhere plastic laminate to backing sheets by cold-press-method. Use of contact cements are not permitted, except at wet areas. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Apply laminate backing sheet to reverse side of tops.

C. Fit corners and joints hairline. Make all joints and miters tight, secure with concealed fasteners.

2.10 CASEWORK FINISH

A. Wood Cabinetry and Trim:

1. Wood Finish, General: Transparent finish.
2. Preparation: Prior to application of the wood finish, case and cabinet surfaces shall be smoothly sanded to remove loose fibers, scratch marks and abrasions, with all dust thoroughly removed by compressed air.
3. Wood Finish Application: Cabinet components shall be finished using a state of the art flat-line system. The finish shall be applied under controlled conditions prior to casework assembly and attachment of hardware. This will provide maximum coverage and protection to the assembled product. The finish shall be fully UV cured to ensure proper performance.
4. Wood Casework Stain: Custom color stain to match doors.
5. Wood Casework Finish (Interiors): Interior surfaces shall receive two applications of chemical-resistant, UV cured, epoxy top coat. The first application will be cured, sanded, and cleaned. The final top coat will then be applied and fully cured.

1. Wood Casework Finish (Exteriors): Exposed exterior surfaces, and interiors of glazed or open cabinets shall be stained and additionally sealed with two applications of chemical-resistant epoxy top coat. The fully reclaimable low VOC water-borne stain shall be uniformly applied by a series of automated spray applicators. The stained components shall then travel through a series of heated chambers to incrementally achieve a temperature of 140 degrees F to dry the stain material. The first of two low VOC epoxy top coats shall be applied, cured, sanded, and cleaned. The final top coat will then be applied and UV cured, providing a semi-gloss sheen. The completed product shall meet the performance test requirements specified under the Article entitled “SYSTEM DESCRIPTION” and referenced SEFA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
2. Examine pre-fabricated woodwork before installation and verify all packing has been removed.
3. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

A. Before installing work under this section, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.

3.3 INSTALLATION

A. Erect casework straight, level and plumb and securely anchor in place.

1. Install casework without distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.
2. Scribe and closely fit to adjacent work. Cut and fit work around pipes, and ducts.
3. Use concealed shims as required
4. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
5. There shall be no variations in flushness of adjoining surfaces.
6. Tops: Anchor tops securely to base units and to other support systems as required.
7. Install all items complete and adjust all moving parts to operate properly.

3.4 TOLERANCES

A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.5 ADJUSTING

A. Repair damaged and defective woodwork where possible eliminating defects functionally and visually.

1. Where not possible to repair damaged or defective work, replace with matching new work.
2. Adjust joinery for uniform appearance.

B. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

3.6 CLEANING

A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area leave area in broom-clean condition.

C. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

D. Remove protective material from pre-finished surfaces, immediately prior to Final Acceptance.

E. Carefully clean exposed and semi-exposed wood surfaces, in strict accordance with fabricator’s instructions. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.

F. Wash down plastic laminate with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

G. Clean and polish hardware, and bright metal trim components.

3.7 PROTECTION

A. Protect installed woodwork and maintain specified conditions, in a manner acceptable to both fabricator and installer. Ensure that work of this Section will not be damaged or soiled, and is completely free of defects at the time of final acceptance of Project by the Architect.

End of Section

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Section 12 35 51

MUSICAL INSTRUMENT STORAGE CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install music instrument storage cabinets and music library storage units.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. Music education system of storage cabinets will be specifically designed and engineered for the intended use and will meet the minimum performance characteristics specified herein. Music instrument storage units will be chip and abrasion resistant under normal usage and will protect instruments and cases from damage under normal use.
2. Provide one-piece high molecular polyethylene instrument storage shelving with integral ventilation grooves, designed and engineered to withstand continuous use without surface or front edge breakdown.
3. Individual instrument storage cabinets will be manufactured with thermofused polyester laminated panels, finish both faces all components. All end panels to be factory jigged and drilled to accept unit-to-unit through-bolting: no conventional wood screws attaching units side-to-side will be permitted. Each instrument storage cabinet will be furnished with an integral base and four (4) steel levelers accessible from within the unit but concealed in final installation. These features combine to provide modularity, on-site rearrangement or future relocation of any music education storage cabinet.
4. Provide full cabinet height straight grille panels. All hinges shall be structurally attached to vertical panels using engineered and tested through-bolt hardware, and either welded to wire grille doors or through-bolted to solid door leaf; screw mounted hinges will not be permitted.

B. Manufacturer to provide documentation of following minimum performance requirements:

1. Molded plastic instrument storage shelf shall have a static load capacity of over 1,000 lbs.
2. Full height straight grille hinged door for instrument storage units will support a minimum dynamic live load of 315 pounds applied at outer edge.
3. Wire grille door hinge to be welded to door frame in five places, pull-tested to withstand 3,000 lbs.
4. Instrument storage shelf system shall have a factory warranty of ten (10) years against defects in material and/or workmanship.

1.4 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:
1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Submit applicable reference standards, performance and test data, and application recommendations and limitations.
2. Shop Drawings: Submit design and installation drawings showing product components in assembly with adjacent materials and products.
3. Quality Control Submittals:
a. Manufacturer's Installation Instructions.
4. Sustainable Design Submittals: As required by NE CHPS.

B. Closeout Submittals: Submit manufacturer’s warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1.6 QUALITY ASSURANCE

A. Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.

1.7 DELIVERY, STORAGE AND HANDLING

A. Pack and ship to avoid damage according to manufacturer's recommendations:
1. Finish and assemble components in factory before shipment.
2. Ship components in individual, sealed, labeled cartons.

3. Deliver components to room designated for installation.

B. Do not accept or install damaged products at the site.

C. Store products in heated indoor storage near point of installation. Retain protective packaging until installing.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Do not install cabinets until all mortar, wet and dust producing work is completed.

B. Field Measurements: Obtain required field measurements from the Contractor and indicate on Shop Drawings.

1.9 WARRANTY

A. Provide manufacturer's written warranty that products not in accordance with requirements of Contract Documents within three years after commencement of warranties shall be corrected promptly after receipt of written notice from Owner. Cabinet shelf will be warranted for ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Wenger Corporation, Owatonna, MN 55060, Product: “UltraStor”.

2.2 MATERIALS

A. Cabinet Wall Panels: 3/4 inch thick industrial (cabinet) grade particleboard, minimum 48 pcf with thermoset polyester (melamine not acceptable) laminate on both sides for totally finished construction. No backer sheets or unfinished surfaces may be used on unexposed sides. Color: Oyster.

B. Cabinet Shelving:

1. Cabinets up to 27 inches wide: One-piece high molecular blow-molded polyethylene with 1-3/8 inch radius front edge. Mount to cabinet walls with one-piece molded rigid nylon clip. Shelf is replaceable without damage to adjacent surfaces. Doweled shelves will not be permitted.
2. Cabinets over 27 inches wide: One-piece high molecular formed polyethylene with radius front edge and 3/16 inch wall thickness. Ribbed for structural integrity. Supported by four structural tubular members 1-1/2 by 1 inch by 16 gage wall thickness with 14 gauge welded end plates.

C. Doors:

1. Doors: Individual compartment doors, manufacturer’s standard straight grille construction with powder paint finish in color selected by the Architect from manufacturer’s full line of standard colors.

2. Hinges: 5-knuckle institutional type hinge. Hinge shall support 315 pounds of dynamic vertical loading. Hinge pin shall be 2-3/4 inches long. Weld hinge to door frames in five places. Fastened to cabinet with through bolt construction; attachment by wood screws not acceptable. Provide four hinges on full height doors.
3. Locking slide-bolt: All doors shall be factory provided with locking slide-bolt designed for padlocks, with formed steel strike plate through-bolt connected to cabinet end panel; 12 gauge steel. Provide clear plastic label holder for identification card insert.
4. Finish: Provide powder paint finish in color selected by the Architect from manufacturer's full line of standard colors.

D. Edging: Heat bonded 3mm beveled PVC edge-banding, machine applied using hot-melt adhesives, edges and corners machine profiled for safety, integral color: oyster.

E. Finish Hardware:

1. Joinery Hardware: two inch, 1/4-20 panel connectors with 15mm head diameter, and steel thread inserts shall be utilized to join desired cabinets side-to-side; use factory jigged and drilled joinery holes. Finish: Powder paint coating, color: oyster.
2. Cabinet levelers: Structural levelers each cabinet, accessible from within the unit when desired, concealed in complete installation; glides with minimum 3/8 inch diameter threaded rod mounted in steel corner brackets. Provide minimum four glides per cabinet, six glides for cabinets with divider panels.

F. Cabinet Back Panel:

1. Standard cabinet back to be 1/4 inch thick prefinished hardboard, color: oyster to match interior of side and top panels.

G. Fabricate and package all components in the factory and ship fully assembled or ready to assemble.

2.3 ACCESSORIES

A. Vertical Closure Kit: Provide visual closure between wall and cabinet. Constructed of 3/4 inch thick thermoset polyester composite wood to match cabinet side panels. Colors: oyster. Will fit 3/4 inch to 30 inch wide opening.

B. Horizontal Closure Kit: Provide visual closure between top of cabinet and soffit. Constructed of 3/4 inch thick thermoset polyester composite wood to match cabinet side panels. Color: oyster. Will fit 3/4 inch to 30 inch high opening.

C. Top Back Filler Kit: Provide visual closure between back wall and top panel of cabinet. Constructed of 3/4 inch thick thermoset polyester composite wood to match cabinet top panels. Color: oyster. Will fit 10 inch and 20 inch deep openings.

D. Finished Back Panel: Provide panel to attach to cabinet back that is exposed. Constructed of 1/2 inch thick thermoset polyester composite wood to match cabinet. Color: oyster.

2.4 CABINET TYPES

A. Band Classroom: Manufactured instrument storage units as indicated on Drawing xxx.

B. Music Classroom: Manufactured instrument storage units as indicated on Drawing xxx.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of project conditions.

C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

3.2 INSTALLATION

A. Assembly units and install in accordance with the approved shop drawings and the manufacturer's written installation instructions.

1. Furnish and install all filler pieces to completely fill recesses, and to align with ends of partitions. Refer to the Drawings for the various conditions.

B. Set storage units absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation.

3.3 ADJUSTING

A. Adjust all hardware for smooth operation.

3.4 CLEANING

A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from waste from materials installed under this Section.

1. Clean all surfaces of soil.
2. Remove all packaging materials and construction debris.

End of Section

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Section 12 48 13

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install:

1. Provide sub-floor filler, to ensure the specified tolerance level for finish surface of recessed entrance mats.
2. Recessed entrance floor mat with frames.
3. Roll-out floor mats.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM E 648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including floor mat, accessories, adhesives, and leveling materials. Include manufacturer's application methods or installation instructions for each item furnished hereunder.
2. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation.
3. Manufacturer's certificate: Provide certificate stating that the floor mat, and other related materials to be supplied hereunder meet all requirements specified herein.
4. Selection samples: Sample swatches containing manufacturer's full color and blend range.
5. Verification samples: (submit [two] each): After initial selection of floor mat and color blends has been made by the Architect: 18-inch by 36-inch sample of selected floor mat for final approval of the Architect. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.
6. Sustainable Design Submittals: As required by NE CHPS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Maintain a temperature of at least 60 degrees Fahrenheit, with a relative humidity of between 15 and 60 percent, for a period of 48 hours before, during, and after installation.

B. Store all mat materials under cover in dry, well-ventilated spaces as soon as delivered. Protect floor mating from damage, dirt, stain, moisture, and mildew.

1.6 ENVIRONMENTAL CONDITIONS

A. Store materials for 3 days prior to installation in area of installation to achieve temperature and humidity stability.

B. Maintain minimum 70 degrees Fahrenheit ambient temperature 3 days prior to, during, and 24 hours after installation of materials.

1.7 SEQUENCING AND SCHEDULING

A. Sequence work to ensure floor mat is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and work overhead is completed.

B. Install floor mat after interior wet work is complete and fully cured.

1.8 WARRANTY

A. Provide 10 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include texture retention, wear, and static protection and edge ravel resistance and run resistance strength for the life of the matting. Commencing on the date of substantial completion.

B. Mat installer's written guarantee covering prompt and proper replacement of any and all floor mating which indicates improper installation workmanship and/or defective material within twenty-four months from completion of the installation and acceptance thereof by the Architect, said corrective work being performed by the mat installer at no cost to the Owner.

1.9 EXTRA MATERIALS

A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal to 25 square feet for each color, pattern and type of mat or tile installed.

B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on the following:

1. Recessed floor mats with frames: Mats, Inc., Stoughton, MA., product: “Trilogy Tile”.
2. Roll-out Floor Mats: American Floor Mats, Rockville, MD., product: “Waterhog Premier”.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. American Floor Mats, Rockville, MD.
2. Mats, Inc., Stoughton, MA.
3. Arden Architectural Specialties, Inc., St. Paul, MN.
4. Balco Inc., Wichita, KS.
5. Construction Specialties, Inc., Muncy, PA.

2.2 RECESSED FLOOR TILE

A. Modular matting tiles: 100 percent nylon fiber, textured tufted loop construction equal to Mats, Inc. “Trilogy Tile”, 19-11/16 by 19-11/16 by 9/32 inch thick tiles, with bitumen backing, total weight 139 oz/sq yd.

1. Accessories:
   a. Adhesive for mounting bitumen backing: Equal to Mats Inc. “Release-Bond Adhesive” or as recommended by manufacturer.

b. Floor mat frame at entrances: 1/2 inch high (upturned edge) by 1/8 inch thick and minimum 1-1/4 inch (bottom edge) by 1/16 inch thick stainless steel with US 32D finish.
   1) Fabricate frame to be truly straight, level and square. Provide frame pieces in longest available lengths to minimize joints. Form corners with tightly mitered joints or use prefabricated joint-less corners.
   2) Shop fabricate framework to the largest unit sizes possible. No joints are permitted within 12 inches of corners.

B. Frame Finish: Conform to AAMA 607.1.
   1. Exposed Aluminum Surfaces: (AA designation M12C22A41) Architectural Class I anodic coating, 0.7 mil thickness or greater, prepared with a mechanical M12, chemical C22 pre-treatment, clear anodized in color.

2.3 ROLL-OUT MATS

A. Rubber backed polypropylene carpet having reinforced scraping ‘nubs’ in a diamond pattern. Raised ‘nub’ surface removes and traps dirt and moisture and holds it on mat below shoe level so it is not tracked in. Mat to be unaffected by salt or ice melt chemicals.
   1. Characteristics:
      a. Fiber: Solution Dyed, colorfast, P.E.T. Polyester (100% Recycled Content).
         1) Static Control: tested 1.6 kv. at 20 percent relative humidity, as measured by the AATCC 134 Electrostatic Propensity Test and complies with NFPA 99.
      b. Pile Weight: 30 ounces per square yard.
      c. Static Coefficient of Friction per ASTM C1028: Dry 0.70
      d. ‘Nub’ height: 3/8 inch. Nubs are reinforced with rubber to resist crushing, maintaining high performance and extending product life
      e. Backing:
         1) 100% SBR Rubber (20% Recycled Content), with grip textured backing.
         2) Thickness:
            a) Field: 0.11 inch.
            b) Nubs: 0.16 inch
            c) Border: 0.19 inch.
         3) Durometer (field): 60.
      f. "Water Dam" border: Border is designed to hold water and dirt on mat keeping them off carpets and floors. Unique raised rubber border allows Waterhog mats to hold up to 1 1/2 gallons of water per square yard. Some styles available without dam for outside use, so water can drain easily.

2.4 ACCESSORIES

A. Filler for patching, smoothing and leveling substrate: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:

1. Ardex, Inc., products “Feather Flash” and “Ardex SD-P”.
2. Quikrete Companies, product “Fast-Set Underlayment 1248”.
3. Silpro Masonry Systems Inc., product “Masco Latex Cement”

2.5 FABRICATION

A. Fabricate frame to be truly straight, level and square. Provide frame pieces in longest available lengths to minimize joints. Space unavoidable joints evenly about centerline of mat and spline butt-joints with connecting pins. Form corners with tightly mitered joints or use prefabricated jointless corners.

B. Provide frames and mats to sizes, shapes, and profiles indicated on approved shop drawings. Provide one-piece mats except where size exceeds manufacturer’s recommended limit for easy removal and cleaning. Where more than one-piece mats are used, locate seams away from main traffic pattern.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

A. Remove sub-floor ridges, and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

1. Apply, trowel, and float filler to leave smooth, flat and hard surface, to ensure that floor mated surfaces will be level to within 1/8 inch tolerance in 10 feet in any direction.
2. Prohibit traffic until filler is cured.

B. Thoroughly sweep and vacuum all surfaces and remove all foreign matter.

3.3 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Architect, anchoring all units firmly into position, square, plumb, straight, and true.

B. Cast the edge extrusion into the concrete slab.

C. Set the grid units in place, shimming with vinyl to provide stability on the Drain Pan.

3.4 PROTECTION

A. Prohibit traffic from floor mat areas for 24 hours after installation.

End of Section

Section 12 61 00

FIXED AUDIENCE SEATING

PART 1 GENERAL

1.1 SUMMARY

A. The work of this Section consists of furnishing and installing fixed audience and planetarium seating where shown on the Drawings, as specified herein, for a complete and proper installation.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

E. Section 09 68 00 - CARPETING.

F. Division 26 - ELECTRICAL: Electrical work related to items in this Section.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. Comply with all applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder indicating configurations, sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.
2. Certification: Manufacturer's written certification stating that seating to be furnished hereunder, meet or exceed the requirements specified under this Section and the fire resistive requirements of California Technical Bulletin No. 133 for the indicated requirements have been met.
3. Shop drawings:
    a. Large scale plans, completely dimensioned showing seating layout. Vary lateral sizes of chair backs, with standards in each row spaced laterally so that the end standards shall be in alignment from first to last row whether aisles are of constant or converging width. Spacing from chairs to walls shall be nominally 1-1/2 inches, and in no circumstances exceed 4 inches. Back to back spacing of chairs shall be not less than 33 inches. Subcontractor assumes complete responsibility for accuracy of layout, and coordination with other trades. As a minimum, indicate the following:
        1) All chair sizes, chair pedestals and aisle widths. Not more than 15 percent of chairs may be 19 inch width.
        2) Wheelchair locations and handicap seating locations
        3) Aisle lighting locations.
        4) Aisle and seat numbering scheme.
    b. Large scale details of chair construction, bases, pedestals, and all other components of the seats.
        1) Indicate all materials, sizes, gauges, thickness, and weights.
        2) Provide complete setting diagrams including anchorage details.
        3) Indicate relationship to electrical stub-outs for aisle lighting.
4. Verification samples:
    a. 36 by 36 inch (1 square yard) samples of upholstery for each color selected by Architect.
    b. If requested by Architect, one complete chair demonstrating all selected finishes and specified components. Approved sample will be returned to Contractor and may be installed in project.
5. Sustainable Design Submittals: As required by NE CHPS.

1.5 REGULATORY REQUIREMENTS

A. Chairs shall have been tested in accordance with California Technical Bulletin No. 133 and certified as passing such tests. Every chair shall be labeled with certification label.

B. Send copy of certificate of compliance to municipal authority having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Do not deliver seating units materials to the project until finish work has been completed and dry, including finish woodwork, ceiling materials, wall finishes and painting.

C. Protect seats from damage due to moisture, direct sunlight, excessive temperatures, surface contamination and damage from construction operations and other causes.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before and during installation of chairs; maintain same temperature until Owner's Final Acceptance.

B. Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before and during installation of chairs: maintain same relative humidity until Owner's Final Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified manufacturer: To establish a level of quality and visual characteristics desired, Drawings and specifications are based on Irwin Seating Company, Grand Rapids, MI., product: "Citation 90.12.10.4".

B. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:

1. Irwin Seating Company, Grand Rapids, MI.
2. American Seating, Grand Rapids, MI.
3. Hussey Products Company, North Berwick, ME.
4. KI Furniture and Seating, Green Bay, WI.

2.2 MATERIALS - GENERAL

A. Steel standards and back wings: All steel shall have smooth surfaces and be of sufficient gauge thickness and designed to withstand strains of normal use and abuse.

B. Padding material: Seat and back padding material shall be of new (prime manufacture) polyurethane foam. Padding material shall comply with the flammability requirements outlined in California Technical Information Bulletin No. 117, Resilient Cellular Materials, Section A and D, dated February 1975, when tested in accordance with Federal Test Method Standard 191, Method 5903.2.

1. Padding shall be securely adhered to plywood inner shell.
2. Thickness: 2 inches.

C. Wood: Plywood, exposed or concealed, hardwood, made with adhesive containing no urea formaldehyde.

D. Upholstery Fabric: Fabric shall be Grade 2 minimum and meet class 1 flammability requirements of US Department of Commerce Commercial Standard 191 per California Technical Bulletin No. 117.

1. Treat fabric for fire retardance to comply with Rhode Island State Fire Safety Code, and California Technical Fire Safety Bulletin 117 Section E, NFPA 701 and as additionally required by City of Central Falls Fire Marshall.
2. Fabric color and pattern shall be as selected by Architect from manufacturer's full available line.

E. Injection molded plastic: one-piece high-impact, linear polyethylene with built-in ultraviolet light inhibitors to retard fading. Plastic shall have a burn rate of 1 inch per minute when tested in accordance with ASTM D635 or the Department of Transportation Motor Vehicle Safety Standard No. 302. Color shall be selected from manufacturer's standard color range.

2.3 SEATING

A. General: Floor attached type chairs, 19, 20, 21 and 22 inch widths, consisting of an attached inner upholstered back and hinged fully upholstered seat which automatically returns to an upright three-quarter fold position.

1. Not more than 15 percent of all seating may be 19-inch width. No 19-inch width seats shall be placed adjacent to another 19-inch width seat. 19-inch width seats shall be randomly distributed throughout the auditorium and lecture halls in the widest possible dispersion pattern.
2. Provide armless seats in compliance with accessibility requirements, where indicated on the Drawings.
3. Provide transfer seats in compliance with accessibility requirements.
4. Provide accessible locations as indicated.

B. Standards: Floor mounted formed steel.

1. Standards: The standards shall be pedestal design made by a rectangular tube, nominally 1 by 3 inches, with heavy gauge steel. A reinforced bracket for seat pan attachment shall be integrated into the standard which has an inlay at midpoint for resistance upon force.
2. Aisle Standards-Rectangular-3/4 size design: The aisle standards shall be fabricated in the same manner as the center standards with a formed panel of 16 gauge steel welded to the column to accept a decorator panel:
    a. Rectangular shaped end standard shall be painted with epoxy powder finish.

C. Chair backs: Padded and upholstered with one-piece injection molded outer panel and hardwood inner upholstery panel.

D. Seat assembly: Self-lifting seat, padded and upholstered with one-piece injection molded outer panel and hardwood inner upholstery panel.

1. Counter Balance: The seat pan shall rotate on two solid steel rods with lifetime lubricated nylon shoulder bushings. The rear area of the pan shall be

weighted to create a counterbalance that allows the seat to return to 90 degree vertical position by means of gravity.

2. Provide seat numbers and locate them on the front edge of the seat pan.

E. Armrests: Solid white maple, 3/4 inch thick by 2-1/4 inches wide and 12 inches long, steamed, kiln dried, with translucent finish.

1. Finish:
   a. Stain: Color as selected by the Architect.
   b. Finish coats: 2 coats factory applied polyurethane.
2. ADA swing-up armrests to hinge with cantilevered end standards to allow equal access for disabled patrons. Accessible chairs shall include the universal handicapped symbol on the cantilevered end aisle standard for clear identification.
   a. Provide not less than eight seats or 1 percent of total seating whichever is greater with ADA transfer armrests.
   b. Provide at each ADA companion seat:
      1) Manufacturer's signage for companion seating adjacent to all seats with ADA transfer armrests at locations as indicated on the Drawings and in compliance with all applicable laws, regulations, and codes.
3. Provide manufacturer's standard down lighting under armrests where indicated.

F. Aisle Lights (locate as indicated on approved shop drawings): UL listed, pre-wired and finished complete with utility box, light socket, LED lamp and detachable lens plate, located under arms.

1. Provide aisle lighting coordinated with Drawings and with Division 26 – ELECTRICAL.

G. Number, letter and braille plates: 5/8 by 1-5/8 inch brushed aluminum finished plates with Helvetica Medium letter and numerals and Unified English Braille Code.

1. Attach plates with escutcheon pins with matching finish.
2. Provide separate braille plate in location compliant with applicable codes and regulations.

2.4 FINISHES

A. All exposed metal, including bolted connections shall have a baked enamel finish in color selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

A. Install chairs in locations indicted on reviewed and accepted shop drawings in accordance with manufacturers written instructions.

1. Check all dimensions against shop drawings and make necessary adjustments for discrepancies in layout.

3.3 TOLERANCES

A. Maximum variation from plumb or level: 1/8inch.

3.4 PROTECTION

A. Protect chairs with temporary plastic covers under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

Section 12 66 13#

TELESCOPING BLEACHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnishing and install power assisted fixed telescoping bleachers and power assisted fixed telescoping audience seating consisting of multiple-tiered seating rows including seat, deck components, and understructure closing without requiring dismantling into a nested configuration for storing or for moving purposes.

1. Multiple-tiered fixed telescoping power assisted audience seating.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Division 26 - ELECTRICAL.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. AA - Aluminum Structures, Construction Manual Series.
2. AISC - Design of Hot Rolled Steel Structural Members.
3. AISI - Design Cold Formed Steel Structural Members.
4. ASTM - Standard Specification for Properties of Materials.
5. AWS D1.1 - Structural Welding Code – Steel.
6. AWS D1.3 - Structural Welding Code - Sheet Steel.
7. ICCC 300 - Standard for Bleachers, Folding Telescopic Seating and Grandstands.
8. NFoPA - National Design Specification for Wood Construction.
9. SPIB - Standard Grading Rules for Southern Pine.
10. PS1 - Construction and Industrial Plywood.
11. United States Department of Justice, Nº 28 CFR Part 36 - Americans with Disabilities Act, (Public Law 101-336).

12. Comply with all applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications and installation instructions.
2. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
3. Shop drawings: Large scale plans showing bleacher layout. Include painted on graphics.
   a. Wiring Diagrams: Indicate electrical wiring and connections.
4. Samples: Minimum 2 square foot sample of painted graphics.
5. Sustainable Design Submittals: As required by NE CHPS.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Do not deliver seating units materials to the project until finish work has been completed and dry, including finish woodwork, ceiling materials, wall finishes and painting. Coordinate installation of bleachers with Section 09 64 66 - WOOD ATHLETIC FLOORING. Take all precautions necessary to protect flooring.

C. Protect bleacher components from damage due to moisture, excessive temperatures and damage from construction operations and other causes.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before and during installation of bleachers; maintain same temperature until Owner’s Final Acceptance.

B. Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before and during installation of bleachers: maintain same relative humidity until Owner’s Final Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Hussey Seating Company, North Berwick ME, Products:

1. Telescoping bleachers with integral power: “MAXAM 26 Series with Courtside Collection XC10”.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Hussey Seating Company, North Berwick, ME.
2. Folding Bleachers Company, Effingham, IL
3. Interkal Inc., Kalamazoo, MI.

2.2 PERFORMANCE/DESIGN CRITERIA

A. Structural Performance: Design, engineer, fabricate and install telescopic gym seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each seating unit.

B. Bleacher seat assembly: Designed to support and resist its own weight and the following forces:

1. Live load of 120 lbs. per linear foot [162.69 N/m] on seats and decking
2. Uniformly distributed live load of not less than 100 lbs. per sq. ft. [135.58N/m] of gross horizontal projection.
3. Parallel sway load of 24 lbs. [32.53 N/m] per linear foot of row combined with (2) above
4. Perpendicular sway load of 10 lbs. [13.56 N-m] per linear foot of row combined with (2) above

C. Hand railings, posts and supports: Engineered to withstand the following forces applied separately:

1. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction.
2. Uniform load of 50 lbs. per foot [.344 N/mm^2] applied in any direction.

D. Guard railings, post and supports: Engineered to withstand the following forces applied separately:

1. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction along top rail.
2. Uniform load of 50 lbs. per foot [.344 N/mm^2] applied horizontally at top rail and a simultaneous uniform load of 100 lbs. per foot [.689 N/mm^2] applied vertically downward.

3. Provide manufacturer’s standard rear railing at all portable bleachers.

2.3 MATERIALS

A. Lumber: ANSI/Voluntary Product 20, B & B Southern Pine.

B. Plywood: ANSI/Voluntary Product PS1, APA A-C Exterior Grade.

C. Structural steel shapes, Plates and Bars: ASTM A 36.

D. Uncoated steel strip for non-structural components: ASTM A569, Commercial Quality, Hot Rolled Strip.

E. Uncoated steel strip for structural components: ASTM A570 Grade 33, 40, 45, or 50, Structural Quality, Hot-Rolled Strip.

F. Uncoated steel strip for structural components: ASTM A607 Grade 45 or 50, High-Strength, Low Alloy, Hot-Rolled Strip.

G. Galvanized steel strip: ASTM A653 Grade 40, zinc coated by the hot-dip process, structural quality.

H. Structural tubing: ASTM A500 Grade B, cold-formed.

I. Polyethylene polymer: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

J. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.4 BLEACHERS

A. General: Wall attached, telescoping bleachers with continuous rows, and self-storing railings at each end. Units with 24 inch row spacing with aisles spaced not more than 15 seats apart. Seat rows shall have a rise not less than 9-1/2 inches and not more than 10-1/2 inches.

B. Framing:

1. Frame: Steel supports and rolling frames shall be constructed of formed steel shapes, engineered to sizes required for the loads and purpose intended. Provide support bracing at the beginning of the second row.
   a. Factory weld all framing components.
2. Wheels: 5 inch diameter by 1 ¼ inch with non-marring soft rubber face with molded-in sintered iron oil-impregnated bushings to fit 3/8 inch diameter axles secured with E-type snap rings.
3. Lower track: Continuous, positive gliding system interlocking each adjacent unit using an integral, continuous, anti-drift feature and through bolted guide at front to prevent separation and misalignment. Units at end sections of powered banks and manual sections shall contain a low profile positive lock to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.

4. Slant columns: High tensile tubular steel.
5. Sway bracing: High tensile steel members through bolted to columns.
6. Deck Stabilizer: High tensile steel members, through bolted to nose and risers at a minimum of three locations per section. Provide interlocks with adjacent stabilizer on upper tier using low-friction nylon rollers to prevent separation and misalignment of sections and incorporating multiple stops to allow field adjustment of row spacings.
7. Deck Support: Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section.

C. Decking:

1. Nose beam and rear riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653, Grade 40, Riser beam shall be continuously roll-formed of ASTM A653, Grade 40. Nose and riser beam shall be designed with no steel edges exposed to spectator after product assembly.
2. Attachment: Through bolted fore/aft to deck stabilizers, and frame cantilevers.
3. Decking at audience seating: High-density polyethylene overlay panel fabricated with a skid-resistant textured top surface of 100% moisture barrier bonded to a plywood substrate with an exterior glue. Panel thickness shall be ¾ inch with top polyethylene surface black colored.
4. Decking at bleachers: 5/8 inch, AC grade clear top-coated tongue and groove Southern Yellow Pine with exterior glue, 5-ply, all plies with plugged cross-bands, produced in accordance with National Bureau of Standards PS-1-97. Plywood shall be cut and installed with top, center and bottom ply grain-oriented from front of deck to rear of deck (nose beam to riser beam). Adjacent pieces shall be locked together with tongue and groove joint from front to rear of deck.
5. Deck end overhang: Not to exceed frame support by more than 5 feet 11 inches.

D. Seat Modules: 18 inches long assembled, gas assisted injection-molded, high density, 100% recyclable HDPE (high density polyethylene) modules in monochromatic colors providing, dual textured scuff resistant 10 inch wide seat surface with ½ inch minimum interlock on seat and face tested to 600 pound occupant load equal to Hussey Seating Company “XC10 Comfort Profile” complying with the following:

1. 10 inch depth continuous comfort curve style bench seat module.
2. Ergonomically contoured forward “waterfall” edge for enhanced spectator comfort and minimization of sensitive pressure point area, regardless of leg positioning.
3. Fore and aft contoured seat surface for uniform support and minimize high pressure points under the buttocks.
4. Seat height ranges from deck to t/o seat range from 16-1/8 inches to 18-1/8 inches.
5. 21-1/8 inch clear foot space area, regardless of leg positioning.

6. Provide integrally molded end caps at aisle end locations with the following features:
    a. Integrally molded recess pockets to accept seat number and row letters.
    b. Integrally molded rear closure panel at back of seat to allow for “continuous clean sweep” of debris at deck level and minimized visibility of structural ribbing.
    c. Seat module shall be securely anchored by a 12 gauge steel clamp bracket that provides steel-to-steel, through bolted attachment to the front nose beam of the bleacher.

E. Aisles:
1. Foot level aisles: Provide deck level full width vertical aisles located as indicated.
2. Intermediate aisle steps: Intermediate aisle steps shall be of boxed fully enclosed type construction. Construction materials shall be coordinated with that of decking. Quantity and location as indicated.
3. Front steps: Provide at each vertical aisle location swing-up front steps. Front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 3 inches in diameter.
4. Non-slip tread; Provide at front edge of each aisle locations an adhesive-backed abrasive non-slip trade surface.

2.5 MOTORIZED SEATING

A. Integral Power: Furnish and install an integral automatic electro-mechanical propulsion system, to open and close telescopic seating. Integral power and control system shall be Underwriters Laboratories, Inc. (UL) approved and listed.
1. Operation shall be with a removable pendant control unit which plugs into seating bank for operator management of stop, star, forward, and reverse control of the power operation.
2. Each unit shall consist of an output shaft gear reducer with a 6 inch diameter by 4 inch and shall be fitted with induction motors, which will provide an average operating speed of 30 feet per minute, spring loaded adjustable for floor variations and installed under the first moving row.
3. Limit Switchers: Furnish and install both open and closed limit switches for the integral power system. The limit switchers will automatically stop integral power operation when seating has reached the fully extended or closed position.
    a. Power operation shall utilize a combination of contactors and limit switches to ensure that the wire is not energized except during keyed operation. Straight-wired electric system will not be permitted.
4. Electrical: Seating manufacturer shall provide all wiring within seating bank including pendant control.
    a. Each unit is power operated by a 1/2 horsepower, 208 volt, 60 Hz, three phase 1.25 service factor motor with a service factor current of 11 amperes. Power service to motor shall be 208 volt three phase service.

The service amperage shall be dependent upon the number of motors to be operated. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electric Code.

b. The electrical contractor shall provide power source with no create than 4% voltage drop at the seating junction box. The electrical contractor shall perform all wiring connections in junction box that is attached or part of the building.

2.6 ACCESSORIES

A. Master Key/Hinged Skirt Boards: All skirtboards shall be hinged and each section shall have key locks with all locks keyed alike.

B. Operating Handles: Provide and install emergency manual operating handles constructed of 1 5/16 inch (3.3 cm) outside diameter schedule 40 pipe. Handles shall be designed for storage under the first moving row.

C. Provide entire first row with modular recoverable seating units to be utilized by persons in wheelchairs and able-bodied persons. Each unit shall have an unlock handle for easy deployment when wheelchair or team seating access is required. Unlock handle shall lock the bleacher seats into position when fully opened.

1. Provide a black full-surround steel skirting with no more than ¾ inch floor clearance for safety and improved aesthetics.
2. Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.
3. Provide a mechanical positive lock when the system is in the open and used position.
4. Provide required modular units for entire front row seating and accessible seating, to meet ADA and facility specific requirements as indicated. Provide modular units from 2 to 7 seats wide as well as full section widths as necessary.
5. Provide a removable belt barrier with signage for the rear of each recoverable module to assist with seating identification.
6. Permanent Handicap Cutouts: Provide permanent handicap cutouts per requirements of Americans with Disability Act (ADA) located as indicated on Drawings. Provide a full width front closure panel at cutout, extending from underside of second tier to within 1 ½ inches of finished floor.
7. Provide at each ADA companion seat:
    a. Manufacturer’s signage for companion seating adjacent to all seats with ADA transfer armrests at locations as indicated on the Drawings and in compliance with all applicable laws, regulations, and codes.

D. Front Panel: Provide elevated seating equipment with full width front closure panels. Panels shall extend vertically from underside of front row to within 1 ½ inches of floor. Paneling to be 5/8 inch Southern pine plywood attached to a steel framework.

E. Rear Panel: Provide required seating units with full width rear closure panels. Panels shall extend vertically full height up to 8'-0' high to within 1 1/2" of floor. Paneling to be 5/8" Southern pine plywood attached to a steel framework.

F. Front Rail: Provide 38" high above deck, demountable steel rails with tubular supports and intermediate members. Rails to be located at each required seating locations.

G. Intermediate Folding Aisle Handrails: Provide single pedestal mount handrails 34 inches high with terminating mid rail. Handrail to be permanently mounted to a rotating socket for rail storage on the intermediate aisle step.

H. Self Storing End Rails: Provide steel self-storing 42 inches high above seat, end rail with tubular supports and intermediate members designed with 4" sphere passage requirements.

I. Rear Rails at Moveable Bleachers: Provide steel self-storing 42 inches high above seat, end rail with tubular supports and intermediate members designed with 4 inch sphere passage requirements.

J. Top Seat Flush Filler: Provide at top seat level a flush filler board mounted between top seat and rear wall. Flush filler board shall be constructed of 4/4" nominal thickness Southern pine Grade B & B clear urethane finished.

K. Rear Bench Seats: Provide seating units not wall attached with a full width 1 foot 5 inch high rear seat. Rear seats shall extend 1 foot 3 inches out from rear of stands and shall be of same material and finish as seating.

L. Manual Ball Fender: Include on units six (6) rows or more of single stack configuration, top row foot well closure to prevent lodging of basketballs.

M. Vinyl end covers: Provide manufacturer's standard heavy-duty vinyl covers with custom graphics at ends of bleachers to conceal undercarriage of bleacher construction. Provide custom graphic printed on each cover.

N. Modular Platforms: Semi-permanent 4 feet by 4 feet, with safety rails and step.

2.7 SHOP FINISHES

A. Understructure: For rust resistance, steel understructure shall be finished on all surfaces with grey "Dura-Coat enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish. Tubular steel that cannot be painted inside is unacceptable.

B. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:

1. Steel nosing and rear risers shall be pregalvanized with a minimum spangle of G-60 zinc plating. Painted nosings or risers are unacceptable.
2. Decking shall have surfaces to receive a sealer coat with use surfaces to receive which gloss clear urethane finish. Painted decks are unacceptable.

C. Railings: Steel railings shall be finished with powder coated semi-gloss black enamel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

A. Install bleachers in locations indicated on reviewed and accepted shop drawings in accordance with manufacturers written instructions.

B. Adjust seating units for smooth and proper operation.

3.3 PROTECTION

A. Protect bleachers from damage until Substantial Completion of Contract under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 13 34 19
METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification section, apply to work of this section.

B. Related Sections: The following sections contain requirements that relate to this section.
1. Section 03 30 00 - Cast-in-Place Concrete
2. See Item 1.8 for Sustainable Requirements applicable

1.2 DESCRIPTION OF WORK

A. Contractor will furnish and install the relocatable storage containers.

B. Contractor to provide crane for lifting the buildings off the delivery truck and placing units on level concrete pads.

C. **This item may be affected by Add Alternates – refer to Plans for further information.**

1.3 DESIGN LOAD ITEMS

A. Design load certification and shop drawings stamped by Professional Structural Engineer including seismic zone, wind loads and snow loads must be confirmed in writing with local code authorization by Contractor prior to manufacture of the building.

1.4 WARRANTY

A. Provide Manufacturer's twenty (20) year warranty against structural failure, material failure and manufacturing defects covering all levels of warranty for the equipment and components.

B. Warranty shall spell out what it does not cover.

1.5 QUALITY ASSURANCE

A. Manufacturer's warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

B. The installation of the Relocatable Storage Unit shall be by Contractor with a minimum of five (5) years of experience on similar projects, with at least two similar projects within the last eighteen months. Evidence of this experience shall be submitted to the Owner's Representative for review and approval.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 for all manufactured/fabricated items. All submittals must be prior to fabrication and/or field installation work.
   1. Shop drawings shall include plans, details, elevations and specifications and shall indicate profiles, sizes, dimensions, connection attachments, size and type of fasteners, accessories, and color and finish as indicated in these specifications and the plans.
   2. Submit manufacturers printed product literature, specifications and data sheets.
   3. Clearly indicate on the shop drawings any deviations from the plans and specifications.

B. Submit Contractor Qualifications as required under Quality Assurance section stated herein.

C. Submit warranty information of all manufactured/fabricated items as required under Warranty section stated herein.

D. Submit samples showing texture, finish and range of colors of all materials. Samples will establish the standard by which materials provided will be judged.

E. Submit drawings and instructions of manufacturers/fabricators installation requirements.

F. Submit stamped shop drawings by a Structural Engineer currently registered in the state where the project is located for footings for all work in this Section. Drawings shall indicate approved materials in this Section.

G. Submit material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated herein, based on comprehensive testing of current materials.

H. Submit design load criteria as required under Design Load Items section stated herein.

I. Sustainable Submittals if applicable

1.7 DELIVERY, STORAGE AND HANDLING

A. All equipment, unless otherwise indicated, shall be furnished, assembled and installed by the contractor.

B. Deliver to site, store and protect products under provisions of Division 1.

C. Installation Documentation, Packing List and Maintenance Kits shall be supplied by the manufacturer for each component.

D. Do not store paint, paint additives or cleaners at site.

1.8 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
   1. The Construction Manager is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
   1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
   2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
   3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
   4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
   5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
   6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
   7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

A. Any manufacturer’s names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that “Or approved equal” applies to all products denoted herein. It is understood that all manufactures will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an approved equal". It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

B. Relocatable storage building shall be Miller Relocatable Storage Buildings, Rite-Away by US Door B Building Components, Mini-Storage Outlet Relocatable/Portable Storage Building system 10’ x 12’ or equivalent and include but not be limited to the following items:
   1. 24-gauge galvalume plus standing seam roof with fixed clip system and with gutters and downspouts with 20-year manufacturer’s warranty.
   2. Building shall have a standard peak roof 3:12 slope. Color of Roof shall be selected by Owner from standard color chart.
   3. 26 gauge “R” panel siding with siliconized polyester finish for walls and blank wall areas. Color shall be selected by Owner from standard color chart, with a 20-year manufacturer’s warranty or equal.
   4. 29 gauge galvalume plus interior partitions designed to provide resistance to smudging, staining and corrosion.
   5. Interior structural steel is red oxide primed.

6. Jambs between exterior doors are 16 gauge galvanized structural steel covered with pre-painted 26 gauge jamb covers with a 20 year manufacturer's warranty.
7. Roof is insulated with ply-foil insulation to help prevent condensation.
8. Eave height shall be 8-'4".
9. Exterior roll-up door shall be located along the 12' length of the unit.
10. 26 gauge exterior roll-up door with corrugated door headers. Door colors shall be selected by Owner from standard color chart and include a 20 year manufacturer's paint warranty.
11. Tension control, coil springs, brackets, door stops, slide latch and bottom bar with rubber astragal and ball-bearings included for all roll up doors.
12. Floor system consists of: (1) 2x4 and 2x6 pressure treated joists covered with ¾" exterior grade plywood with the exterior edges wrapped in a 16 gauge galvanized steel sill. (2) 16-gauge diamond plate aluminum flooring over 3" galvanized corrugated steel floor deck.
13. Standard industry latches.
14. Four corner bracket assembly with steel rods for fastening building to the ground.
15. Eye bolts in all 4 corners for lifting building off of flatbed with crane will be required.
16. All colors to be approved by the Landscape Architect and the Owner prior to fabrication.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall conform to the lines and dimensions shown on the approved shop drawings, where applicable, and the contract drawings.

B. Field stake locations of structure in conformance with the plans for approval by Owner's Representative and the Landscape Architect. Owner's Representative and Landscape Architect may make field changes before approving layout at no additional cost to the Owner.

C. Verify all dimensions in the field and check work by other trades for conformance with the drawings before proceeding with the work. Report any discrepancies to the Owner before proceeding.

D. Deliver to the site all items necessary for completion of installation.

E. Storage Unit shall conform to the manufacturers' recommendations for installation unless otherwise indicated.

F. Secure components in proper alignment and elevation.

G. Protect structure until completely installed and safe for use.

H. Maintenance kit shall be provided to the Owner for each structure and component.

End of Section

Section 13 34 23

PRE-ENGINEERED RESTROOM BUILDING

PART 1 – GENERAL

1.1 SUMMARY

A. The work of this Section consists of pre-designed, pre-engineered, packaged restroom facilities where shown on the Drawings, as specified herein, and as required for a complete and proper installation.

B. Furnish and install the following:

1. Factory pre-designed, pre-engineered, complete fully functional and fitted out restroom facility buildings, field fabricated using manufacturer's "kit of parts and components," complying with all local regulations and codes.
    a. Packaged restroom facilities shall include all mechanical, plumbing and electrical services.

C. Provide all delegated design engineering services required for the design and construction of the pre-engineered restroom building.

D. Furnish the following products to be installed under the designated Sections:

1. Anchor bolts and base plates for placement under Section 03 30 00 – CAST-IN-PLACE CONCRETE.

1.2 RELATED REQUIREMENTS

A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

C. Section 03 05 13 - CONCRETE SEALERS: Requirements for concrete sealers provided under this Section.

D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Requirements for concrete footings, grade beams and floor slab.

E. Section 04 20 00 - UNIT MASONRY: Requirements for masonry, grouts and related work which are provided under this Section.

F. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials which are provided under this Section.

G. Division 26 - Electrical: Incoming electrical utility lines to within approximately 10' of the building.

1.3 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. ASTM A36 - Structural Steel.
3. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
4. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
5. ASTM A325 - High Strength Bolts for Structural Steel Joints.
6. ASTM A386 - Zinc-coating (Hot-Dip) on Assembled Steel Products.
7. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
8. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
9. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
10. ASTM A501 - Hot Formed Welded and Seamless Carbon Steel Structural Tubing.
11. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
12. ASTM A529 - Structural Steel with 42,000 psi (290 MPa) Minimum Yield Point.
13. ASTM A572 - High Strength Low Alloy Columbium Vanadium Steel of Structural Quality.
14. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
15. AWS A2.0 - Standard Welding Symbols.
16. AWS D1.1 - Structural Welding Code.
17. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).
18. SSPC - Steel Structures Painting Council.
19. All applicable federal, state and municipal codes, laws and regulations for exits.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

C. Definitions:

1. Building Supplier: The building package and all associated components provided by Building Supplier shall be warranted against defects in materials and workmanship for a period of not less than one (1) year from the date of acceptance. Acceptance is the date of the final delivery of the building package components.
2. Building Installer: The installing contractor or subcontractor, hereafter designated as the Building Installer***,*** is responsible for building package installation. ***Building installer*** work will generally include foundation/pad construction and building package assembly/construction.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Architect, General Contractor, metal building system Installer's Project Superintendent, metal building system manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
   a. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
2. Agenda:
   a. Scheduling of metal building system erection operations.
   b. Review of staging, material storage locations and temporary protection requirements.
   c. Coordination of interface work by other trades.
   d. Protection of completed Work.
   e. Establish weather and working temperature conditions to which Architect and Contractor must agree.
   f. Emergency rain protection procedure.
   g. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

C. Sequencing:

1. Field Measurements: Verify that field measurements are as indicated on shop drawings.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
    a. Include data on profiles, component dimensions, fasteners, and sealants.
2. Shop Drawings:
    a. Elevations, plans and details: 1/4 inch scale elevations and plans, and large scale design details showing framing, and panel attachment methods (both roof and walls); and complete installation details.
        1) Indicate assembly dimensions, locations of structural members, connections, attachments, openings, cambers (if required), and both live and dead design loads.
        2) Roof and wall panels: Indicate wall and roof system dimensions, panel layout, construction details, anchorages and method of anchorage, method or installation. Show layouts of panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory-assembled, and field-assembled work.
        3) Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
        4) Indicate all connections and interface with adjoining work.
    b. Anchor-Bolt Plans: Indicate framing anchor bolt settings,-sizes, and locations from datum, and foundation loads at each column location.
    c. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
    d. Door Schedule: Provide schedule of doors and frames, using the same reference numbers as indicated on Drawings. Include details of reinforcement and installation requirements for finish hardware.
3. Selection Samples:
    a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
    b. Provide additional samples as requested by Architect for initial selection of colors and finishes.
4. Verification Samples:
    a. 12 x 12 inch samples of roof and wall panels, illustrating material and finish.
        1) Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
    b. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.

c. Vapor Retarders: 6-inch- (150-mm-) square samples.

d. Accessories: 12-inch- (300-mm-) long samples for each type of accessory.

5. Certificates:

a. Shop Finished Products: Manufacturer's written certification stating that metal building components and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section, and that shop finishing has been performed as specified.

6. Delegated Design Submittals:

a. Furnish complete structural design analysis for all structural components of the prefabricated metal buildings.

b. Provide manufacturer load tables indicating the selected panel material, configuration and thickness meets the design requirements for the spans shown

7. Manufacturer’s Instructions: Manufacturer’s written installation instructions indicating preparation requirements, assembly sequence, special procedures, and field conditions requiring special attention.

8. Source Quality Control Submittals:

a. Submit list of installations completed within the last three years, include all contacts and references.

9. Sustainable Design Submittals: As required by NE CHPS.

10. Qualification Submittals:

a. Installer/Applicator: Manufacturer's written certification stating that erector is qualified, licensed, authorized and approved to install the building system in accordance with manufacturer's requirements.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Bonds and Warranty Documentation:

a. Manufacturer’s Warranties and Guarantees as specified elsewhere herein this Section.

2. Record Documentation: Submit accurately record actual locations of concealed utilities.

1.6 QUALITY ASSURANCE

A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Sole Source: Obtain products required for the Work of this Section from only manufacturers recommended by the prime Building Supplier.

C. Qualifications:

1. Manufacturers: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
2. Installer/Erector: Installer/Erector has technical qualifications, experience, trained personnel and facilities to install specified items.
3. Welders Certificates: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
4. Testing Agencies:
5. Licensed Professionals: Design Work under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Rhode Island.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Do not fabricate or deliver items to the site, until all specified Building Supplier's submittals have been submitted to, and approved by, the Architect.
   2. Building supplier shall deliver organized building package components in stages as shrink-wrapped pallets that correspond to a typical sequence of construction. A bill of material stating the stages of palletized components shall be included with every delivery.
      a. Stage 1 pallets shall include structural components such as block, frames, vents, beams, connectors, trusses, etc.
      b. Stage 2 pallets shall include second stage structural components such as filler wall material, windows, skylights, roofing, etc.
      c. Stage 3 pallets shall include structural finish components such as siding material, tile, doors etc.
      d. Stage 4 pallets shall include plumbing and electrical fixtures and other finish materials such as toilets, sinks, drinking fountains, electrical fixtures, accessories, etc.

B. Building installer:
   1. The Building Installer will be responsible for all equipment and labor required for off-loading of the delivered building package onsite.
   2. The Building Installer will assume responsibility for adequate protection and maintenance of delivered building package materials from weather, damage, and pilferage during installation work. Any failure to adequately protect building package materials that affects the warranty of those materials will be at building installer's expense.

C. Storage and Handling Requirements:
   1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
   2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

a. Stack and cover metal building materials with suitable weather-tight covering.

D. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.

1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable an recyclable.
2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

E. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 WARRANTY

A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

B. Pre-Engineered Building Supplier's Warranty: The building package and all associated components provided by Building Supplier shall be warranted against defects in materials and workmanship for a period of not less than one (1) year from the date of acceptance. Date of Acceptance is the date of the final delivery received at the Project Site, of the building package components.

C. Pre-Engineered Building Installer's Warranty: Building installer's work shall be warranted against defects in materials and workmanship for a period of not less than one (1) year from the date of acceptance. Acceptance is the date that installation work for the building package is completed, including any relevant final punch list. In the event that final acceptance of the completed building is delayed for reasons beyond ***building installer's*** control, the warranty shall be one (1) year from the completion of ***building installer's*** installation work and demobilization.

D. Additional Extended Pre-Engineered Building Installer's Warranty:

1. Provide 3 year unconditional warranty or bond for labor and materials, which shall include coverage for weather tightness of building enclosure elements after installation.
2. Provide 3 year warranty which shall include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading.
3. Provide additional product and material warranties

E. Building Supplier, and Building Installer shall pass through to owner all relevant manufacturers warranties for individual products and components supplied by contractor.

PART 2 - PRODUCTS

2.1 BUILDING SUPPLIER

A. Basis of Design (Specified Building Supplier): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Romtec, Roseburg, OR, Model Series: “2082”, as modified by the Contract Drawings.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Romtec, Roseburg, OR.
2. Public Restroom Company, Minden NV.
3. Green Flush Restrooms, Washougal, WA.

2.2 DESCRIPTION

A. General Description:

1. Pre-engineered restroom building, nominally 18’-8 inches by 28’-0”
2. Walls: Split-faced concrete Block
3. Roof System- Preformed standing seam metal roof. with sub-girt framing/anchorage assembly and accessory components.
   a. Roof Slope: 5 inches in 12 inches.

B. Regulatory Requirements

1. Conform to applicable code for submission of design calculations, reviewed shop drawings and as required for acquiring permit.
2. Cooperate with regulatory agency or authority and provide data as requested.

2.3 PERFORMANCE/DESIGN CRITERIA

A. Thermal Resistance: R value through wall panel, roof panels, and insulation, which includes infiltration and stud effect at joints taken into account.

1. Thermal resistance of wall system: R value of [ ].
2. Thermal resistance of roof system: R value of [ ].

B. Members to withstand dead load, collateral loads, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with Rhode Island Building Code. Members shall be additional designed to withstand dynamic auxiliary live loading from cranes and material handling systems.

1. Building components shall be capable of supporting design loads without permanent deformation, loss of watertightness, or disengagement of any part of installation.
2. Design building systems to withstand the most critical effects of load factors and load combinations.
3. Design structural steel sections in accordance with AISC, "Specification for the Design, Fabrication, and Erection of Steel Buildings".

4. Design light gage cold formed structural members in accordance with latest edition of AISI, "Specifications for the Design of Light Gage Cold Formed Steel Structural Members".
5. Welding shall comply with AWS Standard No. D1.1.

C. Members to withstand progressive snow and live loading, and design loads due to pressure and suction of wind.
1. Wind Loading:
a. Comply with specified requirements on Structural Drawings.
b. Conform to the 2018 International Building Code with Rhode Island Building Code Regulation RISBC-1.
1) Basic Wind Speed (V.ult.): 143 miles per hour (three second gust).
2) Risk Category: III.
2. Snow Loading: Conform to the 2018 International Building Code with Rhode Island Building Code Regulation RISBC-1
3. Seismic loading as required by applicable code.
4. Building components shall be capable of supporting design loads without permanent deformation, loss of watertightness, or disengagement of any part of installation.

D. Deflection Limits: Exterior wall and roof system to withstand imposed live and wind loads with maximum allowable deflection of span (L = Span length) not to exceed:
1. Roof framing: L/360.
2. Roof Panels: L/240.

E. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

F. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to the following temperature ranges:
1. Ambient temperature range: 120 deg F (67 deg C).
2. Material surfaces: 180 deg F (100 deg C).

G. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

2.4 MATERIALS - STRUCTURE

A. Cast in-place concrete for building package:
1. All equipment, labor, trades, and materials for cast-in-place concrete shall be provided by under Section 03 30 00 - Cast-in-Place Concrete.
a. Includes all materials and labor for building package foundations/footings and interior slabs.
2. Footings for the building package are to be dug by the Building Installer and poured on-site to meet local code for permanent structures. A prefabricated,

modular mat placed on compacted base is not an accepted equal to a site specific, site poured, engineered foundation.

3. Engineered fill shall be ¾" minus crushed aggregate around footings, foundations, and slabs, or as required in the final approved plans.
4. Slab vapor barrier shall be 6-mil continuous plastic under the concrete slab, or as required in the final approved plans.
5. The foundation shall be installed as designed with all cast in-place concrete poured to dimensions specified, or as required in the final plans.
    a. Footings will be built 4'-0" deep as required by local frost depth or permitting authority.
    b. Minimum compressive strength of foundation concrete shall be 3,000 psi at 28 days, 4" +/-1" slump, with max ¾" aggregate, cured in accordance with ACI 308, or as required in approved final plans.
    c. Slabs shall have a fine broom finish with joints required in flat work as shown on plans.
    d. Steel rebar shall be installed as specified in final plans.

B. Building Installer shall supply and install concrete slab sealer.
1. Concrete slab sealer: Comply with requirements of Section 03 05 13 - Concrete Sealers.

C. Concrete Masonry Units (CMU) shall be supplied by Building Supplier.
1. Walls shall be constructed of 8"W x 16"L x 8"H split-face mortar joint concrete masonry units (concrete blocks).
2. Blocks shall be manufactured to ASTM C90 designation for load bearing concrete masonry units.
3. Block color to be as selected from Manufacturers' range of optional colors.

D. Masonry (concrete) grout shall be supplied and installed by Building Installer, complying with Section 04 20 00 - UNIT MASONRY.
1. Grout shall have a minimum compressive strength of 2,500 psi at 28 days, 9+/-1" slump, with max ½" aggregate.
2. Fine or coarse grout may be used in accordance with 2009 UBC.
3. All CMU block must be fully grouted and may not be wetted.

Building Installer is responsible for providing appropriate equipment and labor for notching CMU block for bond beams, cutting CMU block to make any required shapes, and/or grinding CMU block for fixture mounting.

E. Rebar for walls shall be supplied and installed by Building Installer, comply with Section 04 20 00 - UNIT MASONRY.
1. All walls shall have # 4 and # 5 rebar. See final approved plans for spacing.
2. All rebar used in the building must meet ASTM A615 manufacturing standards and is to be placed per the final approved plans.

F. Rain Guard anti-graffiti coating shall be supplied by Building Supplier.

2.5 MATERIALS - ROOF SYSTEM

A. The following roof components shall be supplied by Building Supplier.
   1. Glulam beam shall be 24F-V4 and architectural grade.
   2. Tongue & groove decking shall be 2x6 V-edge deck boards, select deck Douglas fir.

B. Roof system shall consist of prefabricated structural insulated panels.
   1. Panels shall be constructed of expanded polystyrene foam, OSB and urethane adhesives.
   2. Interior finish shall be white FRP.

C. Roof system shall consist of wood truss package.
   1. Building Supplier shall provide batt insulation.

D. Roofing shall be Fabral, 26-gauge, Horizon 16, standing seam panels, with 16 in. coverage width.
   1. Roofing package shall include inside and outside foam closures, matching trim (eaves, gables, and ridge) and fasteners, sheet metal flashing (all sides), and 30# felt (under metal).
   2. Roofing color to be selected by the ***owner*** from the manufacturers standard color chart.

E. Roofing to be Fabral, 29 gauge, Grand-Rib 3 roof panels with exposed fasteners.
   1. Roofing package shall include inside and outside foam closures, matching trim (eaves, gables and ridge) and fasteners, sheet metal flashing (all sides), and 30# felt (under metal).
   2. Roofing color to be selected by the ***owner*** from the manufacturers standard color chart.

F. Architectural Composition roofing shall have a 5-5/8 in. exposure and a nominal size of 13-1/4 in. x 39-3/8 in.
   1. Roofing color to be selected by the ***owner*** from the manufacturers standard color chart.

2.6 BUILDING COMPONENTS

A. Metal Doors,Frames and hardware:
   1. Doors shall be Steelcraft® SL18 standard laminated honeycomb core and 18-gauge galvanized steel.
   2. Door frame shall be pre-welded Steelcraft® 3-Sided flush frame, 16-gauge galvannealed A-60 steel.
   3. Doors and frames shall be powder coated with undercoating ***(color to be selected by owner)***.
   4. Masonry door clips (3/16” dia.) for door frame shall be fitted between the doorframe and concrete blocks to bond frame to wall. Door clips shall allow full internal grouting of the frame during installation.

5. Hinges shall meet ANSI A5112 with non-removable pin and two ball bearings.
6. Hager 5100 Series Grade 1 door closer shall be constructed of cast iron.
7. Door closure shall be LCN-4111, grade 1, heavy duty closure with cast iron body, full complement bearing, double heat-treated pinion journal.
8. Door shall have 0.038” gauge, stainless steel protection plates.
9. Doors shall have aluminum alloy 6063, T5 temper mill finish saddle thresholds, model 424E.
10. Doors shall have aluminum alloy 6063, T5 temper synthetic rubber polymer blend neoprene sweeps, model 200NA, anodized aluminum finish.
11. Doors shall have pull handles with stainless steel plates and deadbolt locks.
12. Restroom doors shall have Hager 3700 series interconnected locks with occupancy indicator.
13. Door lock shall be Grade 2, standard duty commercial cylindrical lever locks with no exposed mounting screws.
    a. Hager 341C latch protection plate with lock cut out.
14. Restroom doors to have 18” x 18” louvered vents.
15. Restroom doors to have magnetic locking system.
    a. Magnet locks, Hager 2942
    b. Hager 2903, with constant power for fail safe and fail secure locking devices.
    c. Exit switch, Hager 2977
    d. PIR egress sensor, Hager 2-679-0612
    e. Intermatic digital in-wall timer, ST01 Series.

B. Wall finish: Inside face of all exterior walls shall have rigid insulation finished with white FRP panels supplied by Building Supplier.

C. Vents:
1. Wall Vents: Kick proof wall vents for natural ventilation shall be supplied by Building Supplier.
    a. Pre-assembled steel frame with 10-gauge, 1” square lock joint wire weave mesh and interior louver with integral insect screen.
    b. Vents shall be primed and painted ***black***.
2. Gable vents: Wire weave gable vents for natural ventilation shall be supplied by Building Supplier.
    a. Pre-assembled steel frame with 10-gauge, 1” square lock joint wire weave mesh integral insect screen.
    b. Steel frame shall be primed and painted ***black***.

D. Toilet Partitions: Bradley phenolic restroom partitions shall be supplied by ***building supplier***.
1. Solid Phenolic core is composed of compressed cellulose fibers impregnated with resins. The surface laminate is fused to the resin-impregnated core. All

edges are machined and finished smooth with a 15- degree beveled edge. Materials shall be non-absorbent, impact and graffiti resistant. Materials shall be impervious to steam, soaps/detergents, and mildew.

2. Partition color shall be ***Graphite Grafix (006F)***.

E. Toilet Accessories:

1. Grab bars shall be stainless steel.
2. Freestanding, stainless steel, 36-gallon trash receptacle with no lid.
3. Mirror shall be 18” x 36”, framed with one-piece, roll-formed stainless steel with ¾” face and neatly mitered corners.
4. Toilet paper dispenser shall be stainless steel, wall mount with two-roll capacity.
5. Surface-mounted napkin disposal shall be fabricated of 22-gauge stainless steel with exposed surfaces in satin finish. Top attached by piano hinge.
6. Surface-mounted towel dispenser shall be fabricated of type heavy duty, 22 gauge stainless steel with exposed surfaces in satin finish. Refill indicator on face of cabinet. Tumbler lock to secure hinged front panel. Towel dispenser capacity 525 multi-fold or 400 C-fold towels.
7. Surface-mounted toilet seat cover dispenser shall be fabricated of 22-gauge stainless steel with exposed surfaces in satin finish with welded construction. Door with piano hinge and tumbler lock. Capacity 500 toilet seat covers.
8. Surface-mounted liquid soap dispenser shall be fabricated of 20-gauge satin finish stainless steel. Dispenser shall have completely concealed mounting, vandal resistant filler hole cover and sight gauge. Push-in corrosion- resistant liquid soap valve. Capacity: 40-oz. liquid soap.
9. Soap/Sanitizer Dispenser shall be Bradley Corp. Diplomat Series Model 6A01, surface-mounted automatic foam soap/sanitizer dispenser, with face formed with contemporary contours, radii, and finish matching related accessories in manufacturer's designer series. Capacity 27 oz (800 ml). Equipped with hinged cover and completely concealed mounting plate. Vandal resistant filler hole cover and sight gauge. Corrosion-resistant foam soap/sanitizer valve.
10. Surface mounted baby changing station shall be solid light grey (9631) molded bacterial-resistant, high density polyethylene. Steel to steel support hinges with pneumatic gas shock mechanism. Unit shall have integrated liner dispenser and bag hooks. Unit shall have an anti-microbial safety belt. Unit shall be operable with less than 5lbs. of force and complies with ASTM F2285 Standard.
11. Utilitub17 with legs and ADA faucet in the mechanical room.

2.7 PLUMBING

A. Incoming plumbing to within approximately 10’ of the building shall be provided by Building Installer.

1. All underground water service and sewer drain(s) from building to be as specified in final approved site plan.
2. Building water shutoff valve is to be supplied and installed by ***contractor***.

3. Building Installer is responsible to ensure that incoming water pressure is sufficient to meet building package fixture demands.
4. Minimum water pressure at toilet and urinal flush valves shall be 40 psi with minimum pipe sizing as per 2009 Uniform Plumbing Code Section 610, or as required in final approved plans.

B. The following plumbing fixtures and accessories shall be supplied by Building Supplier.
1. Toilet shall be floor mount, top supply, white vitreous China.
a. Flush valve shall be a chrome, manual lever with ADA compliant metal oscillating non-hold-open handle.
2. Urinal shall be wall mount, top supply, back discharge, white vitreous China.
a. Flush valve shall be a chrome, manual lever with ADA compliant metal oscillating non-hold-open handle.
3. Lavatory shall be 19 in. x 17 in. white vitreous china and wall hung with anti-splash rim and concealed front overflow.
a. Faucets shall be deck mounted single hole single supply metering, sink faucet.
b. Faucets shall be a 2.2gpm, pivot action lever style faucet.

C. Drinking fountain shall include bi-level electric water cooler with bottle filling station. VRCTLDDWS shall deliver non-chilled drinking water. Units shall be stainless steel construction and include vandal-resistant bubbler. Bottle filling unit shall include an automatic 20-second shut-off timer. Shall include Green Ticker™ displaying count of plastic bottles saved from waste. Bottle filler shall provide 1.1 - 1.5 gpm flow rate with laminar flow to minimize splashing. Unit shall meet ADA guidelines. Unit shall be lead-free design which is certified to NSF/ANSI 61 and 372 and meets federal and state low-lead requirements. Unit shall be certified to UL399 and CAN/CSA 22.2 No. 120.

2.8 ELECTRICAL

A. Electrical rough-in, installation and trim shall be provided by ***building installer***.
1. All underground and/or overhead service to building shall be as specified in the final site plan.
2. Building Installer is responsible for all necessary wire, connectors, grounding, conduit, and related items to install the building package electrical components and meet all relevant national, state, and local codes.
3. Building Installer shall supply and install all switches and outlets required to complete the building package installation.

B. The following electrical fixtures shall be supplied by Building Supplier.

C. Light fixtures shall be supplied by Building Supplier.
1. Exterior lights to be LED downlights with cast-aluminum housing with corrosion-resistant paint in dark bronze. Polycarbonate lens.

2. Exterior wall mounted, Lithonia, LED vaportight light fixtures that have cast-aluminum housing with corrosion-resistant paint in an industrial grey finish. Sealed gasket protects against moisture and dust.
3. Exterior lights controlled by photocell.
4. Interior surface mount, 48” LED light fixtures.
5. Restroom lights controlled by motion sensor.
6. Mech room lights controlled by switch (switches by installer).

D. Electric tank, 20-gallon, 2.5kw water heater supplied by ***building supplier***.

E. Surface mount, 1000 - 2750-Watt wall heater in mechanical room only shall be supplied by Building Supplier.

F. Broan #771, ceiling exhaust fans shall be supplied by ***building supplier***.

G. Wall mount, white, Bradley hand dryer with 15 second dry time supplied by Building Supplier.

H. Main breaker panel shall be supplied by ***building supplier***.
1. Breaker Panel shall be 100 Amp, single-phase, indoor.

2.9 FABRICATION

A. General:
1. Do not fabricate materials (on-site or off-site) until all specified submittals have been submitted to, and approved by, the Architect.
2. General: Coordinate fabrication and erection of work with related work of other trades. Provide cutouts and supplemental reinforcement as required to accommodate materials and work specified in other sections of the specifications.
3. Protection of Dissimilar Metals: Dissimilar materials which are not compatible with adjoining materials when exposed to moisture shall be separated by means of coatings, gaskets, or other effective means.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
1. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position.
2. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 ERECTION - FRAMING

A. Erect framing in accordance with AISC Specification.

1. Bolt settings and other dimensions shall be held to a tolerance of plus or minus 3 mm (1/8-inch). Use templates or other gaging devices to assure accurate spacing of anchor bolts. Bolt field connections unless otherwise indicated on approved shop drawings.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated on approved shop drawings.

C. Set column base plates with non-shrink grout to uniform full plate bearing and to maintain established floor line elevation(s).

D. Do not field cut or alter structural members without approval of Architect/Engineer.

E. After erection, prime welds, abrasions, and surfaces not [shop primed.] [galvanized.]

3.3 ERECTION - WALL AND ROOFING SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place sidelaps over bearing.

E. Provide expansion joints where indicated.

F. Use concealed fasteners.

G. Install sealant and gaskets to prevent weather penetration.

H. System: Free of rattles, noise due to thermal movement and wind whistles.

3.4 ERECTION - GUTTER AND DOWNSPOUT

A. Rigidly support and secure components. Joint lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

B. Apply bituminous paint on surfaces in contact with cementitious materials.

C. Slope gutters minimum [ ] inch/ft ([ ] mm/m).

D. Connect downspouts to [storm sewer system.

E. Install splash pads.

3.5 INSTALLATION ACCESSORIES

A. Install door frame, door,, in accordance with manufacturers instructions.

B. Seal wall and roof accessories watertight and weather tight with sealant, in accordance with Section 07 92 00.

3.6 TOLERANCES

A. Framing Members, maximum variation from plumb or level: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

B. Siding and Roofing, maximum offset: 1/8 inch (3 mm) from true position

3.7 FIELD QUALITY CONTROL

A. Field inspection will be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.

3.8 CLEANING

A. Daily clean work areas by sweeping and disposing of [debris,] [and] [scraps] [and sawdust].

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

C. Clean work under provisions of Section 01 73 00 – EXECUTION.

D. Waste Management:

1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
2. Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, local) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer for MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required, the following phone numbers for national companies are provided for the Contractor’s convenience only.
    a. Safety Kleen, Plano TX., (telephone 800-669-5740).
    b. Clean Harbors, Norwell MA., (telephone 800-422-8998).
    c. Phillip Services Corporation (PSC), Houston TX., (telephone 800-726-1300).

3.9 PROTECTION

A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

3.10 ATTACHMENTS

A. The following documents, bound herewith, are included as part of this Section:

1. Schedules: (xxx pages).
2. Tables: (xxx pages).
3. Illustrations: (xxx pages).
4. Forms: (xxx pages).

End of Section

Section 14 22 00

COMPACT TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install: electric traction elevators. Elevator work includes:

1. Commercial, standard pre-engineered passenger and service elevators.
2. Elevator car enclosure, hoistway entrances and signal equipment.
3. Operation and control systems.
4. Accessibility provisions for physically disabled persons.
5. Equipment, machines, controls, systems and devices required for safely operating the specified elevators at their rated speed and capacity.
6. Elevator hoist beam.
7. Elevator pit ladder.
8. Provide spare coaxial cable for security camera to be mounted in every elevator cab. Camera to be provided by Section 28 00 00 – ELECTRONIC SAFETY AND SECURITY Trade Contractor and installed by contractor of this section. Section 28 00 00 Trade Contractor shall provide all conversion components from coaxial to IP connection on camera. Trade Contractor of this section shall perform all work in the elevator cab. Coaxial cable shall terminate in elevator mechanical room, with 30’ slack. Provide all connection and installation work to ensure camera is installed on building security network, using components provided by Section 28 00 00 Trade Contractor if Section 28 00 00 Trade Contractor is not authorized to perform work in elevator mechanical room. Coordinate all work with Sections 27 10 00 - STRUCTURED CABLING and 28 00 00 – ELECTRONIC SAFETY AND SECURITY.
9. Coordinate with Section 28 00 00 – ELECTRONIC SAFETY AND SECURITY Trade Contractor and furnish and install required cabling from all elevator mechanical rooms to the elevator doorway on each floor (CR symbol) for security system card readers to be installed to control elevator access. If Section 28 00 00 Trade Contractor is not authorized to work in elevator mechanical room, provide all terminations required to integrate the card reader and elevator controls to the security system. Provide all relay outputs from elevator control panel to ensure proper control of elevator via access control. Only a valid card read OR key override will allow call buttons in hallways of elevator cab to function.
10. Coordinate with Section 28 00 00 - ELECTRONIC SAFETY AND SECURITY Trade Contractor and furnish and install required cabling from all elevator mechanical rooms to the elevator cabs in elevators 1 and 2 (CR symbol inside cab) for security system card readers to be installed to control elevator floor access. This card reader inside the cab is in addition to card readers outside each door in hallways. If Section 28 00 00 Trade Contractor is not authorized to work in elevator mechanical room or cab, provide all terminations required to integrate the card reader and elevator controls to the security system.

Provide all relay outputs from elevator control panel to ensure proper control of elevator via access control. Only a valid card read will enable all OR specific floor selection buttons to be active (i.e.: some cards will be restricted from floor 5 access in elevator 2, some will not. During certain times of the day, floors 3 and 4 may be restricted for some users, some may not be restricted).

11. All other devices, materials and accessories for operation, dispatching, safety, security, leveling, and alarms, to complete the elevator installation.

B. Provide 12 month maintenance and call back services for elevator equipment furnished.

1.2 EXAMINATION OF SITE AND DOCUMENTS

A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to ADVERTISEMENT FOR BIDS for time and date.

1.3 RELATED REQUIREMENTS

A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements relating to recycling goals, waste management program and reporting.

C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Procedural and administrative requirements relating to required *Northeast CHPS Verified Program,* (NE-CHPS) Certification.

D. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

1. Concrete elevator pit foundation.
2. Embedded concrete anchorage.

E. Section 04 20 00 - UNIT MASONRY: Hoistway wall construction.

F. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Hoistway framing, and divider beams.

G. Section 05 50 00 - METAL FABRICATIONS: Supports for guide rail brackets, and continuous supports for sills at each hoistway entrance.

H. Section 08 71 00 - DOOR HARDWARE: Cylinder for key control of elevator call buttons.

I. Section 09 65 23 - RUBBER FLOORING: Rubber flooring in elevator cab(s).

J. Section 10 40 00 - SAFETY SPECIALTIES: Fire extinguisher in elevator machine room.

K. Division 23 - HVAC: Ventilation system and temperature control of elevator machine room.

L. Division 26 - ELECTRICAL:

1. Temporary power supply.
2. Fused mainline switches or circuit breakers in the machine room, including feeders from the mainline switch to controllers or starters.
3. Electrical service to elevators, including fused disconnect switches.
4. Heat and smoke sensing devices.
5. Convenience outlets and illumination in machine room, hoistway and pit.
6. Fire and smoke detectors and interconnecting devices; fire alarm signal lines to contacts in the machine room.

M. Section 27 10 00 – STRUCTURED CABLING: Coordination of final connections.

N. Section 28 00 00 – Electronic Safety and Security:

1. Security camera mounted in elevator cab.

1.4 REFERENCES

A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ADAAG - Accessibility Guidelines for Buildings and Facilities
2. ICC/ANSI A117.1 - Providing Accessibility and Usability for Physically Handicapped People.
3. ANSI/ASME A17.1 - Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks
4. ANSI/ASME A17.2 - Inspection of Elevators, Escalators, and Moving Walks.
5. ANSI/NFPA 70 - National Electrical Code.
6. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows.
7. ASTM A167 (Withdrawn Standard) – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
8. ASTM B151/B151M – Standard Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar.

9. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
10. UL: Applicable requirements for motors, switches and other electrical components.
11. All applicable federal, state and municipal codes, laws and regulations for elevators, including barrier-free requirements.

B. Sustainability Requirement Reference: The following sustainability requirements are hereby made a part of this Section by reference thereto:

1. High Performance Schools Exchange, Northeast Energy Efficiency Partnerships NE-CHPS, (referred to herein as “NE-CHPS”).

1.5 DEFINITIONS

A. All terms in this Section shall have meaning defined in the Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks, ANSI A17.1, including all revisions and modifications thereto. In all cases where a device or part of the equipment is herein referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

1.6 SEQUENCING

A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.

C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.7 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, for elevator components furnished, including:
   a. Signal and operating fixtures, operating panels, indicators.
   b. Cab design, dimensions, layout and components.
   c. Cab and hoistway door and frame details.
   d. Electrical characteristics and connection requirements.
2. Manufacturer's warranties: Manufacturer's written warranty, countersigned by the installer, clearly stating all terms and conditions of the warranty, and

covering all materials and workmanship provided for a period of not less than one year from date of Substantial Completion of the General Contract.

3. Shop drawings: Large scale drawings indicating general arrangement for all elevator equipment; indicate on drawings:
   a. Motor, controller selector, governor and other component locations.
   b. Car, machine beams, guide rails, buffers, and other components in hoistway.
   c. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   d. Individual weight of principal components; load reaction at points of support.
   e. Loads on hoisting beams.
   f. Landing heights, entrance dimensions, and tolerances of shaft dimensions.
   g. All electrical characteristics and requirements for the elevator equipment, including heat release and regenerative amps and KW.
   h. Cab dimensions, show a horizontal emergency stretcher inside of cab with equivalent ease, verifying compliance with MA 524 CMR 17.40 requirements.
4. Manufacturer's certification: Manufacturer's letter, certified by a Notary Public, stating that no proprietary equipment, as is specified under Part 2 - Products, will be used in the installation.
5. Samples: Sample chips of all finishes in elevator car, hoistway doors and frames, and all available colors for, plastic laminate, paints, and finishes, for selections by the Architect.
6. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
   a. Composite Wood and Agrifiber Products: Include certification indicating compliance with the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda for all composite wood and agrifiber products.
7. Sustainable Design Submittals: As required by NE CHPS.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
   1. Parts list and wiring diagrams: Upon completion of the installation, submit four (4) copies of a complete parts list and as-built wiring diagrams for controller and elevator system and maintenance instruction manual.
   2. Provide technical information for servicing operating equipment.
   3. Include legible schematic of hydraulic piping and wiring diagrams of installed electrical equipment, and changes made in the work. List symbols corresponding to identity or markings on machine room and hoistway apparatus.

4. Provide one copy of master electric schematic and one copy of lubrication chart, each framed with clear glass; mounted on machine room wall in location designated by Architect.
5. Manufacturer's written installation warranty and maintenance contract as specified herein below.
6. Sustainable Design Submittals: As required by NE CHPS, version 4.0.

1.8 QUALITY ASSURANCE

A. In the interest of unified responsibility, the elevator installer shall be either the actual equipment manufacturer or a firm fully authorized by the manufacturer of the proposed equipment to install the equipment; regularly engaged in the business of manufacturing, installing, and servicing elevators of the type and character required under this Section, with all major components, including the entire power unit, controller, hydraulic cylinder, door operators, signal fixtures, and other major items, being the products of a single elevator manufacturer.

1.9 REGULATORY REQUIREMENTS

A. All designs, clearances, construction, workmanship, and material, unless specifically excepted, shall be in accordance with the requirements of:
1. ASME/ANSI A17.1 Safety Code for Elevators and Escalators.
2. ICC/ANSI A117.1, *Accessible and Useable Buildings and Facilities,* 2010 Edition, as published by the International Code Council, Inc. (I.C.C.) and American National Standards Institute (ANSI).
3. State of Rhode Island Elevator Safety Code (260-RICR-30-10-1), effective January 4, 2022, as revised and amended January 6, 2019.
4. City of Central Falls applicable municipal regulations.
5. NFPA 70 National Electrical Code.
6. NFPA 80 Fire Doors and Windows.

B. Work shall be in full conformance with all regulations for the physically handicapped in accordance with ANSI Publication No. A-117.1 Part 4, Series 4.12, Design of Barrier-Free Facilities, the recommendations of United States Department of Justice, Nº 28 CFR Part 36 - AMERICAN WITH DISABILITIES ACT Public Law 101-336, (referred to herein as "ADA"), local authorities, and all other governing bodies which may have jurisdiction.

C. Work shall conform to seismic requirements of ANSI A17.1 for Seismic Zone 2.

D. Products requiring electrical connection: Listed and classified by Underwriter’s Laboratories, Inc., as suitable for the purpose specified and indicated.

1.10 PERMITS, TESTS AND INSPECTIONS

A. Obtain and pay for all necessary municipal and State elevator inspections and permits; make all tests by the regulations of such authorities. The capacity and operational performance tests shall be conducted in the presence of the Architect and the code enforcement officer, after completion of the installation.

B. Obtain certificate of compliance from authority having jurisdiction indicating approval of installed elevator.

1.11 WARRANTY

A. Provide 2 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES. Warranty shall include all materials and workmanship for the elevator system and its installation countersigned by the elevator installer, clearly stating all terms and conditions of the guarantee, and covering all materials and workmanship provided for a period of not less than two (2) years from date of Substantial Completion of the General Contract.

1.12 MAINTENANCE

A. Provide Installers maintenance contract under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, for a period equal to warranty. Maintenance contract shall include the following:

1. 24-hour emergency callback service for the equipment.
2. Monthly examinations of the installation during regular working hours by trained employees of the elevator manufacturer.
3. All necessary adjusting, greasing, and oiling.
4. Cleaning supplies and parts necessary to keep the equipment in proper operation, except any parts needed due to misuse, accident, or neglect.

B. Repair work shall be carried out only by the elevator installer's personnel, using only standard parts furnished by the elevator manufacturer. Maintenance shall be carried out directly by the elevator installer and shall not be assigned or transferred to any agent.

1.13 TEMPORARY USE OF ELEVATOR

A. Should the General Contractor, or the Owner, require the use of the elevator before the installation is completed, the user will provide, if needed, at no expense to the elevator installer, temporary car enclosure, necessary guards or other protection for the elevator hoistway, protection for finished elevator entrances, main line wiring with necessary power, signaling devices, lights in car, and qualified operators. In addition, the General Contractor, or the Owner, as applicable, will sign a Temporary Acceptance Form before the elevator is placed into temporary service; pay all costs of power and operation; maintain all of the equipment; and leave the elevator equipment in the same condition and repair that the equipment was in at the time it was placed in temporary service.

PART 2 - PRODUCTS

2.1 MANUFACTURE AND TYPE

A. To establish a standard of quality, design and function desired, Drawings and specifications have been based on Kone, Inc., Product: “Monospace 500DX”.

B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Kone Inc., Moline, IL, product: “Monospace 500DX”.
2. Otis Elevator Company, Farmington CT, product: “Gen2”.
3. Schindler Elevator Corporation, Gettysburg PA, product: “3300”.

C. Proprietary equipment: No proprietary equipment shall be used in the installation. All equipment included in the elevator installation shall have repair or replacement parts readily accessible to the general elevator trade. Without limitation, this shall include diagnostic tools, solid state boards and controller components required for the complete maintenance of the installed equipment.

1. Any costs incurred for changes in the work from that shown on the Drawings, including work of this and other Sections, due to the requirements of the particular equipment furnished thereunder are the sole responsibility of the Elevator manufacturer.

D. Barrier free design: Provide for handicapped requirements in accordance with ANSI Publication No. A-117.1 Part 4, Series 4.12, Design of Barrier-Free Facilities, Americans with Disabilities Act (ADA) and all applicable Federal, State and Local codes.

E. General characteristics Elevator 1:

Load (rated capacity):	3,500 pounds.
Car Speed:	150 feet per minute.
Drive:	Regenerative.
Operation:	Simplex
Total Rise:	As indicated on the Drawings.
Number of Stops:	As indicated on the Drawings.
Number of Openings:	Front entrances: As indicated on the Drawings.
Height under car top:	8’-0”
Height under ceiling:	7’-7”
Clear car inside:	6’-8” wide by 5’-6-3/16” deep.
Car door type:	Single speed side opening.
Hoistway entrance:	3’-6” wide by 7’-0” high.
Machine location:	Inside hoistway mounted on guide rail.
Control location:	Adjacent location on ground floor.
Power supply:	480 volts, 3 phase, 60 hertz Plus or minus 5 percent of normal with separate equipment conductor.
Lighting supply:	120 volts, 1 phase, 15 amps, 60 hertz
Signal supply:	120 volts, 1 phase, 60 hertz
Control space location:	As indicated on Drawings.

F. General characteristics Elevator 2:

Load (rated capacity):	3,500 pounds.
Car Speed:	150 feet per minute.
Drive:	Regenerative.
Operation:	Simplex
Total Rise:	As indicated on the Drawings.

Number of Stops:	As indicated on the Drawings.
Number of Openings:	Front and rear entrances: As indicated on the Drawings.
Height under car top:	8’-0”
Height under ceiling:	7’-7”
Clear car inside:	6’-7-1/16” wide by 6’-8-5/16” deep.
Car door type:	Single speed side opening.
Hoistway entrance:	3’-6” wide by 7’-0” high.
Machine location:	Inside hoistway mounted on guide rail.
Control location:	Adjacent location on ground floor.
Power supply:	480 volts, 3 phase, 60 hertz Plus or minus 5 percent of normal with separate equipment conductor.
Lighting supply:	120 volts, 1 phase, 15 amps, 60 hertz
Signal supply:	120 volts, 1 phase, 60 hertz
Control space location:	As indicated on Drawings.

G. Load capacity: Safely lower, stop, and hold up to 125 percent rated load.

H. Speed: Plus or minus 5 percent contract speed under any loading condition or direction of travel.

I. Stopping Accuracy: ±1/4 inch (6.4 mm) under any loading condition or direction of travel.

J. System Performance:

1. Vertical Vibration (maximum): 25 mg.
2. Horizontal Vibration (maximum): 25 mg.
3. Jerk Rate (maximum): 1.3 ft/sec^3.
4. Acceleration (maximum) 1.3 ft/sec^2.
5. In Car Noise: = 55 dB(A).
6. Leveling Accuracy: 0.2 inches.
7. Starts per hour (maximum): 120.

2.2 CONTROL COMPONENTS AND CONTROL SPACE EQUIPMENT

A. Controller: Provide microcomputer based control system to perform all of the functions.

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current. The drive will be set up for regeneration of AC power back into the building grid.

2.3 HOISTWAY EQUIPMENT

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer.

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit
2. Terminal stopping switches.
3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

G. Elevator pit ladders: Stringers 3/8-inch by 1-1/2 inch flat bar, rungs 5/8 inch diameter solid steel rods. Offset ladder from wall surface by 7 inches to centerline of rungs, with brackets.

1. Fabricate ladders in accordance with OSHA requirements, and ANSI A14.3 standards.
2. Hot dip galvanized finish assembled elevator pit ladders.

2.4 ELECTRICAL COMPONENTS

A. Boxes, conduit, wiring, and devices: Required by ANSI/NFPA 70.

B. Fittings: Steel compression type for electrical metallic tubing. Fittings with setscrews are acceptable only when a separate grounding conductor is also installed across the joint.

C. Spare conductors: Provide 10 percent extra conductors and two pairs of shielded audio cables in traveling cables. Do not parallel conductors to increase electric current capacity unless individually fused.

D. Include wiring and connections to elevator devices.

1. Do not use armored flexible metal conduit as a grounding conductor.

2.5 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each opening with internal channel reinforcement.

1. Manufacturer's standard entrance design, bearing Underwriters' Laboratories "B" labels, and consisting of 14 gauge frames with 2 inch (50 mm) profile, 16 gauge doors, hangers, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
2. Elevator wall interface with hoistway entrance assembly shall comply with elevator manufacturer's requirements.
3. Doors: Flush construction.
    a. Stainless steel: ASTM A167, Type 304 stainless steel panels, No. 4 satin finish.
4. Frames: Formed construction.
    a. Stainless steel: ASTM A167, Type 304 stainless steel panels, No. 4 satin finish.
5. Transom: Flush construction, material and finish matching door and frame materials and finish.
    a. Floating type: Standard height columns with variable height transom panel.
    b. Trim type: Extended height columns with inset variable height transom panel.
    c. Enclosed type: Extended height columns with inset variable height transom panel and trim panel at top.
6. Entrance markings jamb plates: Provide standard entrance jamb tactile markings on both jambs, at all floors.

B. Interlocks: Equip each hoistway entrance with an Underwriters' Laboratories "B" label approved type interlock tested required by code. Interlock shall be designed to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by code and shall prevent opening the doors at any landing from the corridor side unless the car is at rest at that landing or is in the leveling zone and stopping at that landing.

C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway sliding door.
1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable slide to accommodate the up-thrust of the doors.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

D. Hoistway Sills: Extruded, with grooved surface, 1/4 inch (6.4 mm) thickness.
1. Nickel-silver: ASTM B151 nickel silver, alloy UNS C74500, polished finish.
2. Where floors are scheduled for carpet, raise sills 1/2 inch.

E. Doors and sight guards: Sight guards shall be furnished on the leading edge of the doors to conceal the hoistway beyond the doors, and finished to match door panels. Fabricate doors from16 gage sheet steel (minimum).

2.6 CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Platform: Platform shall be per manufacturers standard with fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood subfloor. Underside of the platform shall be fireproofed.

C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with seismic design requirements.

D. Load weighing device shall be strain gauge type mounted to dead-end hitch attached atop the hoistway guide-rail.

E. Cab Enclosure:

1. Walls: reinforced 16 gauge cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical 5/8 inch thick composition board core, laminated front and back with plastic laminate. Edges of each panel shall be plastic laminate.
2. Canopy: Reinforced 14-gauge cold-rolled steel with hinged exit. Finish: Two coats factory applied reflective baked enamel.
3. Ceiling: Suspended downlight type, 16 gauge metal pans with round LED downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six.
    a. Metal panels: Stainless steel, No. 4 satin finish.
4. Cab Columns, Front, and Transom: Stainless steel, No.4 satin finish.
5. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.
    a. Door Finish: Stainless steel, No. 4 satin finish
6. Cab Sills: Extruded, with grooved surface, 1/4 inch (6.4 mm) thickness.
    a. Nickel-silver: ASTM B151 nickel silver, alloy UNS C74500, polished finish.
7. Handrail: Continuous type metal bar handrail with ends curved to the wall, nominal ¼ inch by 2 inches, stainless steel satin finish.
    a. Provide at rear and side walls.
8. Ventilation: Two-speed exhaust fan mounted on the car top.
9. Pad Buttons: Provide pad buttons on cab front(s) and walls.
    a. Provide one set of vinyl protection pads for the project.
10. Base: Stainless steel satin finish.
11. Finished Floor: Provided under Division 9 Sections.

F. Emergency Car Signals

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

2.7 SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation.

1. Full height car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have amber illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be amber 7 Segment. All texts, when illuminated, shall be amber. The full height car operating panel shall have a polycarbonate face plate that is shatterproof and impact resistant in a color and pattern per manufacturers standard selection.
2. Additional features of car operating panel shall include:
    a. Elevator Data Plate marked with elevator capacity and car number on car top.
    b. Help buttons with raised markings.
    c. Firefighter's hat.
    d. Firefighter's Phase II Key-switch.
    e. Call Cancel Button.
    f. Firefighter's Phase II emergency in-car operating instructions.
    g. Medical access signage (Elevator No. 1).
    h. Emergency elevator signage.
3. The lowest module shall contain the "door open," "door close," "alarm" buttons and a keyed "emergency stop" switch.
4. Intermediate modules shall contain floor buttons which illuminate when a call is registered and remain illuminated until the call is answered. Raised floor indications and handicap symbols shall be located immediately adjacent to the floor buttons and be fully integrated in the module design. No applied symbols or floor indications or symbols on the buttons shall be permitted.
5. The next module shall contain required switches.

6. The top module shall contain fire service features in accordance with ASME A17.1, Rule 211.3, including operating instructions.

B. Position Indicator: An electronic dot matrix position indicator. As the car travels, its position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing.

C. Emergency Light: An emergency light and capacity plate. Emergency light shall illuminate automatically upon loss of the building's normal power supply.

D. Communications systems:

1. General: Provide traveling cables with sufficient shielded wires plus two spares into the car.
2. Telephone cabinet: A telephone cabinet shall be furnished in the return panel below the car buttons. Intercom communications equipment and connections to building service system will be furnished and installed by the Owner.
3. Emergency Communications System: Provide an emergency communications device mounted in the swing return. Emergency communications device shall comply with Americans with Disabilities Act (ADA) requirements.
    a. Provide two way communications system between elevator cab and controller room.
    b. Pre-programmed integrated ADA phone (complete description of krms features included as standard)
    c. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

E. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

F. Special Accessories:

1. Independent service switch.
2. Inspection switch.
3. Telephone jack.
4. Certificate frame.

2.8 AUXILIARY OPERATION AND CONTROLS

A. General: In addition to primary control system features, provide the following controls or operational features for elevator.

B. Special emergency service - Phase I: The activation of a key switch in the Level 1 hall button shall return car to Level 1 by-passing all car and hall calls. The car shall park at Level 1 with their doors open and not respond to car or hall calls unless the

SES-II key switch in the car is activated. The system shall be in conformance with the current ANSI Code, Section 211.3. The elevator installer shall furnish contacts on the elevator controller to receive alarm signals from smoke/heat detectors. If an elevator is on Independent Service, when the elevator is recalled, a continuous buzzer will sound in the car and a warning light shall be illuminated.

C. Special emergency service - Phase II: (SES-II) in-car control of elevator during the emergency operation, by means of a key switch in car shall be provided. Operation shall be per ANSI Code, Rule 211.3.

D. Emergency Medical Technician (EMS) Service: Supply in accordance with the current edition of State of Rhode Island Elevator Safety Code (260-RICR-30-10-1).

E. Emergency/secondary power operation:

1. Provide emergency battery power supply to furnish temporary power whenever the main line power is lost for longer than five (5) seconds to allow the elevator controller to function. The elevator shall rise or lower to the first available landing, open the doors, and shut down. The elevator shall return to mail line service upon the return of normal power.

F. Provide emergency lighting system for car.

2.9 HALL FIXTURES

A. Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a polycarbonate face plate that is shatterproof and impact resistant in a color per manufacturers standard selection.

B. Hall fixtures shall feature round, mechanical, illuminated buttons in raised fixture housings. Buttons shall be flat flush in vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature amber illumination. Faceplates shall be stainless steel No. 4 satin finish.

1. Each terminal station shall contain one illuminating pushbutton.
2. Each intermediate station shall consist of two illuminating pushbuttons, one for the up direction and one for the down position.
3. Phase 1 firefighters service keyswitch, with instructions, shall be incorporated into the hall station at the designated level.

C. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

D. Hall Position Indicator: A dot matrix position indicator. As the car travels, its' position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing. When hall lanterns are provided, the position indicator shall be combined with the hall lanterns in the same faceplate.

1. Faceplates shall be No. 4 satin stainless steel finish.

2.10 ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation

1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
2. Zoned Car Parking.
3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation
2. Fan and Light Control.
3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection
5. Top of Car Inspection Station.

C. Additional Operating Features to include:

D. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.
2. Provide devices on car top to run the elevator in inspection operation.
3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means for the control to reset elevator earthquake operation.

2.11 DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

2.12 FINISHES, GENERAL

A. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent and prime two coats.

B. Galvanized Surfaces: Clean with neutralizing solvent; prime with two coats.

C. Aluminum: Mill finish.

D. Wood Surfaces not exposed to public view: One coat primer and one coat enamel.

E. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two finish coats of enamel sprayed and baked.

F. Stainless steel: Number 4 brushed finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces, and required embedded anchorage devices, and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on approved shop drawings.

3.2 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components.

3.3 INSTALLATION

A. Perform the installation in accordance with the approved shop drawings and the manufacturer's written instructions, ANSI/ASME A17.1 and those standards required by authority having jurisdiction, and with the additional requirements specified herein.

B. Install system components. Connect equipment to building utilities. Install piping between hoistway plunger and pump unit.

C. Furnish and install all internal and operational wiring, conforming to the requirements of the National Electrical Code, as necessary to connect the operating buttons and switches, from the control board to the power unit. Except for short lengths of flexible conduit to moving apparatus, ensure that all wiring is contained in rigid conduit or electrical metal tubing.

D. Mount motor and pump unit on vibration and acoustic isolators, on bed plate and concrete pad. Place unit on structural supports and bearing plates. Securely fasten to building supports. Prevent lateral displacement.

E. Accurately machine and align guide rails. Form smooth joints with machine splice plates. Install guide rails using threaded bolts with metal shims and lock washers under nuts. Compensate for expansion and contraction movement of guide rails.

F. Bolt or weld brackets directly to structural steel hoistway framing. Chip and clean field welds of oxidation and residue, wire brush and spot prime with two coats of primer.

G. Hoistway entrances: Coordinate the entrance work with that of the trades responsible for furnishing and installing the structural enclosure. Ensure that the entire front wall of the hoistway is left open (or a rough opening is provided which is 12 inches greater in width and 6 inches greater in height than the finished opening) until the hoistway entrances have been installed.

1. Install the hoistway entrances in perfect alignment with the guide rails, after guide rails have been installed and aligned. Interface the hoistway entrances with the surrounding conditions as indicated on the approved shop drawings.
2. Fill hoistway door frames solid with grout.

3.4 TOLERANCES

A. Guide rail alignment: Plumb and parallel to each other. Align rails vertically with tolerance of 1/16 inch in 100 feet. Secure joints without gaps and file/grind irregularities to a smooth continuous surface.

B. Cab movement on aligned guide rails: Smooth movement, with no objectionable lateral or oscillating movement or vibration. Ensure equalized pressure of guide shoes on rails.

3.5 TESTS AND ADJUSTMENTS

A. In addition to other requirements, tests, inspections, and remedies, specified herein, perform the following:

1. Adjust motors, power conversion unit, brake, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks and safety devices to achieve required performance levels.
2. After completion of the installation, and prior to the date of Substantial Completion of the General Contract, make necessary arrangements with the Architect, and, in the presence of the Architect, conduct a running speed test

with the full maximum load on the elevator, to ensure that the installed elevator meet all specified requirements for speed, capacity, and other requirements contained in this Section.

3. In the event that the equipment does not meet all requirements of this Section, promptly remove from the premises all work determined by the Architect to be non-conforming. Promptly replace and re-execute the condemned work in accordance with the Contract Documents, bearing all expenses and costs therefore, including the costs of other trades as needed to restore related work destroyed or damaged by such removal and replacement work performed.

3.6 CLEANING

A. After all work under this Section has been completed and satisfactorily tested, remove all applied packing labels from the various surfaces, thoroughly clean and polish all stainless steel and prefinished surfaces. Touch up all scratches, abrasions, and other surface defects in the prefinished surfaces, using the same material, color, and gloss as used in the prefinishing system.

3.7 TOLERANCES

A. Guide rail alignment: Plumb and parallel to each other. Align rails vertically with tolerance of 1/16 inch in 100 feet. Secure joints without gaps and file/grind irregularities to a smooth continuous surface.

B. Cab movement on aligned guide rails: Smooth movement, with no objectionable lateral or oscillating movement or vibration. Ensure equalized pressure of guide shoes on rails.

3.8 TESTS AND ADJUSTMENTS

A. In addition to other requirements, tests, inspections, and remedies, specified herein, perform the following:

1. Adjust motors, power conversion unit, brake, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks and safety devices to achieve required performance levels.

2. After completion of the installation, and prior to the date of Substantial Completion of the General Contract, make necessary arrangements with the Architect, and, in the presence of the Architect, conduct a running speed test with the full maximum load on the elevator, to ensure that the installed elevator meet all specified requirements for speed, capacity, and other requirements contained in this Section.

3. In the event that the equipment does not meet all requirements of this Section, promptly remove from the premises all work determined by the Architect to be non-conforming. Promptly replace and re-execute the condemned work in accordance with the Contract Documents, bearing all expenses and costs therefore, including the costs of other trades as needed to restore related work destroyed or damaged by such removal and replacement work performed.

3.9 DEMONSTRATION

A. Demonstration and Training for Owner's Staff: Prior to seeking final acceptance of the project, the Contractor shall conduct a one (1) hour training program on-site with building personnel selected by the Owner. Training to include:

1. Review of each control feature and its correct sequence of operation.
2. Instructions on proper safety procedures and who to contact for the purpose of assisting passengers that may become entrapped inside an elevator car.

3.10 CLEANING

A. After all work under this Section has been completed and satisfactorily tested, remove all applied packing labels from the various surfaces, thoroughly clean and polish all stainless steel and prefinished surfaces. Touch up all scratches, abrasions, and other surface defects in the prefinished surfaces, using the same material, color, and gloss as used in the prefinishing system.

End of Section

SECTION 210000

FIRE PROTECTION

INDEX

SECTION 210000

FIRE PROTECTION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. All the Contract Documents and General Provisions of the Contract including, but not limited to, General and Supplementary Conditions, and Division 1 Specification Sections apply to this Section.

B. The work of this Section provides and contains general information which is inherently made a part of each Section and applies to all work performed under this Contract.

C. The Drawings on which this Contract is based are listed in Section 00860. Consult all Drawings, note all conditions that may affect the Work and care for same in executing the Contract.

D. Refer to Section 012300, Alternates, for alternates which may affect the work of this Section. The following alternates include Fire Protection Scope:

1.2 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services and accessories necessary to Design, Furnish and Install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein. The Design shall conform to the documents and shall be subject to approval by the Architect.

B. Without limiting the generality thereof, the work to be performed under this Section includes:
1. A hydraulically designed combination automatic sprinkler system to provide 100% protection for the new building as noted on the Drawings. Refer to Fire Protection Criteria on the Drawings. Prepare Working Drawings for approval of the Architect, the local authority having jurisdiction, and the owner's insurance company under stamp of an independent Rhode Island Registered Professional Fire Protection Engineer.
2. Backflow Control Devices.
3. Fire Department Connections.
4. Pipe and Fittings
5. Valves
6. Hangers
7. Sprinkler Heads
8. Furnishing and installation of Supervisory Switches and Controls
9. Systems Identification
10. Flushing and Testing of the interior system as provided herein. Coordinate, witness, and certify the flushing and testing of the exterior system and submit certificates. The exterior installation is provided in Division 2.
11. Drilling, Coring, Cutting & Patching of holes and openings (where the largest dimension thereof does not exceed 12 inches), for Fire Protection Piping and Equipment. All such holes require sleeves.
12. Scaffolding, Rigging, and Staging required for all Fire Protection Work. Comply with Division 1 requirements.
13. Provide Seismic Restraints for all Fire Protection Systems conforming to the requirements of the State Building Code which Section is herein incorporated by reference as work of the Fire Protection Sub Contractor. Seismic Restraints are

required in both new and renovated buildings.

14. Furnishing of Access Panels
15. Smoke and Firestopping Seals and sealing of all wall penetrations as detailed on the drawings. Refer to Section 078400 which defines the firestopping materials and methods.
16. When open-flame or spark producing tools such as blower torches, welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant non-working fire watch through the Local Fire Department where work is being performed and until it is completed.
17. It shall be the responsibility of this division 210000 to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this division 210000 and the Testing requirements shall be in addition to those tests and requirements outlined in sections 018000 and 210800 and required to fulfill commissioning obligations.

1.4 RELATED WORK

A. The following items of work related to the Fire Protection Work are included under other Sections of the Specifications:
   1. Fire Services up to 10 feet within foundation: DIVISION 22 – PLUMBING
   2. Cutting & Patching beyond 1.2B.114 above: SECTION 010450 - CUTTING AND PATCHING.
   3. Installation of Access Panels: Respective finish section.
   4. Excavation and Backfill: DIVISION 31
   5. Finish Painting: SECTION 099000: PAINTING
   6. Wiring for Supervisory Switches, Electrical Alarm, and Flow Switches, and Power Wiring: SECTION 260000 - ELECTRICAL
   7. Temporary Facilities: SECTION 015000 - TEMPORARY FACILITIES
   8. Installation of Hood Suppression System – SECTION 114000 FOOD SERVICE EQUIPMENT
   9. Commissioning of Fire Protection – SECTION 210800 COMMISSIONING OF FP

1.5 CODES, ORDINANCES, AND PERMITS

A. Perform all work in accordance with the following Codes:
   1. 780 CMR: The State Building Code.
   2. 527 CMR: The Fire Prevention Regulations.
   3. NFPA-13-2013 and Owner's insurance company requirements.
   4. All applicable Local, State, and Federal Codes, Statutes, or Regulations.

B. Obtain all permits, inspections, and approvals, from the governing authorities and pay all fees and include cost in the bid, including approvals for the cross connection control device. Provide the Owner with the cross connection permit for the device in the Owner's name.

1.6 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications conflict or are unclear, advise Designer in writing before Award of Contract. Otherwise, Designer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities thus resolved.

B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Designer in writing before installation.

Otherwise, make changes in installed work as Designer requires within Contract Price.

C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, this contractor shall provide that material, installation, or work which is of the higher standard.

D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the contractor has failed to notify the Designer of the situation in accordance with the paragraph above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

E. In cases covered by the paragraph above, where the contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Designer shall review, note if necessary, and approve the sketch.

1.7 MODIFICATIONS IN LAYOUT

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.

B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer.

C. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Section will be installed.

D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above. Systems shall be run in a rectilinear fashion.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.

1.8 RECORD DRAWINGS

A. General: Refer to DIVISION 01 - GENERAL REQUIREMENTS for general requirements for maintaining as-built drawings and submitting final reproducible record documents.

B. The General Contractor will provide two sets of black or blue line on white Drawings to the Fire Protection Subcontractor, one set of which shall be maintained at the site and which shall, at all times, be accurate, clear, and complete, showing the actual locations of all equipment and piping as it is being installed. The Record Drawings shall be available to the Architect/Engineer's field representative at all times.

C. Provide electronic AutoCAD drawings to indicate revisions to piping size and location both

exterior and interior; including locations of valves and other equipment requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.

D. Include in the Record Drawings any addenda, sketches, and supplementary Drawings issued during the course of construction.

E. Non-availability of Record Drawings or inaccuracies therein will postpone the final inspection until they are available.

F. All valves shown on these Drawings shall be numbered with numbers corresponding to those on the valve charts.

G. All costs related to the foregoing requirements shall be paid by the Fire Protection Subcontractor.

1.9 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Provide operating instructions to the owner's designated representative with respect to operation functions and maintenance procedures for all equipment and systems installed. At the completion of the project, turn over to the Architect four (4) complete manuals in three-ring, loose-leaf binders, containing the following:
1. Complete Shop Drawings of all equipment.
2. Operation description of all systems.
3. Names, addresses, and telephone numbers of all suppliers of the system.
4. Preventive maintenance instructions for all systems.
5. Spare parts list of all system components.
6. Valve tag chart noting location of any and all valves controlling the fire protection systems including main control, main drain, auxiliary drain, drum drip, inspectors test connections and any low point drains connected to these systems.

1.10 SHOP DRAWINGS AND MATERIAL SCHEDULES

A. Refer to SECTION 013300 - SUBMITTALS for substitution of equipment and submittal of Shop Drawings. If apparatus or materials are substituted for those specified, and such substitution necessitates changes in or additional connections, piping, supports or construction, same shall be provided as the responsibility, and at the expense, of the Fire Protection Subcontractor.

B. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Subcontractor. The Subcontractor is responsible for furnishing and installing materials called for in the Contract Documents, even though these materials may have been omitted from approved Submittals.

C. Submit Shop Drawings for the following materials and equipment.
1. Coordinated Working Drawings and hydraulic calculations including size, type, length, temperature rating of sprinkler heads, piping and the like. Indicate flow test results, design criteria, hydraulic reference points, diffuser and light locations.
2. Access Panels and Covers
3. Sprinkler Heads
4. Hangers and Seismic Restraints
5. Pipe, Fittings, and Appurtenances
6. Systems Identification
7. Valves

8. Fire Department Connection
9. Cross Connection Devices

1.11 COORDINATION DRAWINGS

A. Before materials are purchased or Work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces.

B. Coordination Drawings are for the Contractor's and the Architect's use during Construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.

C. Detailed procedures for Coordination Drawings are contained in DIVISION 01 of these Contract Documents.

1.12 GUARANTEE

A. Guarantee all work under this Section free from defects in workmanship or materials for a period of one (1) year from the date of final acceptance of the building, as set forth in the Contract.

B. Replace any such defective work developing during this period, unless such defects are clearly the result of bad usage of equipment by others. Where such defective work results in damage to work of other Sections of the Specifications, restore such work to its original condition by mechanics skilled in the affected trade.

1.13 DRAWINGS

A. All work shown on the Drawings is intended to be approximately correct to scale but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make a complete working system ready for use.

B. The Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.

C. Refer to the Architectural, Structural, and Other Mechanical and Electrical Drawings which indicate the construction in which this work shall be installed. Locations shown on the plans shall be checked against the general and detailed drawings of the construction proper. All measurements must be taken at the building.

1.14 SYSTEM DESCRIPTION

A. The new building is to be 100% sprinkled with an automatic sprinkler system. The systems shall be designed in accordance with NFPA-13-2013. Do not reduce sizes of sprinkler fire main nor the sizes of risers shown on the drawings.

B. Refer to Fire Protection Criteria on the Drawings. Conform to the zoning shown on the plans.

C. Refer to reflected ceiling plan for location of all sprinkler heads. All sprinkler heads are to be installed dead center of tile.

D. The Contractor shall prepare hydraulic calculations for the entire project. The main distribution system piping including the service, mains and risers shall not reduce in size from those contained in the contract drawings.

1.15 ALARM FACILITIES

A. Furnish and install all Supervisory Switches, Flow Switches, Pressure Switches, and other Alarm Devices. Install all such devices on the piping and coordinate with the Electrical Subcontractor who shall wire all such devices to the Fire Alarm System. Every shutoff valve installed on this project shall have a supervisory trouble switch wired to the Fire Alarm Panel.

1.16 PIPE MARKER IDENTIFICATION SYSTEM

A. Mark all fire mains installed under this Section with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Apply snap on markers every 20 feet on center on piping which is exposed in mechanical or storage areas and above suspended accessible ceilings. Also, apply at all access panels, valves, tee joints, alarms, and/or controls. Adhesive pipe ID system not accepted.

1.17 VALVE TAGS

A. All valves installed in the Fire Protection Contract shall be tagged. Tags shall be secured to valves with chain link and shall be marked with 3/4 inch high letters as to function. All valve tags shall indicate the Fire Zone.

B. A corresponding framed Valve Tag Chart shall be installed within each Sprinkler Riser or Control Valve Room indicating location of each valve and the section it serves. This chart shall also be included within the Owner's O&M Manual with valve tag locations noted on the As-Built Sprinkler drawings.

1.18 IDENTIFICATION SIGNS

A. All equipment and systems shall be identified with signs furnished and attached in accordance with NFPA 13.

1.19 PAINTING

A. All interior exposed piping is to be painted and all painting, except as noted, will be done by the Painting Subcontractor. All uncovered piping and hangers shall be thoroughly cleaned of rust, oil, and other containments by the Fire Protection Subcontractor and left ready to receive primer coat.

B. Painting for pipe markings shall be done under this Section.

1.20 WATER SUPPLY TEST DATA

A. The following water supply data is included as information available to bidders.

B. A hydrant flow test was performed.

C. Flow Test Results:
1. Static Pressure = 105 PSI
2. Residual Pressure = 100 PSI
3. Flow = 1,550 GPM

1.21 BREAKDOWN

A. Submit a breakdown of the contract price to aid the Architect in determining the value of the work installed as the job progresses.

B. No requisition will be approved until the breakdown is delivered to the Architect.

1.22 VISIT TO SITE

A. Prior to submitting a bid, visit the site of work and become familiar with existing conditions at the site of the work. Any assumptions made are at this Subcontractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment furnished under this Section shall be new, unused, first quality of a manufacturer of established reputation and shall be U.L./F.M. approved. Each valve, fitting, section of pipe, and piece of equipment shall have cast or indelibly stamped thereon the manufacturer's name and pressure rating where applicable. All threads for fire department connection shall conform to the standards of the Local Fire Department.

2.2 PIPE AND FITTINGS

A. Pipe and fittings shall conform to the latest A.S.A., A.S.T.M., C.A., and F.S. Standards. All grooved products shall be of one manufacturer to conform to NFPA Standards.

B. All piping installed under this Section shall be in accordance with the following:

Service	Materials
Trim piping around alarm valves, sprinkler piping 1-1/2 inch and smaller	ASTM A-53, Schedule 40 steel pipe, black for wet system, galvanized for dry
Sprinkler piping 2 inch to 6 inch	Schedule 10, ASTM A-135 U.L./F.M. steel black for wet system, galvanized for dry
Underground service	CL 52 ductile iron pipe

C. Fittings on fire line piping, 2 inch and larger, shall be Victaulic Fire Lock Ductile Iron Fittings conforming to ASTM A-536 with integral grooved shoulder and back stop lugs and grooved ends for use with Style 009-EZ or Style 005 couplings.

D. Fittings for risers, 2-1/2 inch and larger, and where ever required to conform to Seismic Requirements shall be Victaulic Vic-Flex Style 75 or 77 with Fire Lock Gasket.

E. Branch line fittings shall be welded or shall be Victaulic 920/920N Mechanical Tees.

F. Schedule 10 pipe shall be roll grooved. Schedule 40 pipe where used with mechanical couplings shall be rolled groove and shall be threaded where used with screwed fittings.

G. Fittings for threaded piping shall be malleable iron screwed sprinkler fittings.

H. All pipe and fittings shall be U.L./F.M. approved for sprinkler and standpipe service. All pipe

and fittings shall be galvanized for dry or pre-action system and black for wet system.

I. Fittings on underground fire service piping shall be 250 psi gray iron fittings with mechanical joint ends. Coordinate with site contractor to assure all joints are properly thrust blocked.

J. Grooved fittings shall be manufactured by Victaulic, Grinnell, Anvil, or equal.

2.3 JOINTS

A. Threaded pipe joints shall have an approved thread compound applied on male threads only. Teflon tape shall be used for threads on sprinkler heads.

B. Joints on piping, 2 inch and larger, shall be made up with Victaulic, or equal, Fire Lock Style 005, rigid coupling of ductile iron and pressure responsive gasket system for wet or dry sprinkler system as recommended by manufacturer. Couplings on dry systems shall be galvanized. Cutting, roll grooving, lubrication, and assembly of all joints shall be made strictly in accordance with manufacturer's recommendations. Exercise particular caution in the use of lubricant to avoid “squeeze out” of lubricant when system is in service.

C. Grooved joints and fittings shall be manufactured by Victaulic, Grinnell, Anvil, or equal.

D. Furnish and install where piping crosses building expansion joints furnish and install listed expansion joints and anchors per NFPA-13 2013. Expansion joints shall be Metraflex "Fireloop", or manufactured by Flexonic Company or Hyspan, or equal. Expansion joints shall be UL approved for use for fire sprinkler systems.

E. All joints on Fire Service under slab shall be restrained up to the service stub flange connection above slab.

2.4 VALVES

A. All shutoff and control valves shall be U.L./F.M. approved, indicating type valves equipped with a supervised trouble switch wired to the fire alarm system. Shutoffs and zone valves may be either OS&Y indicating gates or butterfly valves.

B. Gate valves shall be outside screw and yoke indicating type, 175 psi W.P. and U.L./F.M. listed, Jenkins or equal. All such valves shall have supervised trouble switch.

C. Butterfly valves shall be Victaulic Series 705-W for 2-1/2 inch and larger, and Milwaukee indicating type U.L./F.M. butterball for threaded service. Coordinate with Electrical Sub-contractor to have factory installed monitor switches compatible with the remainder of the Fire Alarm System.

D. Check valves shall be iron body bronze mounted U.L./F.M., 175# W.P. or U.L./F.M. wafer checks. Grooved end valves shall be Victaulic Style 717 Fire Lock Check Valve.

E. Pressure relief valves shall be located on wet systems pressure regulating valves and downstream of check valves per NFPA-13-2013. Pressure relieve valves shall be listed and not less than 1/2 in. in size and shall be by AGF, Watts, Cla-Val or equal.

F. Ball drips shall be Potter Roemer #5682, 3/4 inch straight design ball drip valve, or by Victaulic, Viking, or equal.

G. Drains shall be provided in the systems as may be required by field conditions. Provide drains at all low points and wherever necessary to insure that all portions of the sprinkler

piping may be completely drained. Test connections shall be provided as required to test all portions of the system. Pipe low point drains and test connections to suitable receptor as determined in field or shown on Drawings.

H. Install an inspector's test connection at the furthest point of each sprinkler zone. Run discharge back to a suitable receptor. Exterior wall penetration is permitted with test drain but only as approved by the Architect.

I. Valves shall be manufactured by Victaulic, Nibco, Viking, or equal. Inspector's test stations shall be manufactured by AFG, Tyco, Victaulic, or equal.

2.5 SPRINKLERS

A. All sprinklers to be used on this project shall be Quick Response type and shall be stamped with date of manufacture and temperature rating. Temperature ratings shall be determined by the location of the heads per NFPA 13-2013, section 8.3.2.5, and shall be minimum 155 degrees F. throughout except in special areas around heat producing equipment, skylights, and attics in which case use temperature rating to conform with hazard as specified in NFPA 13-2013. Orifice diameter and K factor shall be appropriate to meet the hydraulic design criteria, the available water supply, and NFPA Standards.

B. Furnish spare heads of each type installed located in a cabinet along with special sprinkler wrenches. The number of spares and location of cabinet shall be in complete accord with NFPA 13-2013.

C. Sprinklers shall be manufactured by Tyco, Victaulic, Viking, or equal.

D. Upright sprinkler heads in areas with no ceilings shall be Victaulic Model "V2704" Quick Response, upright natural brass finish heads. Include Victaulic FireLock Sprinkler guards in all mechanical, storage rooms, gymnasium outdoor activity, & all areas noted on drawings.

E. Sidewall heads shall be Tyco Model "TY-FRB" Quick Response with white polyester head and escutcheon.

F. Pendent wet sprinkler heads shall be Tyco Model "TY-FRB" Quick Response recessed adjustable escutcheon, white polyester finish.

G. Concealed heads shall be Tyco Model "RFII" Quick Response concealed type, 1-1/2 inch adjustment white cover plate. In special areas, as may be noted on the Drawings, provide alternate cover plate finishes.

H. Pendent dry sprinkler heads shall be Tyco Model "DS-1" Quick Response dry type, white polyester finish and escutcheon.

I. Dry sidewall heads shall be Tyco Model "DS-1" dry horizontal sidewall heads, white polyester finish.

J. Window sprinkler heads shall be Tyco Model "WS" pendent vertical sidewall heads, white polyester finish.

K. Sprinkler heads located in concealed combustible spaces shall be Tyco Model "CC2" upright sprinkler head, natural brass finish.

2.6 FIRE DEPARTMENT CONNECTION

A. Fire Department Inlet Connection shall be Croker #6350 Series; 4 inch Storz inlet x 4 inch outlet, 30 degree elbow, brass plate, and stamped “Sprinkler-Standpipe”. Install 1/2” ball drip valve and chrome plated trim wall fitting on bottom of inlet fitting body. Provide access panel for servicing the ball drip.

B. Fire Department Connection shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.

2.7 ROOF MANIFOLD

A. Fire Department outlet hydrant connection on roof shall be Potter Roemer #5826 polished brass flush 2 way fire department outlet connection assembly – 2-1/2”x2-1/2”x6”. Hydrant valve control assembly shall be Potter Roemer #5852-DH polished brass hydrant valve control assembly.

B. Fire Department roof hydrant shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.

C. Roof Manifold shall be manufactured by Croker, Potter Roemer, Elkhart or equal.

2.8 FIRE STANDPIPE EQUIPMENT

A. Fire Department Valves shall be Croker Series 5015 Fire Department Valves fitted with 2-1/2 inch x 1-1/2 inch reducer, caps and chains all conforming to Local Fire Department thread standard. Valves shall be polished chrome plated and shall be mounted in a recessed cabinet as indicated on Drawings.

B. FDVC-1 Cabinets for the Fire Department Valves shall be Croker model 1710 - 18 inch x 18 inch x 10 inch deep. cabinet, fully recessed, solid door, prime painted steel. Include graphic and door catch.

C. Provide 32 inch x 32 inch access panels at floor control locations or recessed cabinets as appropriate to the wall construction. Provide graphic.

D. FDVC-2 Fire Hose Cabinets located in the stage, auditorium and other locations to meet code reshall be Croker Series 1200 full recessed mounted, prime painted steel door with graphic equipped with 2-1/2 inch valve with 1-1/2 inch fire hose rack containing 50 feet of 1-1/2 inch Pr. Superflex hose and nozzle conforming to local fire department standards.

E. Furnish and install at each Sprinkler Control Valve Cabinet, Fire Hose Cabinet and Fire Department Valve Cabinet a Potter-Roemer Model 1930 cabinet alarm switch to be tied into the security system. Coordinate with Electrical Sub-contractor.

F. Cabinets and access panels provided at fire standpipe equipment shall be fitted with pull handles. Cylinder locks are not allowed.

G. Cabinets and valves shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.

2.9 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

A. Furnish and install All Supplementary Steel, Channels, and Supports required for the proper installation, mounting, and support of all equipment.

B. Supplementary Steel and Channels shall be firmly connected to building construction in a

manner approved by the Architect.

C. The type and size of the Supporting Channels and Supplementary Steel shall be determined by the Fire Protection Subcontractor and shall be sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

D. All Supplementary Steel and Channel shall be installed in a neat and workmanlike manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 degree fittings, as required to suit the construction and installation conditions.

2.10 HANGERS AND SEISMIC RESTRAINTS

A. Hangers shall be furnished, installed, and supported from the building structure in accordance with NFPA – 13 and the State Building Code.

B. All piping whether in the building shall be seismic restrained.

2.11 ALARM DEVICES

A. Flow switches shall be vane type water flow detectors with 0-70 Sec. Adjustable non-accumulative retard device and (2) single pole double throw contacts, Notifier Series WFD Potter, VSR.F or equal.

B. Pressure switches shall be adjustable Potter Model PS10A or equal.

C. High/Low pressure switches shall be adjustable Potter Model PS40A or equal.

D. Supervisory switches on all O.S. & Y. gate valves shall be Notifier NGV complete with mounting bracket.

E. The wet system alarm device shall be Reliable Model ‘E’ alarm valve with “E1” trimmings. Package to include Electric bell. Electric Bell shall be 24 volt, 6” in diameter and shall be furnished by the Fire Protection sub-contractor. The electrical sub-contractor shall tie into Fire Alarm System.

F. Refer to Drawings for additional devices. Co-ordinate, prior to ordering devices, with the Electrical Sub-Contractor to assure device compatibility with the Fire Alarm System.

G. Alarm valves shall be as manufactured by Reliable, Victaulic, Tyco, or equal. Flow, pressure and supervisory switches shall be manufactured by Potter, Notifier, System Sensor, or equal.

H. Electric Bell shall be 24 volt, 6” in diameter and shall be furnished by the Fire Protection subcontractor. The electric bell shall be mounted 9 feet above finished grade or as directed by the local Fire Department. The electrical subcontractor shall tie into Fire Alarm System.

2.12 DOUBLE CHECK VALVE ASSEMBLY

A. Double check valve assembly shall be State approved, U.L./F.M. approved, with iron body bronze mounted construction complete with supervised OS & Y gate valves and test cocks. Install a soft close check valve on the inlet side of the Double Check Valve Assembly similar to Watts ICV-125-2-2-T. Furnish two spare sets of gaskets and repair kits.

B. Double check valve assembly shall be of one of the following:
1. Watts Series 757-OSY

2. Wilkins 350A-OSY
3. Conbraco Series 4S-100

C. In the name of the owner pay for, file for, and obtain required permits from D.E.P. and/or local authority whichever has jurisdiction prior to installation.

D. Provide on the inlet side of double check valve an 8 inch Soft-close check valve similar to Watts model ICV-125-2-2-T.

2.13 ACCESS DOORS

A. Furnish Access Doors for access to all concealed control valves, drains, inspector's tests, supervisory devices, and to all other concealed parts of the system that require accessibility for the proper operation and maintenance of the system. These doors shall be installed under the appropriate Section of the Specifications for the surface upon which the panels are mounted.

B. All Access Doors shall be located in a workmanlike manner in closets, storage rooms, and/or non-public areas, positioned so that the valve or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 inch x 16 inch). When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.

C. Access Doors shall be prime painted and be complete with cylinder lock and two keys as manufactured by Acudor, Inland Steel Products Company "Milcor", or Walsh-Hannon-Gladwin, Inc., "Way Loctor". Type shall be as follows:

Acoustical Tile Ceiling	Acudor AT-5020
W.B. Surfaces	Acudor DW-5040
Masonry Construction	Acudor UF-5000
Fire Rated Construction	Acudor FB-5060

D. Access Doors Shop Drawings shall be submitted to the Architect for approval.

2.14 FIRE PUMP

A. This contractor shall furnish and install, complete in every respect, Peerless model 6AEF14A Fire Pump system complete with pump, driver, controller and accessories. The pump manufactures representative company shall employ its own service group with 24/7 service capabilities. The pumping unit shall be listed by Underwriters Laboratories, Inc. and shall be fully approved by the Associated Factory Mutual Fire Insurance Companies. The pump unit shall meet all requirements of the National Fire protection Association Pamphlet No. 20.

B. Fire Pump (FP-1)
1. The Fire Pump shall be a Peerless Pump model 6AEF14A, horizontal split case base mounted, bronze fitted, single stage, double suction, centrifugal pump as supplied by Gustavo Preston Co, 978-250-3333.
2. Static Suction Pressure is 105 PSIG. Residual Suction Pressure is 100 PSIG.
3. The pump shall be designed to deliver 1000 GPM when producing a differential pressure of 65 PSIG.
4. The pump shall deliver not less than 150% of rated capacity at a pressure not less than 65% of the rated pressure.
5. The shut off pressure shall not exceed 136% of rated pressure.
6. The pump casing shall be cast iron with 6" 125-pound ANSI rated suction and 5”, 250 pound ANSI rated discharge flanges machined to American National Standards Institute (ANSI) dimensions.

7. The driver shall be a 50 Hp / 1800 RPM horizontal, foot mounted, open drip-proof, ball bearing type, AC, induction, squirrel cage motor: wound for 460 volts, 3 phase, 60 Hertz. The motor shall be of such capacity that 115% of the full-load ampere rating shall not be exceeded at any condition of pump load. Locked rotor current shall not exceed the values specified in NFPA Pamphlet No. 20. 3550 RPM pumping units will not be considered.
8. Pump and motor shall be mounted on a common fabricated steel baseplate. The pump and driver shall be connected by a UL Listed coupling for fire service. Pump and motor shall be checked for alignment after the pump base has been installed, and after the base has been grouted in place, final alignment shall be laser alignment by pump manufacturer's representation, provide before and after alignment reports for installation and operations manuals. The pump manufacturer's representative company shall employ its own service group with 24/7 service capabilities.
9. Casings shall be of cast iron having a minimum tensile strength of 35,000 P.S.I. Bearing housing supports, and suction and discharge flanges shall be integrally cast with the lower half of the casing. Removal of the upper half of the casing must allow the rotating element to be removed without disconnecting the suction and discharge flanges. Casings shall have integrally cast bearing housings, bolt-on bearing housings shall not be considered equal. Impellers shall be of the enclosed type and shall be of vacuum cast bronze. Impellers shall be dynamically balanced, keyed to the shaft, and held in place with threaded SS shaft sleeves.
10. The pump shaft shall be made of SAE 1045 steel or equal, accurately machined to give a true running rotating element. Shaft shall be protected by 300 series stainless sleeves, key locked and threaded so that the sleeves tighten with the rotation of the shaft. An O-Ring shall seal between the impeller hub and the shaft sleeve to protect the pump shaft.
11. Pump shall be equipped with renewable bronze casing rings so designed that the hydraulic pressure seats them against a shoulder in the pump case around the full periphery of the wearing ring. The wearing rings will be locked by doweling to prevent rotation. The rotating element uses heavy-duty grease lubricated ball bearings and shall be equipped with water slingers. Bearing housings shall be so designed to flush lubricant through the bearing.
12. All pumps where the suction pressure is expected to average 40 P.S.I. or below, shall be provided with a lantern ring connected to the pressure side of the pump by a tee atop the pump casing. Stuffing boxes shall be equipped with split, cast stainless steel packing glands designed for easy removal for packing inspection and maintenance.
13. The fire pump unit shall include the following accessories, as required by NFPA 20 standards:

    Liquid filled Suction pressure gauge
    Liquid filled Discharge pressure gauge
    ½" Automatic air release valve rated 300 PSI
    ¾" Cla-Val casing relief valve rated 20-300 PSI
    Eccentric Suction Reducer
    Concentric Discharge Reducer
    Hose valve head, with angle hose valves, caps and chains
    Flowmeter

C. Jockey Pump:
1. Contractor shall furnish and install a vertical multistage Grundfos Jockey Pump model CR1-8 with a rated capacity of 8 US GPM against a total head of 84 PSI.
2. The pump shall be coupled to a motor rated 1 Hp 460 Volt, 60 Hz 3 Phase, Totally Enclosed Fan Cooled enclosure which is built to NEMA standards.
3. The pump shall have stainless steel diffusers and cast-iron adapter with registered fits to maintain axial alignment, stainless steel enclosed impellers, PTFE neck ring, steel shaft coupling, stainless steel shaft. The impellers shall

conform to shaft shape to prevent damage due to reverse rotation and to maintain proper interstage lateral setting.

4. Pump shall be designed for and equipped with a mechanical seal type stuffing box. A vent tap shall be provided for mechanical seal units to relieve entrapped air. Pump shall be provided with cast iron base with drain plug.
5. Where jockey pump churn pressures may exceed system design pressures, a casing relief valve shall be installed before the jockey check valve.

D. Main Fire Pump Controller

1. The soft start transfer switch fire pump controller shall be designed and built strictly in accordance with the 2022 edition of the National Fire Protection Association's Pamphlet No. 20.
2. It shall be a factory assembled, combination fire pump controller with built-in transfer switch. The entire combination shall be listed for fire protection service by Underwriters Laboratories and approved by Factory Mutual Research.
3. The controller short circuit current rating shall be 100,000 RMS symmetrical amps.
4. The enclosure shall be floor mounted and shall not exceed 70 inches in height, 72 inches in width, or 13 inches in depth. All enclosure doors shall be equipped with safety mechanical interlocks to prevent all doors from being opened until the isolating switch is opened.
5. The controller shall be provided in a dust-tight, NEMA 2 enclosure with a driphood. The finish shall be a baked on fire engine red paint.
6. The Transfer Switch shall be capable of fast transferring from the Normal Source to the Emergency Source in 100 msec. Adjustable time delays shall be provided for genset start, motor disconnect, engine cooldown, and retransfer. In addition, a genset weekly or monthly test shall be provided with an option to transfer power to the Emergency Source during the test.
7. The Isolating Switch of the fire pump controller shall be located in a separate enclosure attached directly to the fire pump controller. Access to the Isolating Switch shall only be through the removal of a bolted cover plate. A hinged door with door handle is not allowed. Interlocks on the Isolation Switch shall be provided so two hand operation is required to open or close the Isolation Switch. The load side of the separate isolating switch enclosure shall connect to the fire pump controller through waterproof conduit filled with fire stop. The attached separate enclosure with Isolation Switch shall be UL Listed and FM Approved as part of the fire pump controller. The Normal Source fire pump controller section shall be marked with an incident energy calorie rating not exceeding 0.5 cal/cm2.
8. The controller shall utilize a pressure transducer for the digital pressure switch. The digital pressure switch shall have start and reset settings that can be set to the nearest 1.0 psi. These settings shall be readable through the door.
9. All transducers, pressure switches, and all related pressurized wet parts shall all be mounted externally to the side of the controller. They shall also be mechanically protected from damage. No water pressure connection of any kind shall be provided inside the controller enclosure.
10. The controller shall be rated to operate in a 50C ambient environment.
11. The control unit shall be comprised of a control board enclosed in a protective metal chassis. All plug-in cables shall be securely latched or locked in place. Insulation displacement connectors are not acceptable.
12. Control power shall be 24 VDC and shall be derived from 3 independent, control power transformers with redundant isolated rectifier circuits.
13. Power for the circuit breaker DC shunt trip solenoid shall be derived from any of the three transformers and shall be completely independent of any one single phase A.C. voltage.
14. An input shall be provided for a normally closed remote start contact.
15. A separate input shall be provided for a normally closed deluge valve start contact.
16. A test valve solenoid shall be provided on the outside of the enclosure to facilitate local

pressure drop testing or auto testing. It shall include a y-strainer to protect the valve from debris.

17. Anytime the test valve is operated, either through the local pressure drop test button or through the auto testing function, the transducer shall be tested. If the pressure reads greater than 10 psi while the valve is open, a Transducer/DVS failure alarm shall activate. If the transducer is disconnected, the pump shall start.
18. A Failure to Start alarm shall provide an alarm when motor current is not measured within 15 seconds of the pump start demand signal.
19. PhaseSmart logic shall be provided to assure that the controller will not start the fire pump under single phase conditions when the voltage on any phase is lower than 65% of the rated motor voltage. However, if the motor is already running when a phase loss occurs, the Phase Smart logic shall keep the motor running.
20. A Human Machine Interface (HMI) shall be provided to set up the controller and display the status but shall not be relied on for the controller operation. The accuracy of the display shall be 2 percent or 2 digits and shall be traceable to the National Institute of Standards and Technology.
21. The starting and running functions controller shall operate independently of the HMI and shall even operate with the HMI damaged or disconnected.
22. The HMI shall be a 5.7-inch, 64 K color touch screen interface that simultaneous displays all 3 phase voltages and currents, the System Pressure, Start/Reset settings, Manual/Auto Stop setting, and the Weekly/Monthly test setting. It shall also display the starting sequence and pump running status.
23. It shall also capture the pump test values for the following flow conditions when the save button is pressed. At 0%, 25%, 50%, 75%, 100%, 125%, and 150% flow, the HMI shall save the time and date, discharge PSI, suction PSI, L1-L2, L2-L3, L3-L1 line voltages, and L1, L2, L3 line currents. Once saved, the Present test values can also be saved as Acceptance the test values. On the next year, the Present test values can be saved as the Previous test values. The Present, Previous, and Acceptance test values shall be saved and plotted to show the net pump curve for each test condition. The Present can be compared with the Previous or Acceptance pump test values. Further, pump curve can be displayed as the net pump curve or the system discharge pump curve. All pump test values shall be accessible by Modbus TCP/IP and downloadable directly through an external USB waterproof adapter to a USB drive.
24. In addition, the HMI shall be capable of enabling or disabling remote or deluge start, auto testing, minimum run timing, setting sequence timing, and acceleration timing. Further, it shall display the following alarms: AC Failure, CB Trip, Fail to Start, Load Shed, Lockout, Low Discharge Pressure, On Demand, Phase Reversal, PhaseSmart, 8 Pump House Trouble inputs, Pump Run, Single Phase Running, and Transducer Failure. A password protected Setup Assistant screen is provided to quickly access the pressure start/reset settings, the sequence, accelerate time settings, the remote/deluge start settings, and the weekly/monthly test settings. A Setup summary screen accessible to anyone is available to view all the controller settings. A Remote alarm contact testing screen shall be provided to operate each remote alarm contact individually to facilitate remote alarm testing. The Alarm Silence shall be provided with a 24 hour auto re-sounding function. The internal Data Recorder shall download directly through an external USB waterproof adapter to a USB drive. No codes, settings, or menu operations shall be required. Once the USB is inserted, the data recorder shall recognize the USB drive and indicate “USB Active”. The file shall then be automatically transferred and indicate “USB OK”. The USB can then be removed.
25. In addition, the controller system settings shall be capable of being downloaded. All files shall be downloaded as CSV files capable of being opened by any spreadsheet program. The Data Recorder shall record the system pressure every hour or every time the pressure changes by 5 psi. It shall also record all 3 phase voltages and currents on every alarm event and every 5% change from the previous reading. In addition, all active alarms and the starting sequence shall be recorded. Voltage Free Remote Contacts shall be provided for Pump Running (2 sets), AC Failure, Phase

Reversal, System Trouble, and On Demand.

26. Additionally, 8 programmable inputs and 8 programmable relay outputs shall be provided for any the displayed alarms. The Voltage Free Contacts shall be rated for 6 amps at 30 vdc, 6 amps at 250 vac and have a UL pilot duty rating of R300 and B300.
27. It is intended that the manufacturer of the specified equipment shall be a business regularly engaged in the manufacture, assembly, construction, start up, and maintenance of fire pump controllers. The manufacturer shall have at least three (3) years of successful experience in providing this equipment.
28. Certified factory test data shall be provided, if requested, to verify that the following tests have been performed: 1) A complete visual inspection; 2) A complete operational test; 3) A plumbing leakage test done at the maximum system pressure; 4) A pressure transducer accuracy test; 5) A dielectric voltage withstand test; and 6) A power path voltage drop test.
29. The controller, as manufactured in the United States of America by Master Control Systems, Lake Bluff IL, shall be a model MCST-60-46-XG4,POC,SIS,2,82H.

E. Jockey Pump Controller

1. The jockey pump controller shall be designed for a 1 hp, 460 vac, 3 ph motor, built strictly in accordance with UL-508A and shall be listed by Underwriters Laboratories Inc.The controller shall be provided in a red driptight NEMA 2 enclosure.
2. The jockey controller shall consist of a Manual Motor Protector, motor contactor, pressure transducer, 32 character display, and control unit.
3. The pressure transducer provided to sense the system pressure shall be the same as the pressure transducer used in the fire pump controller.An Auto-Off-Manual selector switch shall be provided.
4. A menu shall be provided on the 32-character display to display the system pressure, the position of the selector switch, On/Off status of the pump, running hours, number of starts, start and stop settings, minimum run timer setting, restart timer setting, and alarms.
5. Navigation buttons for moving and changing settings on the display shall be provided on the door of the controller.A security jumper shall be provided to lock the settings.
6. If the pump starts more than a preset number of starts in a 24 hour period, an Excessive Start alarm shall be displayed.
7. If the system pressure exceeds the overpressure setting, an Overpressure alarm shall be displayed and the pump shall shutdown.If the pump does not start after demanded to do so, a Failure to Start alarm shall be displayed.
8. Remote contacts shall transfer and an audible alarm shall sound when an alarm is displayed.
9. An Ethernet connector shall be provided for a Modbus RTU connection to the fire pump controller. Once connected, all settings and operations of the jockey controller shall be recorded by the fire pump controller data recorder.
10. The controller, as manufactured in the United States of America by Master Control Systems, Lake Bluff IL., shall be a model JPCE-1-3-46-XAUD,TR

F. Start Up

1. The pump manufacture, prior to shipment, shall hook up and test the pump assembly.
2. The pump manufacture shall have a sales and service representative of a factory trained representative for the initial startup and to in the final acceptance tests.
3. The controller manufacture shall have a sales and service representative in the area with minimum of 10 years' experience with their product. 24 hours 7 day service access must be available, as well as a moderate availability of spare parts.
4. The controller manufacture, prior to shipment, shall hook up and test the jockey pump controller as a completed assembly. This test shall include, but not be restricted to, each function the controller may be required to perform including manual start-stop, automatic start-stop and minimum run timing.
5. The controller manufacture shall provide the services and local representation of a

factory trained reprehensive to the initial startup and to the final acceptance tests.

6. Coordination of final acceptance test with underwriting authorities shall be made by the installing contractor.

G. Testing

1. The pump and electric motor shall be thoroughly shop-tested by the respective manufactures as required by NFPA Pamphlet No. 20. The control panel shall also be tested as a unit. All such tests shall be conducted prior to shipment.
2. The pump, driver, controller and all accessories shall be purchased under a unit contact. The pump shall be given a complete performance test with positive suction pressure. A certified performance curve shall be prepared and submitted. Pumps shall also be hydrostatically tested to twice the shut off pressure, but in no case less than 250 lbs. per sq. inch.
3. The pump manufacture shall assume unit responsibility and shall provide the services a factory trained representative to supervise and/or be available to conduct final field acceptance tests.
4. The controller manufacture, prior to shipment, shall hook up and test the jockey pump controller as a completed assembly.
5. This test shall include, but not be restricted to, each function the controller may be required to perform including manual start-stop, automatic start-stop and minimum run timing.
6. The manufacture shall perform a high potential test of the controller power circuit at not less than two times the rated voltage plus 1000 volts.

H. Warranty

1. The pump and controller manufactures shall warranty all components against defects in workmanship and materials for a period of 12 months from the time of substantial completion.

2.15 FIRE PUMP TEST HEADER

A. Furnish and install a Croker model 6818-PC test header where indicated on the drawings. Connection shall be labeled as "FIRE PUMP TEST HEADER".

B. System test header shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

A. All work shall be installed in a first-class manner consistent with the best current trade practices. All materials shall be securely installed plumb and/or level, and all flush mounted equipment shall have front edge flush with finished wall surface.

B. Protect all concealed heads. Coordinate and advise finishing trades so as to prevent painting of sprinkler heads or inadvertent filling with paint or jointing compound of required air spaces in the case of the concealed type sprinkler heads.

3.2 WORK COORDINATION AND JOB OPERATIONS

A. The equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same.

B. Before materials are purchased or work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly

annotated and cross-referenced at their interfaces.

C. Coordination Drawings are for the Contractor's and the Architect's use during construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.

D. Detailed procedures for Coordination Drawings are contained in DIVISION 01 - GENERAL REQUIREMENTS of these Contract Documents.

E. Particular attention shall be directed to the coordination of piping and other equipment installed in the ceiling areas. Coordinate the elevations of all piping in hung ceiling areas to insure adequate space for the installation of recessed lighting fixtures before other mechanical equipment is installed.

F. Furnish to the General Contractor, and all other Subcontractors, all information relative to the portion of the Fire Protection installation that will affect them, sufficiently in advance so that they may plan their work and installation accordingly.

G. In case of failure to give proper information as indicated above, sufficiently in advance, pay for all back-charges for the modification, renovation, and relocation of any portion of the work already performed.

H. Obtain from the other trades, all information relative to the Fire Protection Work to be executed in conjunction with the installation of their respective equipment.

3.3 CUTTING AND CORE DRILLING

A. Perform all cutting and core drilling operations that are outlined in Part 1 of this SECTION. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the walls, floors, overhead structure, and other structural components is maintained until permanent work is installed. Prior to any coring or cutting, verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved Coordination Drawings.

B. Cut all masonry and concrete with an approved diamond blade concrete saw in a neat straight direction, perpendicular to the plane of the wall or floor.

C. Use a core drilling process which produces clean, sharp edges and the minimum hole size which will accommodate the size of pipe sleeve specified.

D. Patch all holes up to the sizes indicated in this Section with material and methods as are specified in the Section of the Specifications for the finish trade involved. Holes which are improperly done due to poor materials or method, shall be patched to the satisfaction of the Architect by the finish trade and back-charged to this Subcontractor.

3.4 CLEANING AND PROTECTION

A. Protect all materials and equipment during shipment and installation and properly handle and store at the job site so as to prevent damage. Assume full responsibility for protection of work until its completion and final acceptance.

B. Keep the premises reasonable clean at all times and remove rubbish caused by the Fire Protection work as directed by the Architect.

C. Upon completion of this work, clean all sprinklers, and equipment and replace damaged parts. Failure to fulfill this obligation will result in back-charges for correction of the defective work by others.

3.5 SLEEVES, INSERTS, AND ESCUTCHEONS

A. All piping passing through slabs, floors, walls, and partitions shall be sleeved and all such sleeves shall be furnished and installed by the Fire Protection Subcontractor as detailed on the Drawings and herein specified. Fire Protection Contractor, shall do his core drilling as approved by the Architect and the cored opening shall have a sleeve caulked and leaded in place. Set sleeves in concrete floors and walls as soon as forms set and before concrete is poured.

B. All pipes passing through floor, whether slab-on grade or above grade levels shall be sleeved with sleeve extending 1 inch above floor. This includes all piping in toilet room pipe space, stairwells, closets, and partitions. In mechanical penthouses, pipe sleeves shall extend 4 inches above floor.

C. All sleeves shall be Schedule 40 galvanized steel pipe and shall be reamed. There shall be annular space between the sleeve and pipe per NFPA requirements. Sleeves on drywall, masonry, or concrete walls and partitions shall be flush with wall on both sides.

D. The space between sleeve and pipe, in all cases, shall be filled with U.L./F.M. approved caulking compound. This includes pipes concealed in chases and/or partitions.

E. Inserts, where required, shall be furnished and set by the Fire Protection Subcontractor and, where necessary, may be drilled or power driven and shall be sized such that the insert will not exceed a depth of penetration of 1 inch into concrete.

F. Escutcheons: All exposed pipe, uncovered, passing through walls, or floors, or ceilings, shall be fitted with C.P. brass spun or split type escutcheons with approved clamping device for holding in position. Floor escutcheons shall be deep enough to fit over sleeves, fastened to pipe, and extend down to floor.

3.6 TESTING

A. Flush the system and test all work in the presence of the Architect and/or Engineer and as required by NFPA and the Insurance Company. The flushing and testing procedures to be followed are specified herein. At the completion of the testing, submit fully executed copies of Contractor's Material and Test Certificate for both above ground and underground piping as contained in NFPA-13.
   1. Water Supply:
      a. Flushing: Underground/exterior service entrance shall be flushed at a minimum velocity of 10 fps in accordance with NFPA Standards 13, 14, and 24. The Fire Protection sub-contractor shall coordinate with Division 33 and shall notify the Water and Fire Departments prior to testing of the entire exterior system.
   2. Sprinkler System:
      a. Hydrostatic Testing: The interior system shall be hydrostatically tested at 200 psi for 2 hours in accordance with NFPA 13.
      b. Operational Testing: Water flow switches and associated alarm systems shall be tested by water flow through the inspectors test assemblies in accordance with NFPA 13.
      c. Main Drain Test: A flow test shall be performed on the main drain valve and recorded on the Contractor’s test certificate in conformance with NFPA 13.
      d. Backflow Preventor Flow Test: The double check valve assembly shall be flow tested in conformance with NFPA 13.
      e. Dry system shall be trip tested and acceptance tested with recorded results submitted to the owner for their review and record in accordance

with NFPA 13 and 25. All dry systems shall be completely drained with all water removed prior to being placed in permanent service.

f. Underground Piping: Underground piping and fire sprinkler lead in connections to each building shall be hydrostatically tested, flushed and chlorinated in accordance with NFPA 24, The Town of Andover and any other pertinent laws or governing standards. Flushing, Testing and chlorination reports shall be given to the owner for review and included in the O&M Manuals for the fire protection systems.

3. Standpipe or Bulk Fire Main:
   a. Flushing: The fire department connection piping shall be flushed at a minimum velocity of 10 fps in conformance with NFPA 13, and NFPA 14.
   b. Hydrostatic Testing: All piping shall be pressure tested at 200 psi for 2 hours in conformance with NFPA 14.
   c. Flow Tests: The system shall be flow tested at the hydraulically most remote hose connection in conformance with NFPA 14.
   d. Valve and Supervisory Switch Test: All valves and tamper switches will be tested by opening and closing valves in conformance with NFPA 14.
4. Fire Pump
   a. Flushing: Suction piping shall be flushed at a flow rate not less than indicated in Tables 11-1.2(a) in accordance with NFPA 20.
   b. Hydrostatic Testing: Suction and discharge piping shall be hydrostatically tested to not less than 200 psi for 2 hours in accordance with NFPA 20.
   c. Flow Test: The minimum, rated and peak loads of the fire pump shall be determined by controlling the quantity of water discharged through approved test devices in accordance with NFPA 20.
   d. Load Start Test: The fire pump unit shall be started and brought up to rated speed without interruption under the conditions of a discharge equal to peak load in accordance with NFPA 20.
   e. Phase Reversal Test: A test shall be performed to ensure that there is not a phase reversal condition on either the normal power or the alternate power supply in accordance with NFPA 20.
   f. Controller Acceptance Test: The fire pump controllers shall be tested in accordance with NFPA 20.

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SECTION 220000

PLUMBING

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SECTION 220000

PLUMBING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. All the Contract Documents and General Provisions of the Contract including, but not limited to, General and Supplementary Conditions, and Division 1 Specification Sections apply to this Section.

B. The work of this Section provides and contains general information which is inherently made a part of each Section and applies to all work performed under this Contract.

C. The Drawings on which this Contract is based are listed in Section 00860. Consult all Drawings, note all conditions that may affect the Work and care for same in executing the Contract.

D. Refer to Section 01030, Alternates, for alternates, which may affect the work of this Section.

1.2 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.

B. The work covered by this Section of the Specifications includes the furnishing of all labor and materials and in performing all operations in connection with the installation of the Plumbing Work.

C. Without limiting the generality thereof, the work to be performed under this Section includes:
1. Complete Sanitary, Waste & Vent Systems to below slab and/or as shown on the drawings.
2. Storm drainage to below slab system and/or as shown on the drawings.
3. Kitchen grease waste and vent systems with interior and exterior grease traps to below slab system and/or as shown on the drawings.
4. Potable Cold, Hot, and Hot Water Re-circulation System.
5. Furnish and install domestic water heater air intake and exhaust breeching.
6. Insulation.
7. Elevator sump pump and oil interceptors.
8. Domestic Water Heating Equipment.
9. Fixtures and Equipment
10. Connection to Equipment Furnished by Others
11. Flushing, Sterilization, and Tests
12. Furnishing of Access Panels
13. Drilling, Coring and Cutting & Patching of holes and openings where the largest dimension thereof does not exceed 16 inches for Plumbing Piping and Equipment.
14. Scaffolding, Rigging, and Staging required for all Plumbing Work. Comply with Division 1 requirements.

15. Provide Seismic Restraints for all Plumbing Systems conforming to the requirements of the State Building Code, which Section is herein incorporated by reference. Seismic restraints are required on all new systems whether in new or existing building.
16. Preparation of Co-ordination Drawings.
17. Smoke and Firestopping Seals and sealing of all wall penetrations as detailed on the drawings. Refer to Section 078400 which defines the firestopping materials and methods.
18. At Project close out the Plumbing Sub-Contractor shall provide the services of an outside firm who shall run an underground video camera, locating all drainage system lines including depth, preparing a video and identifying & correcting any problem areas. The Plumbing Sub-Contractor shall rod-out and power wash all underground drainage systems. Turn over 4 copies of the video and written report to the owner. Videos are required for the underground sanitary, garage waste, and special waste systems, main lines. Branches are not required.
19. It shall be the responsibility of this division 220000 to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this division 220000 and the Testing requirements shall be in addition to those tests and requirements outlined in sections 018000 and 220800 and required to fulfill commissioning obligations.
20. When open-flame or spark producing tools such as blower torches, welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant non-working fire watch, paying all fees, where work is being performed and until it is completed. Fee for fire watch shall be included in the bid.

1.3 RELATED WORK

A. The following Related Work will be performed under the designated Sections:
1. Cutting and Patching beyond 1.2C.1319 above: SECTION 010450 - CUTTING AND PATCHING
2. Installation Of Roof Drains, Flashing for vents through roof: SECTION 075100 - ROOFING & FLASHING
3. Electric Power Wiring: SECTION 260000 - ELECTRICAL
4. HVAC Equipment: SECTION 230000 - HVAC
5. Excavation and Backfill: DIVISION 31 - EARTHWORK
6. Sanitary Sewer and storm drains to 10 feet outside the foundation wall: DIVISON 33 - UTILITIES
7. Finish Painting: SECTION 099000 - PAINTING
8. Installation of Access Panels: SECTION describing material in which panel is installed.
9. Toilet Room Accessories: SECTION 108000 - TOILET ACCESSORIES
10. Temporary Facilities: SECTION 015000 - TEMPORARY FACILITIES
11. Food Service Equipment: SECTION 114000 FOOD SERVICE EQUIPMENT
12. Laboratory Casework and Sinks: SECTION 123000 LABORATORY EQUIPMENT
13. Commissioning of Plumbing; SECTION 220800 COMMISSIONING OF PLUMBING

1.4 CODES, ORDINANCES, AND PERMITS

A. Perform all work in accordance with the requirements of the City of Central Falls Building Department, Rhode Island State Plumbing, D.E.P., A.D.A., NFPA, The Architectural Barrier Code, Energy Code and applicable State and Federal Laws. Give all requisite notices, file all requisite plans, and obtain all permits required to perform all Plumbing Work. Where the Contract Documents indicate more stringent requirements than the above Codes and Ordinances, the Contract Documents shall take precedence.

B. Obtain all permits, inspections, and approvals, from the governing authorities and pay all fees and include cost in the bid, including approvals for the cross connection control device. Provide the Owner with the cross connection permit for the device in the Owner's name.

1.5 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications conflict or are unclear, advise Designer in writing before Award of Contract. Otherwise, Designer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities thus resolved.

B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Designer in writing before installation. Otherwise, make changes in installed work as Designer requires within Contract Price.

C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, this contractor shall provide that material, installation, or work which is of the higher standard.

D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the contractor has failed to notify the Designer of the situation in accordance with the paragraph above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

E. In cases covered by the paragraph above, where the contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Designer shall review, note if necessary, and approve the sketch.

1.6 MODIFICATIONS IN LAYOUT

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.

B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer.

C. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Section will be installed.

D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above. Systems shall be run in a rectilinear fashion.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.

1.7 SHOP DRAWING AND MATERIAL SCHEDULES

A. Refer to SECTION 013000 - SUBMITTALS for submittal of Shop Drawings. If apparatus or materials are substituted for those specified, and such substitution necessitates changes in or additional connections, piping, supports or construction, same shall be provided as the responsibility, and at the expense, of the Plumbing Subcontractor.

B. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Subcontractor. The Subcontractor is responsible for furnishing and installing materials called for in the Contract Documents, even though these materials may have been omitted from approved Submittals.

C. Submit Shop Drawings for the following materials and equipment.
1. Valves, Piping, couplings and Fittings
2. Fixtures, Drains and Equipment including Supports
3. Backflow Preventers
4. Access Panels and Covers
5. Insulation
6. Drains, and Hydro Mechanical Specialties
7. Hose Bibs, Wall Hydrants
8. Hangers, Anchors, Guides, and Supports including Seismic Restraints
9. Cleanouts
10. Piping Identification System
11. Water Heating Equipment
12. Domestic Water sub-meters
13. Domestic Gas sub-meters
14. Interior Grease Traps
15. Exterior Grease trap
16. Oil interceptors
17. Sump pumps
18. Gas / Sand traps

1.8 COORDINATION DRAWINGS

A. Before materials are purchased or Work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings

are compatible and correctly annotated and cross-referenced at their interfaces (match lines).

B. Coordination Drawings are for the Contractor's and the Architect's use during Construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.

C. Detailed procedures for Coordination Drawings are contained in DIVISION 01 - GENERAL REQUIREMENTS of these Contract Documents.

1.9 RECORD DRAWINGS

A. General: Refer to DIVISION 01 - GENERAL REQUIREMENTS for general requirements for maintaining as-built drawings and submitting final reproducible record documents.

B. The General Contractor will provide two sets of Drawings to the Plumbing Subcontractor, one set of which shall be maintained at the site and which shall, at all times, be accurate, clear, and complete, showing the actual locations of all equipment and piping as it is being installed. The Record Drawings shall be available to the Architect/Engineer's field representative at all times.

C. Provide electronic AutoCAD drawings to indicate revisions to piping size and location both exterior and interior; including locations of valves and other equipment requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.

D. Include in the Record Drawings any addenda, sketches, and supplementary Drawings issued during the course of construction.

E. Non-availability of Record Drawings or inaccuracies therein will postpone the final inspection until they are available.

F. All valves shown on these Drawings shall be numbered with numbers corresponding to those on the valve charts.

G. All costs related to the foregoing requirements shall be paid by the Plumbing Subcontractor.

1.10 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Provide operating instructions to the Owner's designated representative with respect to operation functions and maintenance procedures for all equipment and systems installed. At the completion of the project, turn over to the Architect four (4) complete manuals, in three-ring, loose-leaf binders, containing the following:
   1. Complete Shop Drawings of all equipment.
   2. Operation description for all systems.
   3. Names, addresses, and telephone numbers of all suppliers of the system.
   4. Preventative maintenance instructions for all systems.
   5. Spare parts lists of all system components.
   6. Valve tag chart.

1.11 GUARANTEE

A. Refer to Division 1 of the Contract. Guarantee all work under this Section free from defects in workmanship and materials for a period of one (1) year from the date of final acceptance of the building, as set forth in the Contract. Replace any such defective work developing during this period, unless such defects are clearly the result of bad usage of equipment by others. Where such defective work results in damage to work of other Sections of the Specifications, restore such work to its original condition by mechanics skilled in the affected trade.

1.12 DRAWINGS

A. All work shown on the Drawings is intended to be approximately correct to scale, but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make complete working systems ready for use. The Plumbing Drawings are intended to show the main stacks and risers and may or may not necessarily show all runout piping particularly in lavatories and gang toilet areas. Contractor shall include all runout piping to all referenced scheduled fixtures and equipment appearing on the Plumbing Drawings.

B. All floor drains installed on this project, including all kitchen floor drains and trough drains, shall be equipped with trap primers. The trap primer piping below slab is not shown on the drawings and shall be located in the filed by the Contractor as dictated by field piping conditions.

C. The Plumbing Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.

D. Refer to the Architectural, Structural, and other Mechanical and Electrical Drawings, which indicate the construction in which this Work shall be installed. Locations shown on the plans shall be checked against the general and detailed Drawings of the construction proper. All measurements shall be taken at the Building.

1.13 VALVE TAGS, NAMEPLATES, AND CHARTS

A. All valves on pipes of every description shall have neat circular brass valve tags at least 1-1/2 in. in diameter attached with brass hook to each valve stem. Stamp on these valve tags, in letters as large as practical, the number of the valve and the service, such as "H.W., C.W.,", for hot water and cold water respectively. The numbers for each service shall be consecutive. Where valves are located above ACT ceilings, furnish and install valve finder ceiling tack, tack shall be minimum 7/8 in. diameter with 1/2 in. steel point, color as determined by Owner.

B. All valves on tanks and pumps shall be numbered by 3 in. red metal discs with white numbers 2 in. high, secured to stem of valves by means of small solid link brass chain, to correspond to numbers indicated for valves on the Record Drawings and on two (2) printed detailed lists. These printed lists shall state the numbers and locations of each valve and the fixture or group of fixtures which it controls, and other necessary information such as requiring the opening or closing of another valve or valves when any one valve is to be opened and closed, and shall be prepared in form to meet approval of the Architect, and shall be framed under glass.

C. Nameplates, catalog numbers, and rating identifications shall be securely attached to Electrical and Mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

1.14 PIPE MARKER IDENTIFICATION SYSTEM

A. Mark all piping installed under this Section and at all Access Panels with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Markers shall be applied at all valves and tee joints, and on straight runs of pipe at every 20 ft.-0 in. on center. Adhesive markings are not acceptable. Markers shall be painted on under the scope of this Section or may be snap-on system.

B. Clearly mark potable and non-potable water system with 4 inch wide colored bands, with arrow for direction of flow, every twenty-five (25) feet on center on all piping installed whether it is concealed or exposed and also on both sides of floor and/or wall penetrations. Mark potable water green and non-potable yellow. Within 6 in. of each band identify with letter "Potable C.W."Color of letter shall match banding.

1.15 SANITARY WASTE, KITCHEN GREASE WASTE AND STORM SYSTEMS

A. Furnish and install complete Sanitary, Waste, Vent, Kitchen Grease Waste and Vent, and Storm Drainage Systems (all hereinafter called Drainage Systems) to convey wastes from all Soil and Waste Stacks, Fixtures, Equipment, Kitchen Fixtures, and Roof Drains as indicated and/or described in these Plans and Specifications. Urinal waste shall be 2 in. cast iron or sizes indicated on the drawings. Waste piping smaller than 3 in. shall not be used underground. The use of double "Y's" in the horizontal shall not be permitted. All piping shall be installed straight and true and located concealed within building construction.

B. All horizontal Drainage Systems Piping within the building, 3 in. and smaller, shall be pitched at least 1/4 in. per ft. in the direction of flow. Drainage Piping 4 in. and larger shall be pitched at least 1/8 in. per ft. Make changes in direction of drainage lines with 45 wyes, long turn wyes, or sweep bends.

C. Furnish and install all cleanouts indicated on the Drawings and/or where required in Drainage Pipes regardless of size so that the distance between cleanouts does not exceed 45 ft. o.c. Cleanouts shall be installed at the base of all risers and at each change of direction.

D. The Kitchen Grease Waste System shall be a completely separate system beginning at the exterior grease interceptor through the kitchen and vented individually through the roof. Do not connect soil lines to the grease waste nor sanitary vents to the grease vent.

1.16 DOMESTIC WATER SYSTEMS

A. Furnish, install, sterilize, and test in accordance with the documents and the Plumbing Code, complete potable and non-potable Domestic Cold, Hot, and Hot Water Recirculating Systems including all piping, valves, low point drains, shock absorbers, hangers, insulation, backflow preventers and water heating equipment. Clearly mark the systems as provided above. This work shall start as indicated on the Drawings.

B. In general, piping shall pitch upward in the direction of flow with each branch and riser separately valved and with 1/2 in. hose end drain on the outlet side of the

valve and at all low points in the system. Install shutoff valves for each battery of fixtures and other valves as necessary to isolate any part of each system.

C. Install shock absorbers on hot and cold water piping to each fixture. Provide shock absorbers at all quick closing valves and as shown on the Drawings and/or specified.

D. Install a 1/2 inch hose bibb in each toilet room provided with a floor drain. The hose bibb shall be installed under a lavatory.

E. Install a 1/2 inch hose bibb in each mechanical room.

F. Furnish and install a ball valve, balancing valve and check valve at each hot water recirculation line before it connects to another hot water recirculation line.

G. At all faucets connecting to the non-potable system whether furnished hereunder or by other sections, provide a “water unsafe” sign.

1.17 EQUIPMENT FURNISHED BY OTHERS

A. Miscellaneous items, including but not necessarily limited to the following, shall be furnished and set by others as specified in other SECTIONS of the Documents.
1. Dishwashers
2. Kitchen Equipment
3. Miscellaneous Sinks

B. Verify the extent of the connection requirements from the General and Mechanical Plans and Specifications and be responsible for: Setting in place, all such sinks and furnishing and installing trim and roughing including, but not limited to, drains, vent, water, gas or other plumbing piping, traps, tailpiece, nipples, escutcheons, faucets, and stop valves for all items which above are not so supplied. The equipment sections specify sinks including faucets and tailpieces as well as countertop turrets for gas. Include for all sinks which are installed in cabinet work a pair of 1/2 in. ball valve stops (same as specified under 2.4) and a rough bronze p-trap, special waste trap, or sediment trap as required.

C. Include a "Bakelight" stamped adhesive marker at each faucet indicating "Water Unsafe" as called for in 1.16 above.

D. The Plumbing Subcontractor shall be responsible in making final connections to all equipment furnished by others to ascertain complete cross-connection prevention compliance and to furnish and install vacuum breaker and backflow preventers which may be required to be Code compliant and are not so furnished with the equipment.

E. All sinks are intended to be "Accessible" and all drain outlets on all sinks and lavatories where furnished by the Plumbing Subcontractor or the other SECTIONS shall have an off-set drain. Set all roughing tight to wall in all cases to comply with ADA Standards. Provide where required ADA insulation kits to prevent injury where a barrier is not included in the casework. Refer to Equipment Drawings.

1.18 PAINTING

A. All interior exposed piping is to be painted and all painting, except as noted, will be done by the Painting Subcontractor. All uncovered piping and hangers shall be thoroughly cleaned of rust, oil, and other containments by the Plumbing Subcontractor and left ready to receive primer coat.

B. Painting for pipe markings shall be done under this Section.

1.19 HOISTING EQUIPMENT AND MACHINERY

A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by each sub-contractor, as specified under Section 015000, TEMPORARY FACILITIES AND CONTROLS.

1.20 STAGING AND SCAFFOLDING

A. Unless otherwise specified, each sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 015000 Temporary Facilities and Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.21 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – General Commissioning Requirements.

B. Complete installation and startup checks and functional tests according to Section 019113 – General Commissioning Requirements and manufacturers written instructions.

C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.

D. Verify that equipment is installed and commissioned as per requirements of Section 019113 and manufacturers written instructions/requirements.

E. Refer to Section 220800 Commissioning of Plumbing.

1.22 BREAKDOWN

A. Submit a breakdown of the contract price to aid the Architect in determining the value of the work installed as the job progresses.

B. No requisition will be approved until the breakdown is delivered to the Architect.

1.23 VISIT TO SITE

A. Prior to submitting a Bid, visit the site of work and become familiar with existing conditions. Any assumptions made are at this Subcontractor's expense.

1.24 ENERGY REBATE PROGRAM

A. This project has been designed to incorporate equipment approved for energy rebate such as domestic water heaters. Provide unit prices for each equipment type scheduled to be part of Rebate Program. Assist the Owner in filling out forms for utility company rebates.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment furnished under this SECTION shall be new, unused, first quality of a manufacturer of established reputation. Each valve, fitting, section of pipe, and piece of equipment supplied to project shall have cast or indelibly stamped thereon the manufacturer's name, pressure rating where applicable, type, and any other specific information provided by manufacturer. Materials shall conform to Rhode Island Code as a minimum requirement

2.2 PIPE AND FITTINGS

A. Pipe and fittings shall conform to the latest A.S.A., A.S.T.M., C.A., and F.S. standards.

B. All piping installed under this SECTION shall be in accordance with the following:

Service	Material
Underground Drainage and Vent piping	Service weight cast iron soil pipe-coated bearing collective trademark of the Cast Iron Soil Pipe Institute (CISPI)
Above ground Drainage and Vent, piping 2 in. and larger	No Hub cast iron soil pipe and fittings bearing collective trademark of the CISPI
Above ground drainage, and Vent piping 2 in. and smaller	Type ‘L’ hard tempered copper tubing
Trap primer piping from Primer to floor drain	Type ‘K’ soft rolled copper tubing with Swaged ends
Forced Main / Pump Discharge	Type ‘L’ hard tempered copper tubing
Domestic water and non-potable water piping above ground	Type ‘L’ hard tempered copper tubing
Kitchen indirect waste piping	Type ‘L’ hard tempered copper tubing coated with two (2) coats of white epoxy paint
Kitchen Waste pipe and fittings	No hub epoxy coated cast iron piping with EPDM XH no hub couplings with type 304 stainless steel shield. 4 bands for up to 4 inch and 6 bands for 6 inch

	and above.
Exposed piping at fixtures and in kitchen	Schedule 40 chrome plated red brass I.P.S.
Special Waste and Vent Piping above ground (not in plenums)	Schedule 40 electric heat fused flame retardant poly-propylene piping, fittings & traps; "George Fischer Fuseal" or approved equal
Special Waste & Vent Piping below ground	Schedule 40 electric heat fused non-flame retardant poly-propylene piping; fittings & traps, "George Fischer Fuseal", Orion, Zurn or equal
Compress Air Piping & Gas piping above ground	ASTM A-53 Schedule 40 black steel pipe

Fittings for underground Drainage Piping shall be service weight bell and spigot pattern C.I. soil pipe fittings. Above ground shall be no hub C.I. soil pipe fittings, Rhode Island Standard.

A. Fittings for underground Drainage Piping shall be service weight bell and spigot pattern C.I. soil pipe fittings. Above ground shall be no hub C.I. soil pipe fittings.

B. Fittings for sweat drainage piping shall be cast bronze or wrought copper of recessed drainage pattern.

C. Fittings for Type 'L' hard tempered copper tubing for laboratory vacuum and for potable and non-potable water piping shall be cast bronze or wrought copper sweat type, water pattern fittings.

D. Fittings for polypropylene Lab-waste and Lab vent (special waste system) shall be Schedule 40 polypropylene fittings with electrical resistance heat fusion joints as manufactured by George Fischer, Orion, Zurn, or equal. All underground pipe and fittings shall be bedded, jointed, backfilled with materials and methods outlined by the manufacturer's published instructions.

E. Fittings for compressed air piping shall be threaded malleable iron air pattern fittings for screwed pipe.

F. Fittings for gas piping for pressures below 14 in. W.C. shall be threaded malleable iron gas pattern fittings for screwed pipe. All elevated pressure gas piping regardless of size and low pressure gas piping 2 ½ in. in size and larger shall be welded and shall utilize butt welded steel pipe fittings.

G. Fittings for underground domestic water service shall be 250 psi gray iron cement lined fittings with mechanical joint ends.

2.3 JOINTS

A. Joints for underground cast iron bell and spigot soil pipe shall be made up with jute or oakum packing, caulked with 16 oz. of molten virgin pig lead per nominal inch diameter of pipe or with resilient gaskets.

B. Above ground shall be made up of heavy duty – 4 band stainless steel clamps, and gaskets. Couplings shall be in compliance with CISPI 310 and shall bear the mark of NSF International. Couplings shall be Husky “SD 4000”, Clamp - All HI-TORQ 125, Mission “HW”, or equal.

C. Copper tubing and sweat fittings shall be assembled with lead free solder, Silverbrite, Oatey, Harris, or equal, and a non-corrosive flux recommended by the manufacturer (includes waste piping and water piping). Press pipe and fittings are acceptable joining method for domestic water piping.

D. Joints between copper waste/vent tubing and cast iron shall be made with cast iron threaded fittings and copper thread by sweat fittings.

E. Joints between copper tubing and ductile iron water pipe or at flanged joints to tanks shall be made with a combination iron and brass flange with composition gasket and iron bolts.

F. Joints at water heaters or other tanks having threaded connections shall be made up with dielectric unions.

G. Joints between floor or wall flanges and fixtures shall be made with one-piece special molded neoprene gaskets which shall be furnished by the fixture manufacturer.

H. Threaded pipe joints including plastics shall be made up with teflon tape.

I. Joints on screwed gas piping shall be made up with thread compound on male threads only. Welded joints shall be made up by certified welders. All joints on piping 2-1/2 in. and larger, and on emergency generator exhaust regardless of size shall be welded. Joints for plastic gas piping shall be performed by the heat fusion method by Rhode Island Certified Technicians.

J. Joints on polypropylene acid waste and vent up to the outlet side of all traps shall be made up with electrical resistance fused joints utilizing manufacturer supplied power unit. Slip joints shall be used only in the final makeup connection between the trap and sink tailpiece. Vertical risers shall have vertical expansion joints at 20 ft. intervals. Horizontal runs shall have expansion joints in accordance with manufacturer's recommendations.

2.4 VALVES

A. Furnish and install valves where indicated on the Drawings or where specified and located so that they may be operated, repaired, or replaced with a minimum effort and repacked under pressure.

B. The following list of valves is intended only as a guide for type and quality. Valves shall be as manufactured by Apollo, Milwaukee, Nibco, Elkhart, Watts or approved equal.

Shutoff valves 2 in. and smaller	Apollo #70LF-202 through #70LF-208 solder end lead-free ball valves

Shutoff valves, 2-1/2 in. and 3 in.	Apollo #70LF-109 and #70LF-100 lead Free
Balancing valves	Bell & Gossett Model CB lead free calibrated balance valve.
Gate valves 4 in. and larger	Jenkins 651-A
Stop and waste valves 1 in. and smaller	Apollo #95LF-203 through #95LF-205, lead-free
Check valves	Walworth #406 SJ
Drain valves	Apollo #78-103-01 or #78-203-01 ball valve with cap and chain 1/2 in. x 3/4 in. hose end
Backwater Valve (Drainage Systems)	Zurn #Z1095. At below grade installations provide with extension to grade Zurn model Z1095-FC, height as required.

2.5 INSULATION

A. Insulation for all cold water piping and all horizontal roof leaders whether concealed or exposed shall be 1 in. thick, heavy density, preformed snap-on insulation equal to Johns Manville Micro-Lok HP, 850 degrees snap-on system. Insulation for cold water piping shall have a factory applied vapor barrier with ends and butts sealed with overlapping 4 in. sealing strips.

B. Insulation for all hot water piping 1 1/4” and smaller shall be 1 in. thick, heavy density, preformed snap-on insulation equal to Johns Manville Micro-Lok HP, 850 degrees snap-on system.

C. Insulation for all hot water piping 1 1/2” and larger shall be 1.5 in. thick, heavy density, preformed snap-on insulation equal to Johns Manville Micro-Lok HP, 850 degrees snap-on system.

D. Valves, fittings, and the underside of roof drain bodies shall be insulated with pre-formed fiberglass fitting insulation cut from dense fiberglass blanket and covered with pre-molded P.V.C. fitting covers. P.V.C. covers shall overlap the adjoining insulation and shall be secured with pressure sensitive vinyl tape over a vapor barrier adhesive seal at the joints. (Note: Staples or tacks are not permitted on covers).

E. All insulation shall have self-sealing type, all service jacket (ASJ-SSL) factory applied. At all exposed piping, cover jacket with continuous P.V.C. jacket.

F. Sealers, solvents, tapes, and adhesives, and mastics used in conjunction with the installation of insulation under this Section shall possess the maximum possible fire safe qualities available and shall be NFPA approved.

G. Covering shall be applied over clean and dry surfaces. No covering shall be applied until after the approval of all pressure and leakage tests.

H. Insulation shall be as manufactured by Johns Manville, Inc., Owens-Corning Fiberglass Corporation SSL II-ASJ, or Knauf Insulation 1000. Insulation shall be applied by skilled insulation mechanics in a first class manner.

2.6 TRAPS

A. Furnish and install traps with cleanouts on all fixtures and equipment requiring connection to the sanitary system of the same size and material as the pipe on which they occur. Traps installed on threaded pipe shall be recessed drainage pattern.

2.7 DRAIN VALVES

A. It shall be possible to drain the water from all sections of the Potable and Non-Potable Hot and Cold Water Piping. Furnish and install 1/2 in. x 3/4 in. hose end ball valves with cap and chain. (see 2.04 for model no.)

2.8 SHOCK ABSORBERS

A. Furnish and install, where shown on Drawings and where required to prevent water hammer, manufactured by Zurn J.R. Smith Manufacturing Company, Josam Manufacturing Company, or equal.See schedule on drawings.

B. Installation of absorbers shall be as per manufacturer's recommendations.

2.9 PIPING ACCESSORIES

A. Pressure and Temperature Relief Valves shall be A.S.M.E. rated temperature relief 210 deg. F. double BTU rated, self-closing, as manufactured by Watts Regulator Company or equal by Wilkins, McDonnell and Miller, or equal.

B. Vacuum reliefs shall be lead free Watts Regulator Company #LFN36 or equal by Wilkins or Lawler.

C. Temperature gauges shall be 4-1/2 in. diameter dial thermometers, any angle, and range of 30 degrees F. to 240 degrees F. as manufactured by Weiss Instruments, U.S. Gauge, Trerice or equal.

D. Pressure gauges shall be 4-1/2 in. diameter with a range of 0 to 160 psi as manufactured by Weiss Instruments, U.S. Gauge, Trerice or equal.

E. Furnish and install where piping crosses building expansion joints on the domestic water piping and gas piping, expansion joints and anchors sized for 1-1/2 in. expansion per one hundred feet. Expansion joints shall be Metraflex "Metraloop", or manufactured by Flexonic Company or Hyspan, or equal. Piping shall be anchored and guided to force the expansion in the proper direction. Domestic water expansion joints shall be NSF approved.

F. Furnish and install where indicated on Drawings, Watts Regulator Company lead free pressure reducing valve and strainer combination size as indicated on the Drawing or equal, as manufactured by Donnelly Products Company or McDonnell and Miller.

G. Trap primer connections are required on all floor drains to maintain trap seal. The requirement for trap primer connections shall include all floor drains in the kitchen including trough drains furnished by others. Trap primers shall be Precision Plumbing Products, Inc., Zurn, Josam, Smith or equal.

H. At daylight drains to raingardens, provide Rain leader outlets termination points furnish and install vandal proof type 304 stainless steel downspout cover, Zurn model ZS-199-DC-VP, or as manufactured by JR Smith, Josam, or equal. All fasteners shall be stainless steel.

2.10 HYDRANTS AND HOSE BIBBS

A. Wall hydrants shall be cast brass 3/4 in. non-freeze wall hydrant with integral backflow preventer, 3/4 in. hose connections, polished nickel bronze face, loose key handle, brass wall sleeve, and fitted with brass locknut.

B. Hose bibb shall be T & S Brass or equal, chrome plated, 3/4 in. hose end, integral stop, vacuum breaker, modified with lock shield and loose tee handle.

C. Hydrants shall be manufactured by Zurn, J.R. Smith, Josam, or equal. Hose bibbs shall be manufactured by T&S Brass, Speakman, Chicago, or equal. See schedule on the drawings.

2.11 CLEANOUTS

A. Cleanout plugs on the Sanitary System shall be of heavy cast brass of the screwed type. Plugs shall be full size up to and including 4 inch.

B. For piping running under floor slab, cleanouts shall be brought up to just under the floor slab level. Furnish and install access cover for all floor-type cleanouts, Zurn ZN-1400 Series with scoriated nickel bronze or by Josam, J.R. Smith, or equal. In the garage area and at exterior locations use Zurn model #Z-1474 cleanout housing set over brass cleanout plug.

C. Cleanouts for Sanitary Waste System shall be as follows:
1. FCO-1 - Below floor - Bring cleanout plug to below floor level and use Zurn #ZANB-1463-VP nickel bronze scoriated floor access cover mounted on Shamrock Industries concrete sleeve. See detail on drawings.
2. FCO-2 - Below floor - Bring cleanout plug to below floor level and use Zurn # Z-1474 heavy duty nickel bronze scoriated floor access cover mounted on Shamrock Industries concrete sleeve. See detail on drawings.

2.12 ACCESS DOORS

A. Furnish Access Doors for access to all concealed control valves, cleanouts, valves, expansion joints, and to all other concealed parts of the Plumbing System that require accessibility for the proper operation and maintenance of the system. These doors shall be installed under the appropriate SECTION of the Specifications as determined by the surface upon which the panels are mounted.

B. All Access Doors shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that the valve or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 in. x 16 in.). Furnish Access Doors for each pipe space to permit thorough inspection of same. When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.

C. Access doors shall be prime painted and completed with cylinder lock and two (2) keys as manufactured by Acudor, Inland Steel Products Company "Milcor", or Walsh-Hannon-Gladwin, Inc., "Way Loctor". Type shall be as follows:

1. Acoustical Tile Ceiling Acudor AT-5020
2. G.W.B. Surfaces Acudor DW-5040
3. Masonry Construction Acudor UF-5000
4. Fire Rated Construction Acudor FB-5060

D. Access Door Shop Drawings shall be submitted to the Architect for approval.

2.13 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

A. Furnish and install all supplementary steel, channels, and supports required for the proper installation, mounting, and support of all equipment.

B. Supplementary Steel and Channels shall be firmly connected to building construction in a manner approved by the Architect.

C. The type and size of the Supporting Channels and Supplementary Steel shall be determined by the Plumbing Subcontractor and shall be sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

D. All Supplementary Steel and Channel shall be installed in a neat and workmanlike manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 deg. fittings, as necessary to suit the construction and installation conditions.

2.14 HANGERS, ANCHORS, GUIDES, AND PIERS

A. All piping shall be supported from the Building Structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration, and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.

B. The spacing for hangers for horizontal piping shall be in accordance with the following:
1. Cast Iron Soil Pipe: 5 ft.-0 in. at the hubs for 5 ft. lengths. For 10 ft. lengths, use one (1) hanger at the hub and one (1) at midpoint of the length. Install cast iron pipe in accordance with CISPI Handbook - latest edition.
2. Copper Tubing: 6 ft.-0 in. o.c. for 1-1/4 in. and smaller, and 10 ft.-0 in. o.c. for 1-1/2 in. and larger.
3. Steel Pipe: 10 ft.-0 in. o.c. for 1-1/2 in. and over; 8 ft. - 0 in. for 1-1/4 in.; 6 ft. – 0 in. for 1 in. and smaller.
4. Polypropylene acid waste: 4 ft.-0 in. o.c.

C. Hanger rod diameter shall be as follows:

Pipe Size	Rod Diameter
1/2 in. thru 2 in.	3/8 in.
2-1/2 in. and 3 in.	1/2 in.
4 in. and 5 in.	5/8 in.
6 in.	3/4 in.

8 in. and over	7/8 in.

D. Vertical lines shall be adequately supported at their bases by a suitable hanger placed in the horizontal line near the riser and at every 10 ft. interval.

E. All Hangers (including those for acid-waste) shall be adjustable Clevis Hanger. Hanger rods shall have machine threads. Malleable iron brackets of approved type shall be used along the walls. All Hangers for copper tubing shall be copper plated except where pipe is insulated, in which case, Steel Clevis Hanger and pipe shield shall be used.

F. Piping shall not be hung from the hangers of other trades.

G. Provide seismic restraints for all piping per requirements of the RI Building Code

H. Hangers shall be manufactured by Grinnell, Carpenter and Paterson, Fee and Mason, or equal.

I. Wire and strap hangers will not be permitted in this installation.

J. Install a 14 gauge metal pipe shield between pipe insulation and all pipe hangers. Hangers shall be sized so that the pipe insulation passes through the hanger and is supported on the shield.

2.15 DRAINS

A. Furnish and install all floor drains where shown on the Drawings. Furnish all roof drains for installation by the General Contractor.

B. All floor drains in flooring systems without waterproofing membranes shall have galvanized iron clamping rings with 6-pound lead flashing to bond 9 in. in all directions. All drains shall be checked with Architect's Drawings to determine depth of the flashing collar. Brass extension pieces shall be provided if necessary.

C. All floor drains installed on this project shall be fitted with Automatic Trap Primer Connections. Field determine appropriate location for Trap Primer valve and drain piping.

D. Drain Schedule:
1. Refer to Schedule on Drawings for Drain Specifications.

E. Drains shall be of one manufacturer, by Zurn, J.R. Smith, Josam, or equal.

2.16 PLUMBING FIXTURES

A. All water closets, urinals, private lavatory faucets, shower heads and aerators that are legible for labeling must be WaterSense labeled.

B. Lavatory Electronic Faucets to be 4” center & (3) hole mounted.

C. Furnish and install all fixtures and equipment, including supports, connections, fittings, and any incidentals, to make a complete installation in accordance with the Drawings and as specified. This project includes hard wired electronic actuated fixtures. Furnish transformers. Electrical Subcontractor shall wire all the fixtures requiring power.

D. The Architect shall be final judge as to whether fixtures and trim fulfill the requirements of the Specifications and as to whether they are of suitable quality.

E. All fixtures requiring hot and cold water shall have the cold water faucet on the right hand side of the fixture and the hot water faucet on the left hand side of the fixture.

F. Escutcheons shall be furnished and installed on all supplies and traps. Escutcheons shall be one (1) piece chrome plated brass with set screws.

G. All fixtures shall have the manufacturer's guaranteed label or trademark indicating first quality. All acid resisting enameled ware shall bear the manufacturer's symbol signifying acid resisting material.

H. Unless otherwise specified, faucets and all exposed fittings shall be chromium plated.

I. All supply pipes shall run in a reasonable straight vertical line from the stops to faucets. Traps shall be installed perpendicular to walls.

J. Vitreous china and acid resisting enameled fixtures shall be of one manufacturer by American Standard, Kohler Toto, or equal. Faucet Trim shall be, Speakman, Chicago, T & S Brass, or equal. Flush valves shall be Sloan, American Standard, Zurn, or equal. Water coolers and drinking fountains shall be manufactured by Elkay, Just, Filtrine, or equal. Stainless steel sinks shall be Elkay, Just, or equal.

K. Note: All fixtures and fittings shall be vandal proof mounted, unless specifically noted otherwise.

L. Carefully coordinate roughing for flush valves so that the dimension from top of fixture to C-L of flush valve is a minimum of 6 in..

M. Special Note: There are several age groups accommodated in this building and therefore there are different mounting heights. Irrespective of the heights called for on the Documents, be responsible to re-verify in writing in field before installing any roughing for any fixture.

N. Fixture Schedule:
1. Refer to Schedule on Drawings for Plumbing Fixture Specifications.

2.17 BACKFLOW PREVENTERS

A. Backflow preventers shall be reduced pressure type furnished complete with shutoff valves, Rhode Island Approved. Backflow preventers 2-1/2 inch and smaller shall be Watts #LF009-QT-S. Backflow preventers 3 inch and larger shall be Watts 957-QT. Backflow preventers shall be lead free, all bronze, complete with strainer and soft seated check valve on inlet side. Size shall be as indicated on Drawings.

B. Mount backflow preventer 3 ft.(+/-) above finished floor. Provide indirect waste funnel and run pipe to an air gapped discharge at sink or floor drain. Furnish a spare parts kit and parts list mounted in the vicinity of the device.

C. Prior to the installation of devices in the name of the Owner file for, pay for, and obtain all required permits and approvals for cross connection control devices from the Authority having Jurisdiction.

D. Backflow preventers shall be of one manufacturer, by Watts, Wilkins, Beeco, or equal.

2.18 UNION AND NIPPLES

A. All connections between copper tubing and galvanized piping or between copper tubing and all tanks (such as water heaters, chillers, and similar equipment) shall be made with dielectric unions and nipples.

B. All connection to Water Heaters, Meters, Pumps, and other equipment requiring maintenance or alteration shall be made up with unions. Unions on brass piping, 2 in. and smaller, shall be brass composition "E" in strict accordance with Federal Specification WW-U-516. On plastic piping, use unions of the same material as the piping.

C. All close and shoulder nipples shall be corresponding materials as the pipe and shall be extra heavy.

2.19 DOMESTIC GAS WATER HEATER

A. This section includes storage water heaters for potable water utilizing hot water as the energy source.

B. Refer to Plumbing Drawings for Domestic Water Heater Specifications.

C. The water heaters shall include all standard equipment, as shown on manufacturer’s specification sheet, shall fit properly into the space provided for it and shall conform to the Drawing requirements. The complete installation shall be in accordance with all applicable federal, state and local codes and installation drawings.

D. REGULATORY REQUIREMENTS
1. Conform to ASME Section IV. Part HLW for Duplex Storage Tank construction.
2. Conform to NSF/ANSI Standard 372- Drinking Water System Components – Lead Content
3. Conform to ASHRAE/IES 90.1-2010.
4. ASME Compliance: Duplex Storage Tank shall bear the ASME HLW stamp and be National Board listed
5. NSF/ANSI Compliance: Duplex Storage Tank shall conform to the NSF/ANSI 372 by a recognized certifying body.

2.20 DOMESTIC ELECTRIC WATER HEATER

A. This Contractor shall furnish and install an electric hot water heater on the floor, as shown on the drawings

B. Refer to Plumbing Drawings for Domestic Water Heater Specifications.

C. The water heaters shall include all standard equipment, as shown on manufacturer’s specification sheet, shall fit properly into the space provided for it and shall conform to the Drawing requirements. The complete installation shall be in accordance with all applicable federal, state and local codes and installation drawings.

2.21 MASTER MIXING VALVES

A. Furnish and install where shown for temperature control at the domestic storage tanks:

B. Refer to Plumbing Drawings for Mixing Valve Specifications.

C. Furnish and install where shown for temperature control at the water heater, Powers Intelistation digital mixing valve size as indicated on the drawing schedules with integral check-stops, outlet volume/shutoff valve, and dial thermometer. Valves are to be furnished in rough bronze finish and are to be factory assembled and tested.

D. Furnish and install a 4 in. diameter thermometer on the outlet side of the mixing valve and where indicated on the Drawings as manufactured by U.S. Gauge Company, Powers Regulator Company, and/or Trerice Company.

2.22 RECIRCULATING HOT WATER PUMPS

A. Refer to Plumbing Drawings Recirculating Hot Water Pump Specifications.

B. Circulators shall be connected to the Building Management System by Section 230000.

C. Manufacturers: Subject to compliance with requirements, provide all steel, insulated, positive pressure double wall vents of one of the following:
1. Metal-Fab, Corr/Guard Model CG
2. Selkirk Heat-Fab Saf-T Vent CI
3. Schebler eVENTplus
4. or equal

2.23 WATER METER

A. Furnish and install water meter with inlet strainer in accordance with the standards of the Local Water Department. Coordinate the installation with the water department and include in the Plumbing Bid the cost of the meter. Refer to Part 1 of this section regarding assessments, and the like.

2.24 DOMESTIC WATER SUB-METER

A. Furnish and install ONICON or equal, model F-3500 water flow meter at the main water service entrance downstream of the water meter. Furnish 24VDC power supply with plug connection. Coordinate power wiring with Section 260000. Include Onicon N-100 network interface module.

B. Unit shall be capable of providing BACnet output. All BACnet control wiring shall be by Section 230000.

2.25 FIRESTOP SYSTEMS

A. General: Provide firestopping at all new fire-rated construction where penetrated by the Work of this Section.

B. Refer to Section 078400 - Firestopping, for all product requirements for maintaining integrity of fire-rated construction at penetrations.

2.26 SCAFFOLDS AND STAGING

A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - Temporary Facilities and Controls and herein.
   1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 01 50 00 - Temporary Facilities and Controls shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contract requiring such scaffolding.
   2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - Temporary Facilities and Controls and as additionally required for dust control).
   3. General Contractor is responsible to provide enclosures required for temporary heat; refer to Section 01 50 00 - Temporary Facilities and Controls.
      a. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.

2.27 HOISTING MACHINERY AND EQUIPMENT

A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - Temporary Facilities and Controls.

2.28 INTERIOR GREASE INTERCEPTORS

B. This Contractor shall furnish and install interior grease interceptors, which will be complete in all respects. Interceptor shall be as manufactured by J.R. Smith, Zurn, Josam or equal.

C. Grease interceptor shall be provided with cradle, having acid-resistant epoxy inside and outside, and flow control fitting having a rating of 50 GPM and grease capacity of 100 pounds, bearing approval seal of the Plumbing and Drainage Institute. Interceptors to have three inch (3") non-submerged inlet and three inch (3") outlet connections, internal air-relief double wall deep seal code trap and removable baffles.

D. Contractor to provide interceptor extension if required to meet field invert conditions.

2.29 EXTERIOR GREASE INTERCEPTOR

A. Exterior grease interceptor shall be precast concrete. Refer to drawing schedule for additional information.

B. Cast iron manholes, frames, and covers, shall be of the form, dimensions, and manufacture shown on the Contract Drawings. Manhole extensions shall be neatly and accurately brought to dimensions of the base of the frame. Casting shall be of tough gray iron, free from cracks, holes, and cold shuts. All castings shall be made accurately to dimensions and shall be machined to provide even bearing surfaces. Covers must fit the frames in any position and, if found to rattle

under traffic, shall be replaced. Filling to obtain tight covers will not be permitted. No plugging, burning-in, or filling will be allowed. All castings shall be carefully coated inside and out with coal tar pitch varnish of approved quality.

C. Castings shall be as detailed on drawings or castings that appear on the RIDEM approval list for manhole frame & cover castings. Castings shall be by LeBaron Foundry, Neenah Foundry, or Campbell Foundry.

2.30 NATURAL GAS SUB-METER

A. Furnish and install, where shown on the Drawings, ONICON or equal, model F-5500 thermal mass flow meter. Furnish 24VDC power supply with plug connection. Coordinate power wiring with Section 260000. Include Onicon D-100 network interface module.

B. Unit shall be capable of providing BACnet-IP output. All BACnet-IP control wiring shall be by Section 230000.

2.31 DOMESTIC WATER SUB-METER

A. Furnish and install ONICON or equal, model F-3500 water flow meter at the main water service entrance downstream of the water meter. Furnish 24VDC power supply with plug connection. Coordinate power wiring with Section 260000. Include Onicon D-100 network interface module.

B. Unit shall be capable of providing BACnet-IP output. All BACnet-IP control wiring shall be by Section 230000.

2.32 EMERGENCY GAS SOLENOID VALVE

A. Emergency gas solenoid valve shall be normally closed FM approved gas solenoid valve ASCO “Red-Hat” Series 8040/8215. Valve shall operate on 120volt power and shall close the gas flow on the main gas feed to the Kitchen cooking equipment. This solenoid valve is furnished and installed by Section 220000.

B. Gas solenoid valves shall be manufactured by ASCO, QMI, ISIMET, or equal.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

A. All work shall be installed in a first-class manner consistent with the best current practices. All materials shall be securely installed plumb and/or level, and all flush mounted equipment shall have front edge flush with finished wall surface.

B. All piping shall be installed true to line and grade in the case of underground piping. All piping above ceilings or exposed shall be grouped together, be parallel to each other, and be either parallel or perpendicular to the structure. Utilize gang hangers wherever feasible. Group all valves together where feasible.

3.2 WORK COORDINATION AND JOB OPERATIONS

A. The equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same.

B. Particular attention shall be directed to the coordination of piping and other equipment installed in the ceiling areas. Coordinate the elevations of all piping in hung ceiling areas to insure adequate space for the installation of recessed lighting fixtures before other mechanical equipment is installed.

C. Furnish to the General Contractor, and all other Subcontractors, all information relative to the portion of the Plumbing installation that will affect them, sufficiently in advance so that they may plan their work and installation accordingly.

D. In case of failure to give proper information as indicated above sufficiently in advance, pay for all back-charges for the modification, renovation, and relocation of any portion of the work already performed.

E. Obtain from the other trades, all information relative to the Plumbing Work to be executed in conjunction with the installation of their respective equipment.

3.3 CUTTING AND CORE DRILLING

A. Perform all cutting and core drilling operations that are outlined in Part 1 of this SECTION. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the walls, floors, overhead structure, and other structural components, which are to remain, is maintained until permanent work is installed. Prior to any coring or cutting, verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved Coordination Drawings

B. Cut all masonry and concrete with an approved diamond blade concrete saw in a neat straight direction, perpendicular to the plane of the wall or floor.

C. Use a core drilling process which produces clean, sharp edges and the minimum hole size which will accommodate the size of pipe sleeve specified. Submit procedures for cutting thru existing steel beams to Architect for review.

D. The patching of holes shall be performed by Plumbing Sub-contractor utilizing methods outlined for the finish trade involved. Holes shall be patched to the satisfaction of the Architect.

3.4 CLEANING AND PROTECTION

A. Protect all materials and equipment during shipment and so as to prevent damage. Water closets, lavatories, and sinks shall be boarded over and all other fixtures shall be protected with pasted on paper. Post notice prohibiting the use of the fixtures prior to completion. Assume full responsibility for protection of work until its completion and final acceptance.

B. Keep the premises reasonably clean at all times and remove rubbish caused by the Plumbing Work as directed by the Architect.

C. Upon completion of this work, clean all fixtures and equipment installed herein and replace damaged parts. Failure to fulfill this obligation will result in back-charges for correction of the defective work.

3.5 SLEEVES, INSERTS, AND ESCUTCHEONS

A. All piping passing through slabs, floors, walls, partitions, foundation walls and grade beams, shall be sleeved and all such sleeves shall be furnished and installed by the Plumbing Subcontractor as detailed on the Drawings and herein

specified. Set sleeves in concrete floors and walls as soon as forms are set and before concrete is poured. Core drilling openings shall have a sleeve caulked and leaded in place.

B. All pipes passing through floor, whether slab-on grade or above grade levels, shall be sleeved with sleeve extending 1 in. above floor. This includes all piping in toilet room pipe space, stairwells, closets, partitions and pre-cast planks.

C. All sleeves shall be Schedule 40 galvanized steel and shall be reamed. There shall be a minimum of 1 in. annular space between the sleeve and pipe provide greater clearance where seismic requirements dictate. Sleeves on insulated pipe shall be large enough to allow insulation to pass through sleeve. Sleeves on drywall, masonry, or concrete walls and partitions, shall be flush with wall on both sides.

D. The space between sleeve and pipe in all cases shall be filled with a U.L./F.M. approved caulking compound. This includes pipes concealed in chases and/or partitions.

E. Inserts where required shall be furnished and set by the Plumbing Subcontractor and where necessary may be drilled or power driven and shall be sized such that the insert will not exceed a depth of penetration of 1 in. into concrete.

F. Escutcheons: All exposed pipe, uncovered, passing through walls or floors or ceilings shall be fitted with C.P. brass spun or split type escutcheons with approved clamping device for holding in position. Floor escutcheons shall be deep enough to fit over sleeves, fastened to pipe, and extend down to floor.

3.6 TESTING

A. Test all Work in the presence of the Architect and/or Engineer and as required by Local Codes.

B. After Soil, Storm and Vent Piping is in place and before being buried or furred in, plug lower ends and fill the system with water up to the top of stacks. Piping is to be left tight under these conditions and water lever shall be maintained intact for the period of at least four (4) hours.

C. Test all water piping by applying a hydrostatic pressure of 150 PSIG using a pump for this purpose. Make sure that all lines are properly plugged or capped and that air has been vented before applying pressure which shall remain constant without pumping for two (2) hours at least.

D. Any leaks in joints or evidence of defective pipe on fittings disclosed by test shall be immediately corrected by replacing defective parts with new joints or materials. No makeshift repair effected by caulking threaded pipe with lead wool, application or Wilky or patented compounds will be permitted.

E. Test gas piping per State Gas Code.

F. Any leaks in joints or evidence of defective pipe on fittings disclosed by test shall be immediately corrected by replacing defective parts with new joints or materials. No makeshift repair effected by caulking threaded pipe with lead wool, application or Wilky or patented compounds will be permitted.

3.7 CHLORINATION

A. Upon completion of the Plumbing Work, thoroughly chlorinate the entire domestic water system before putting same in service. Chlorinate all work in the presence of the Architect and/or Engineer. The chlorinating agent shall be as a solution of sodium hypochlorite. Water shall be fed slowly into the new line with chlorine in the proper amount to produce a dosage of 50 PPM. Open and close all valves while system is being chlorinated.

B. After the sterilization agent has been applied for 24 hours, pay for an independent testing agency to test for residual chlorine. A residual of not more than 5 PPM shall be required in all parts of the line.

C. If test show 5 PPM or greater of residual chlorine, flush out system until all traces of the chemical used are removed.

D. Provide testing report from independent testing agency.

3.8 INSTALLATION OF FIRESTOP SYSTEMS

A. General: Install firestop systems at all fire-rated construction where penetrated by the Work of this Section.

B. Refer to Section 078400 - Firestopping, for all installation requirements for maintaining integrity of fire-rated construction at penetrations.

3.9 INSTALLATION OF AIR INTAKE AND EXHAUST BREECHING, CHIMNEYS AND STACKS

C. VIBRATION CONTROL AND SEISMIC RESTRAINT: Refer to section 230548 and drawing VS-1 for the appropriate support of each piece of equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS-1.

D. Install all gas vents/intakes in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.

E. Seal joints between sections of positive pressure vents in accordance with manufacturer's installation instructions, and using only sealants recommended by manufacturer.

F. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances.

G. Install barometric and thermostatically operated dampers in accordance with manufacturer's instructions. Locate as close to draft hood collar as possible.

H. Clean breechings internally during installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

I. Temporary Closure: At ends of breechings and chimneys which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until installations are completed.

END OF SECTION

SECTION 22 08 00 - COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section presents specific commissioning requirements for the Central Falls High School project to be met in addition to other commissioning requirements, including but not limited to Section 01 91 13 “General Commissioning Requirements.”

1.2 RELATED COMMISSIONING SECTIONS

A. Section 01 91 13 General Commissioning Requirements

B. Section 23 08 00 Commissioning of HVAC and Controls

C. Section 26 08 00 Commissioning of Electrical

1.3 ABBREVIATIONS

A. See Section 01 91 13 for abbreviations and definitions.

1.4 CONTRACTOR REQUIREMENTS

A. Meet all the requirements of Section 01 91 13 “General Commissioning Requirements.”

B. Provide factory start-up and required technical personnel for participation in Owner’s Commissioning.

C. Construction and Acceptance Phase

1. Provide submittal data, commissioning documentation, O&M data and training related to Commissioning, including information from equipment suppliers.
2. Attend meetings necessary to facilitate the Commissioning process (refer to Section 01 91 13 and PART 3 of this specification for more information on meetings).
3. Review the commissioning Issues Log for items related to contracted work and assist the commissioning team in addressing and resolving these issues.
4. Complete commissioning checklists provided by Stephen Turner Inc. and return completed checklists to the General Contractor. Startup checklists may require specific input from the Equipment Supplier such as a copy of the Manufacturer’s Startup Checklist.
5. Address any available Design Professional punch list items before final commissioning testing.
6. Install a P/T plug at each water sensor that is an input point to the plumbing control system.
7. Complete Plumbing TAB with discrepancies and problems remedied before commissioning testing of the respective systems.
8. Execute commissioning tests, which will be developed and led by Stephen Turner Inc. Testing will start at the components level, will proceed to the system level, and will end with inter-system testing.

9. Correct deficiencies (differences between specified and observed performance) as interpreted by Stephen Turner Inc., the Owner, and Design Professional and retest the equipment.
10. Provide training of the Owner's operating staff, as required in PART 3 of this specification and elsewhere in the Contract Documents.
11. Assist and cooperate with Stephen Turner Inc. Provide skilled technicians familiar with this building to assist with commissioning testing.

D. Warranty Period

1. Execute seasonal or deferred commissioning testing, witnessed by Stephen Turner Inc. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.5 INCLUDED SYSTEMS

A. For the following systems and components, Stephen Turner Inc. will develop pre-functional checklists (PFCs) that are completed by the Trade Contractors (TC) and Functional Performance Tests (FPTs) that are executed by the Trades with Stephen Turner Inc., as indicated.

Building Systems to be Commissioned	Pre-Functional Checklists	Functional Performance Testing
Plumbing Systems		
Heat Pump Hot Water Heaters	Yes	100%
Electric Hot Water Heaters	Yes	100%
Hot Water Pumps	Yes	100%

B. The work provided under this Division that is listed above is included in the scope of the Commissioning activities to meet the Owner's goals.

C. In addition to component and systems level commissioning of the work listed, participation in inter-system testing and integrated commissioning of inter-related work is required. For list of all commissioned work see Section 01 91 13 "General Commissioning Requirements."

PART 2 - PRODUCTS

2.1 P/T PLUGS

A. 1/4" & 1/2" NPT Pressure/Temperature Test Plugs & Caps:

1. P/T plugs shall have a self-sealing pierce-able rubber core that is rated at 1000 PSI and 275°F.
2. Pressure/Temperature test plugs shall be provided at each pressure or temperature sensor on hot water systems where other means do not exist for

temporary pressure and temperature measurement access without disturbing the process.

PART 3 - EXECUTION

3.1 COMMISSIONING TEAM PARTICIPATION

A. Each trade including all Sub-contractors, Tier Contractors, manufacturers' start-up personnel, as well as direct Equipment Suppliers shall designate personnel to be responsible for coordinating commissioning activities with the Commissioning Authority as required in Section 01 91 13 "General Commissioning Requirements."

3.2 CONTRACTOR RESPONSIBILITIES

A. Execution requirements for the following are in Section 01 91 13 "General Commissioning Requirements" with additional specific requirements for this Division stated below.

3.3 COMMISSIONING MEETINGS

A. Additional requirements for this Division:

1. Attendance is required by at least one (1) representative from the Contractor(s) for the systems being commissioned during delivery, installation, and start-up, and when checklists and tests are being performed.
2. As specific issues arise, a representative from each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor will be required to attend the meeting to assist in resolution.

3.4 SUBMITTALS

A. Additional requirements for this Division:

1. The Plumbing Contractor's Submittals shall include Sequences of Operations demonstrating that the control design and application incorporate the requirements provided by the Design Professional within the contract documents into a fully functional system. The controls submittals shall document Step-by-Step Control sequences for each controlled device, for each mode of operation, and for each possible transition from one mode to another.
2. Sequences documented in the submittals shall include all custom and standard sequence elements including but not limited to:
    a. Start-up sequences
    b. Shutdown sequences
    c. Emergency or stand-by power sequences where applicable, including effects of power or equipment failure and all stand-by functions
    d. Effects of equipment failure
    e. Sequences for all alarms and emergency shut-downs including annunciation and notification sequences
    f. Initial and recommended values for all adjustable settings, setpoints, and parameters that are typically set or adjusted by operating staff
    g. Schedules, if known

h. All interlocks, interfaces, and interactions with other systems including controls systems provided by others.

i. Detailed delineation of control interface for any packaged equipment controls, listing all controllable or adjustable points and all monitoring points.

j. Written sequences of control for packaged controlled equipment, including additional clarifying narrative for equipment manufacturers' stock sequences.

k. The Plumbing TAB Contractor shall submit a project-specific TAB Plan four weeks prior to starting TAB work. The Plan shall address each system and component, and shall include but not be limited to:
   1) Field reporting forms that list each piece of equipment and show the data to be gathered for each.
   2) Final test report forms.
   3) Detailed procedures for TAB work for each system.
   4) Specific procedures to ensure Domestic Hot Water system operates at the lowest energy use and the methods to verify and document this.
   5) Phasing plan for performing TAB work by floor or area.

l. Submittals shall be marked to show exact items, sizes, components, electrical characteristics, operating characteristics, details required for this project, service clearances, and shall be annotated to match drawing schedules.

m. Include ranges for all thermometers, pressure gages and other measuring devices.

n. Provide performance data including range, accuracy, data storage, local read-out, and data connections for each meter type submitted.

o. Provide performance curves (full and part-load as applicable) for each pump submitted.

p. Provide Manufacturers' detailed installation requirements clearly marked (arrow, underline, circled, etc.) to indicate exactly the intended item.

q. Provide Manufacturers' detailed start-up requirements and procedures clearly marked (arrow, underline, circled, etc.) to indicate exactly the intended item.

r. Provide Manufacturers' operating instructions clearly marked (arrow, underline, circled, etc.) to exactly indicate the intended item.

s. Provide Manufacturers' recommended maintenance and troubleshooting procedures clearly marked (arrow, underline, circled, etc.) to exactly indicate the intended item.

t. Provide Warranty and clear statement of Owner's obligations to maintain equipment to preserve warranty.

3.5 PRE-FUNCTIONAL CHECKLISTS

A. No Additional requirements for this Division.

3.6 O&M MANUALS

A. No additional requirements for this Division.

3.7 EQUIPMENT START-UP

A. Additional requirements for this Division:

1. For all commissioned systems and equipment, one copy of the equipment manufacturer's or Contractor's start-up report shall be provided to Stephen Turner Inc. for review and to document that the equipment is installed, operational, and ready for commissioning testing.
2. Copies of additional testing performed including but not limited to leak tests required elsewhere in the specifications shall be provided to Stephen Turner Inc.

3.8 COMMISSIONING TESTING

A. Additional requirements for this Division:

1. Each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor shall assist the installing contractor in commissioning testing.
2. The Contractor shall assist and cooperate with the Stephen Turner Inc. Skilled technicians familiar with this project shall execute the functional performance testing of the controls system, and shall assist in the functional performance testing of systems and equipment, including systems with interlocks, interfaces, or other interaction with other systems.

B. Additional Requirements for Testing Specified Elsewhere:

1. This includes the following tests:
   a. Piping Pressure Testing.
2. Additional requirements for each of these tests:
   a. The General Contractor (GC) shall provide a copy of the proposed test procedure to Stephen Turner Inc. for review.
   b. The GC shall notify the Design Professional and Stephen Turner Inc. of the date and time the test is scheduled.
   c. The GC shall provide copies of field and final test results to Stephen Turner Inc.
   d. Stephen Turner Inc. will review the test results for consistency with the Owner's Project Requirements.
3. Stephen Turner Inc. will provide all commissioning team members (contractors, Design Professional, Owner, etc.), and others as required, the commissioning test procedures prior to scheduled testing. If no comments are received from a particular commissioning team member, that shall constitute acceptance of the commissioning test procedures as is.
   a. Once all commissioning checklists have been completed by the Contractor and accepted by Stephen Turner Inc., testing will be scheduled and performed.
4. Initial Testing
   a. The systems shall be sufficiently operational prior to the TAB of the system. It is understood that a portion of the final system startup occurs in conjunction with the TAB work.

b. Commissioning verification of sensors will be made using the sampling method; an exhaustive re-test of all control system inputs and outputs will not be conducted by Stephen Turner Inc. Prior to Stephen Turner Inc. verification, the control contractor shall be responsible for complete input/output checkout quality assurance.

c. Sensor Tolerances. The following are the tolerances of the actual sensors in the system. Unless noted differently on the commissioning test procedure, use the following:
   1) Temperature: +/- 2.0 deg. F
   2) Pressure: +/- 5.0 % of reading
   3) Flow rates for water: +/- 5.0 % of reading

d. Valve Stroke Setup and Check
   1) For all valve actuator positions, verify the actual position against the control signal.
   2) Set pumps to normal operating mode. Command valve closed, visually verify that valve is closed and adjust output zero signal as required. Command valve open, verify position is full open and adjust output signal as required. Command valve to at ;east one intermediate position. If actual valve or damper position doesn't reasonably correspond, repair or replace actuator.
   3) Closure for normally closed valves: Disconnect power to the actuator motor, and verify the valve moves to full closed position. Restore to normal.
   4) Normally open valves: disconnect power to the actuator motor, and verify the valve moves to full open position. Restore to normal.

e. Stephen Turner Inc. will witness the Initial tests. Each contractor will be responsible, as required, to put the system in various modes of operation, to fix minor problems found during the test (i.e. problems that can be fixed without delaying the completion of the test), and to witness the testing. Where Stephen Turner Inc. develops a procedure for the test, the contractor shall implement the test to the satisfaction of Stephen Turner Inc.

5. Intermediate Testing

a. The Plumbing TAB contractor shall, upon request by Stephen Turner Inc. if necessary during system troubleshooting, provide Stephen Turner Inc. with the technician(s) who accomplished the TAB, along with the specific equipment used for the TAB, to verify and re-test between 10% and 20% of the TAB final report.

b. Included in this work will be:
   1) Sample-based verification of measured quantities
   2) Review of firm qualifications
   3) Review of instrument calibration records
   4) Review of basic procedures. Particular emphasis will be placed on the use of iterative methods (repeat measurements) acknowledging the fact that changes in branch flows have an overall system effect.

c. The TAB Contractor shall provide the field reports or draft TAB reports to Stephen Turner Inc. within one week of completion for each system or area, before functional performance testing.

d. The TAB Contractor shall make skilled technicians and instruments used during TAB available to address functional performance test results that are at variance with TAB reports.

6. System Level Testing

a. Additional commissioning testing will be conducted after testing of the control system and TAB work. This testing will provide both the owner and Contractor with documentation that the system operated correctly according to the Owner's Project Requirements.

b. Stephen Turner Inc. will lead this portion of commissioning testing. Each Contractor will be responsible, as required, to put the system in various modes of operation, to fix minor problems found during the test (i.e. problems that can be fixed without delaying the completion of the test), and to witness the testing. Where Stephen Turner Inc. develops a procedure for the test, the Contractor shall implement the test to the satisfaction of Stephen Turner Inc.

c. Contractors shall attend and operate equipment during commissioning testing as required by the specific test being performed.

7. Inter-System Testing

a. Additional inter-system testing is required under the Owner's Commissioning process to ensure that work in this Division is properly interoperable with other work. Contractors shall participate in system level and inter-system testing. Testing will include operation under both normal power and emergency power where applicable, and complete exercising of systems through all modes and sequences. The inter-system functional performance tests will address all systems with interface to other systems. These systems include but are not limited to:

1) HVAC and hot water systems
2) BAS system
3) Metering system
4) Plumbing systems including but not limited to Domestic Hot Water and pumps
5) Lighting controls, indoor and outdoor
6) Power systems
7) Emergency power systems, including recovery from utility power loss

3.9 SITE OBSERVATIONS AND VERIFICATION

A. No additional requirements for this Division.

3.10 DOCUMENTATION OF COMMISSIONING ISSUES

A. Additional requirements for this Division:

1. Each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor shall assist the installing contractor in resolving commissioning issues.

3.11 TRAINING

A. No additional requirements for this Division.

3.12 AS-BUILT DRAWINGS

A. No additional requirements for this Division.

END OF SECTION 22 08 00

SECTION 23 00 00

HEATING, VENTILATION AND AIR CONDITIONING

INDEX

SECTION 23 00 00

HEATING, VENTILATING AND AIR CONDITIONING

PART 1- GENERAL

1.1 GENERAL REFERENCES

A. Bidding Requirements, Contract Forms, General and Supplementary Conditions and Division 1, General Requirements are hereby made a part of this Section.

1.2 SCOPE OF WORK

A. Work Included: The scope of work consists of the installation of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of furnishing all labor, materials, equipment, plant, transportation, rigging, staging, appurtenances and services necessary and/or incidental to properly complete all heating, ventilating and air conditioning work as shown on the Drawings, as described in the Specifications, or as reasonably inferred from either, in the opinion of the Architect as being required, and includes:
1. Gas fired hot water boilers and associated combustion air system and flue system.
2. Hot water/DX rooftop units and energy recovery units.
3. Hot water supply and return piping distribution system and accessories.
4. Hot water circulation pumps, expansion tanks, air separators and accessories.
5. Supply ductwork with associated terminal boxes, hot water reheats coils and supply registers and diffusers.
6. Return and exhaust ductwork with associated grilles and registers.
7. Refrigerant piping systems and accessories.
8. Radiant panels, fintube radiation, cabinet unit heaters, convectors and horizontal unit heaters.
9. Toilet exhaust and general exhaust systems.
10. Kitchen hood exhaust system.
11. Piping and ductwork insulation.
12. Balancing, air and water.
13. Automatic temperature controls.
14. Chemical treatment.
15. Fire Stopping
16. Furnish, erect and maintain staging and scaffolding, including mechanical hoisting and rigging equipment required for the performance of the heating, ventilating and air conditioning work.
17. Furnish, install and include all work in its entirety for Section 08 90 00 Louvers and Vents.

A. The HVAC Subcontractor shall be responsible for all cutting and patching related to the work of this Section except in finished surfaces. Patching is the responsibility of the trade affected.
1. For coordination of cutting and patching, refer to Section 01 31 00,

PROJECT MANAGEMENT AND COORDINATION.

2. For cutting and patching specifications, refer to Section 01 73 00, EXECUTION.

B. The HVAC Subcontractor shall be responsible for all Fire Stopping related to the work of this Section.
   1. Refer to Section 07 84 00 for Firestopping.

C. The HVAC Subcontractor shall be responsible for all louvers and vents related to the work of this Section.
   1. Refer to Section 08 90 00 for Louvers and Vents.

D. The work of this Section is shown on Drawings numbered, M0.01 through M7.05 inclusively.

E. Items to be Furnished Only: Furnish the following items for installation by the designated Sections:
   1. Access Panels
      a. Access panels for access to heating, ventilating and air conditioning equipment shall be furnished under this Section for installation by the General Contractor or appropriate Subcontractor.

F. Items to be Installed Only: Install the following items as furnished by the designated Sections:
   1. SECTION 26 00 00 - ELECTRICAL
      a. Duct mounted smoke detectors.

G. Related Work: The following items of work are not included in this Section and are specified under the designated SECTIONS:
   1. DIVISION 1 - GENERAL REQUIREMENTS
      SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION
      a. Coordination of cutting and patching.
      SECTION 01 73 00 - CUTTING AND PATCHING
      SECTION 01 91 13 – COMMISSIONING REQUIREMENTS
   2. DIVISION 2 - SITE CONSTRUCTION
      a. Excavation, backfill, pumping and shoring.
   3. DIVISION 3 - CONCRETE
      a. Concrete bases and supports.
   4. DIVISION 7 - THERMAL AND MOISTURE PROTECTION
      SECTION 07 00 02 - ROOFING AND FLASHING
      a. Flashing for all roof penetrations.
   5. DIVISION 8 - DOORS AND WINDOWS
      a. Door louvers and undercut doors.
   6. DIVISION 9 - FINISHES
      SECTION 09 00 09 - PAINTING
      a. Field painting, except as noted otherwise. Field painting of radiation shall be done using the electrostatic method.
   7. DIVISION 8 - OPENINGS
      SECTION 08 90 00 - LOUVERS AND VENTS
      a. Exterior wall louvers.
   8. DIVISION 11 - EQUIPMENT
      SECTION 11 40 00 - FOOD SERVICE EQUIPMENT
      a. Kitchen equipment.
   9. DIVISION 21 - FIRE SUPPRESSION

SECTION 21 00 00 FIRE SUPPRESSION
a. Sprinklers and equipment.

10. DIVISION 22 - PLUMBING
SECTION 22 00 00 - PLUMBING
a. Domestic water heaters.
b. Town water make-up.

11. DIVISION 26 - ELECTRICAL
SECTION 26 00 00 - ELECTRICAL
a. Power wiring except power wiring to variable air volume terminal units
b. Starters and disconnects where not furnished integral with equipment.
c. Emergency generator and related equipment.
d. Wiring of smoke detectors.
e. Wiring of Solid State Controller and wiring to associated destratification fans.
f. Wiring of Solid State Controllers to respective exhaust fans.

H. The work of this Section is shown on Drawings numbered, M0.01 through M7.04

1.3 DEFINITIONS

A. “HVAC” as used hereinafter in this SECTION shall mean “Heating, Ventilating and Air Conditioning.”

B. “HVAC Subcontractor” as used hereinafter in this SECTION shall mean the “Heating, Ventilating and Air Conditioning Subcontractor,” i.e., the bid subcontractor under this Section 23 00 00.

C. “Concealed” shall be defined as areas where piping is located in chases, shafts, pipe tunnels, and above furred ceilings.

D. “Underground” shall mean piping exterior to or within the building that is buried. All other piping shall be considered “exposed.”

E. “Piping” shall mean, in addition to pipe, all fittings, valves, hangers, and other accessories relating to such piping systems.

F. “Provide” shall mean “provided complete in place,” that is, “furnished and installed.”

1.4 VALVE TAGS, NAMEPLATES AND CHARTS

A. Furnish and install on each gate and globe valve, and on all automatic control valves used in this contract, a two-inch diameter brass tag with stamped numeral a minimum height of one-half inch painted white. The tags shall be attached to the valve handles or stem necks with brass hooks or chains and properly secured.

B. These numbers shall correspond to numbers indicated for valves on the Record Drawings and on two printed detailed lists. These printed lists shall state the numbers and locations of each valve and control and the section, fixture or equipment which it controls, and other necessary information such as requiring the opening or closing of another valve or valves, when any one valve is to be opened or closed. These printed lists shall include all automatic control valves required in

this Division

C. These printed lists shall be prepared in form to meet approval of the Architect and shall be framed under glass.

D. Nameplates, catalog numbers and rating identification shall be securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

1.5 SHOP DRAWINGS

A. General: Refer to Division 1, General Requirements, Section 01 33 00, Submittal Procedures, for submittal provisions and procedures.

B. In accordance with Division 1, General Requirements, submit to the Architect for approval complete sets of detailed information consisting of manufacturers' bulletins, capacities, shop drawings, and parts lists of all material to be provided for this project.

I. Any manufacturer's names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. Unless noted otherwise, this is NOT a proprietary specification and it should be noted that "Or approved equal" applies to all products denoted herein. It is understood that all manufactures will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an "approved equal". It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

1.6 CODES, REGULATIONS AND PERMITS

A. All work done under this SECTION shall conform to the codes and regulations governing such work as set forth by the Rhode Island Department of Public Safety, the Rhode Island State Building Code and all local codes having jurisdiction.

B. Give notices, file plans, obtain permits and licenses, and obtain necessary approvals from authorities having jurisdiction. Deliver certificates of inspection to Architect. No work shall be covered before examination and approval by Architect, inspectors and authorities having jurisdiction. Imperfect or condemned work shall be replaced with work conforming to requirements, without extra cost to Owner, subject to the approval of the Architect. If work is covered before due inspection and approval, the HVAC Subcontractor shall pay costs of uncovering the installed work, whether it meets contract requirements or not.

C. Refer to Division 1, Section 01 41 00, Regulatory Requirements.

1.7 INTENT

A. It is not intended that the Drawings show every pipe, fitting, and appurtenance. All such parts necessary for the complete execution of the work, in accordance with the best practices of the trade and to the satisfaction of the Architect shall be provided whether these parts may have been specifically mentioned or not, or indicated on

the Drawings.

1.8 DRAWINGS AND SPECIFICATIONS

A. The Drawings and Specifications are complementary each to the other, and any labor or material called for by either, whether or not by both, or necessary for the successful operation of any components shall be furnished and installed.

B. Before installing any work, verify that it does not interfere with the clearances required for other work. Installed work which interferes with existing necessary services shall be modified as directed by the Architect, at no additional cost to the Owner.

C. Be familiar with the Drawings and Specifications of all other trades to prevent interferences and assure complete coordination.

1.9 GIVING INFORMATION

A. Keep fully informed as to the shape, size and position of all openings and foundations required for all apparatus furnished under this SECTION and give full information to the General Contractor sufficiently in advance of the work, so that all such openings and foundations may be built in advance. Furnish all sleeves and supports herein specified, so the General Contractor may build same in place.

B. In the case of failure to give proper information as noted above, assume the cost of having necessary changes to the work made by the General Contractor.

1.10 OBTAINING INFORMATION

A. Obtain detailed information from the manufacturers of apparatus which is to be provided, for the proper methods of installation. Obtain all information from the General Contractor and other Subcontractors which may be necessary to facilitate the work and the completion of the whole project.

1.11 MATERIALS AND EQUIPMENT

A. All materials and equipment furnished under this SECTION shall be new and of the best grade for the service intended. The manufacturers mentioned in the specifications are intended to indicate the quality desired. Any substitutions shall be as approved by the Architect as herein provided by the “or equal” clause, in addition to meeting the limitations of space and capacity shown or specified. Re-built materials and equipment will not be accepted.

1.12 REFERENCES

A. National standards referenced herein are included to establish recognized quality only. Equivalent quality and testing standards will be acceptable subject to their timely submission, review and acceptance by the Designer.

B. Refer to SECTION 01420 - REFERENCES for schedule of references.

C. Reference Standards:

1. Reference herein to any technical society, organizations, group or body are made in accordance with the following abbreviations:

ADC	Air Diffusion Council
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ARI	Air Conditioning & Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
AWG	American Wire Gauge
AWS	American Welding Society
FS	Federal Specifications
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriters Laboratories, Inc.

1.13 COORDINATION DRAWINGS

A. Before materials are purchased or work is begun, the HVAC Subcontractor shall prepare and submit to the Designer, Coordination Drawings showing the size and location of his equipment, ductwork and piping lines relevant to the complete system. He shall ensure that these drawings are compatible and correctly annotated and cross- referenced at their interfaces.

B. Coordination drawings are for the Contractor’s and the Designer’s use during construction and shall not be construed as replacing any shop or record drawings required elsewhere in these Contract Documents.

1.14 MOTORS AND STARTERS

A. Motors for all equipment under this SECTION shall be quiet in operation and shall be guaranteed to run without objectionable noise or vibration.

B. Motors smaller than one-half (1/2) horsepower shall be wound for 120 volts, single phase, 60 hertz.

C. Motors one-half (1/2) horsepower and larger shall be wound for 480 volt, 3 phase, 60 hertz.

D. Starters for all equipment shall be provided by the Electrical Subcontractor.

E. Voltages shown in Paragraphs B and C are typical unless otherwise noted.

F. All motors one horsepower and over shall be premium efficiency type.

1.15 TEMPORARY HEATING

A. Special reference is made to “Heating during Construction”, Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

1.16 OPERATIONS AND MAINTENANCE MANUALS

A. Refer to SECTION 01 78 00 - CLOSEOUT SUBMITTALS, for submittal procedures pertaining to operating and maintenance manuals.

B. At least two (2) months prior to the time of turning over this contract to the Owner for Use & Occupancy or substantial completion, secure and deliver to the Architect three (3) complete indexed files containing approved operating and maintenance manuals, shop drawings, and other data as follows:
1. Operating manuals and operating instructions for the various systems.
2. Catalog data sheets for each item of mechanical or electrical equipment actually installed including performance curves, rating data and parts lists.
3. Catalog sheets, maintenance manuals, and approved shop drawings of all mechanical or electrical equipment controls and fixtures with all details clearly indicated.
4. Names, addresses and telephone numbers of repair and service companies for each of the major systems installed under this Contract.
5. Copies of all service contracts provided for the guarantee period.
6. Copies of all equipment and system warranties.

C. Non-availability of operating and maintenance manuals or inaccuracies therein may be grounds for cancellation and postponement of any scheduled final inspection by the Owner until such time as the discrepancy has been corrected and/or retainage of sufficient monies to prepare same.

D. Provide qualified trained personnel to insure proper operation of the systems and to train the Owner’s operating and maintenance personnel in the proper operation and maintenance of the systems. Instruction period shall be a minimum of five (5) eight-hour days. Coordinate with Commissioning Agent per specification section 01 91 10.

D. Refer to SECTION 01 75 00, Starting and Adjusting. Coordinate all start-up, operation, and testing activities with the Project Manager, General Contractor and the Commissioning Agent per specification section 01 91 10.

1.17 RECORD DRAWINGS

A. General: Refer to Division 1, General Requirements, SECTION 017800, Close-out Submittals for Requirements.

B. The record drawings required to be furnished under this SECTION are of drawings numbered M0.01 through M7.05.

1.18 CONTRACT COST BREAKDOWN

A. Within 30 days of commencing the work, submit to the Architect a complete breakdown of the Contract price to aid in determining the value of the installed work

during the construction period. The form shall correspond to the construction schedule with a percentage of progress to complete breakdown with progress description by month.

1.19 GUARANTEE AND SERVICE

A. Attention is directed to the provisions of the CONTRACT AND GENERAL CONDITIONS regarding guarantees/warranties for the Work.

B. Manufacturers shall provide their standard guarantees/warranties for work under this Section. However, such guarantees/warranties shall be in addition to and not in lieu of all other liabilities which the manufacturer and the Contractor may have by law or by other provisions of the Contract Documents.

1.20 DEBRIS REMOVAL AND CLEAN-UP

A. The HVAC Subcontractor shall, at the end of each day's work, remove waste materials and debris resulting from the installation of the heating, ventilating and air conditioning system. The HVAC Subcontractor shall deposit such waste and debris in a dumpster on-site. Dumpster shall be provided by the General Contractor. The General Contractor shall be responsible for the emptying of dumpster when required.

The HVAC Subcontractor shall, at the completion of his work, remove from the school property all tools, equipment and surplus materials resulting from the installation of the heating, ventilating and air conditioning system.

1.21 COMMISSIONING REQUIREMENTS

A. An independent Commissioning Agent (CA) will be retained for this project. The commissioning process will be implemented in accordance with the NECHPS.

B. This contractor shall assist and support the CA as necessary in accordance with the requirements of specification section 01 91 10 – COMMISSIONING.
1. "Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Tenant's and Building Owner's operation and maintenance personnel, is required in cooperation with Tenant's and Building Owner's Representatives and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation and issue closure. Refer to Commissioning Specification, Section 01 91 10, for detailed commissioning requirements."

1.22 EXAMINATION OF SITE AND DOCUMENTS

A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor or Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions

and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.23 SEQUENCING

A. Phasing: Refer to Section 01 10 00 - SUMMARY, and Drawings for phasing and milestone completion requirements which affect the General Contractor's Work and the Work of this Subcontract.

B. Coordinate work of this Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

C. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Subcontract, have been received and approved by the Architect.

D. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

A. All work shall be installed so that all parts requiring inspection, operation, maintenance and repair are readily accessible. Minor deviations from the drawings may be made to accomplish this, but changes of magnitude shall not be made prior to written approval from the Architect.

B. Furnish access panels for installation in walls and ceilings at locations indicated on the drawings to permit access.

C. All access panels shall be located in closets, storage rooms and/or other non-public areas, in a workmanlike manner, positioned so that junction can be easily reached and the size shall be sufficient for this purpose (minimum 12 inches x 16 inches). When the access panels are required in corridor, lobbies or other habitable areas, they shall be located as directed by the Architect.

D. Access panels shall be as manufactured by Inland Steel Products Company "Milcor", Walsh-Hannon-Gladwin, Inc., "Way-Loctor" or approved equal. Types shall be as follows:

1.	Masonry or Tile	"Milcor" Type M
2.	Drywall	"Milcor" Type DW
3.	Fire-Rate	"Milcor"

E. Units shall have 16 gauge steel frame and 14 gauge steel hinged door panel. Door shall have concealed spring hinges allowing door to be opened to 175 degrees.

F. Provide flush screwdriver operated camlocks in accordance with manufacturer's schedule of panel sizes and number of locks.

G. Units shall be factory primed for field painting by Section 09 00 09.

H. Install U.L. rated 1-1/2 hour Class B access panels where required to comply with applicable code requirements.

2.2 AIR-COOLED CONDENSING UNIT

A. Furnish and install, where indicated on the drawings, air-cooled condensing unit as manufactured by TSI or equal and having the capacity as scheduled on the drawings and characteristics as specified herein.

B. Unit shall be complete with, but not limited to, the following features:
1. All-weather heavy gauge cabinet enclosure.
2. Condenser coil with die-formed aluminum plate and non-ferrous coil construction.
3. Propeller type direct drive condenser fan.
4. Accessible hermetic compressors.
5. Filter drier and sightglass.
6. Suction filter.
7. Accumulator.
8. Receiver
9. Six (6) steps for unloading control.

C. All features shall be furnished and installed in compliance with manufacturer's recommendations.

D. Unit shall be outfitted with weather hood and crankcase heater for outdoor usage and also with all accessories for –20 degrees F. low ambient operation. Compressors shall have a five (5) year warranty and five (5) minute lock-out and starters, head pressure controls.

2.3 AIR SEPARATORS

A. Furnish and install as shown on the drawings a Spirotherm, Bell & Gossett, or Taco air separation fitting on the hot water heating system.

B. All fittings shall be fabricated steel, rated for 150 psig design pressure and be selected for less than 1 foot of water pressure drop and velocity not to exceed 4 feet per second through the unit at specified GPM. Performance curves specifying air collection efficiency and pressure drop at rated flow shall be furnished by the unit manufacturer as part of the submittal for each unit.

C. All units shall include an integral spirally wound three dimensional copper grid to act as a turbulence suppressive coalescing medium which must completely fill the fitting's internal area. Units are to remove free and entrained air during system start up and continue to eliminate dissolved air through continual circulation and the coalescing action of the spirally wound grid.
1. Alternate units shall have an internal stainless steel air collector tube with 5/32" diameter perforations and 63% open area designed to direct accumulated air to the compression tank via an NPT connection at top of

unit.

D. Each fitting is to have a separate air and venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral float actuated brass air vent. There shall be no restriction in the connection from the venting chamber to the vent.

E. The fittings are to include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill. Units shall include a bottom connection for use as a blow down connection for periodic cleaning.

F. Provide integral high capacity float actuated air vent at top fitting of tank.
1. Alternates must include bronze or cast iron float actuated air vent rated at 150 psig which shall be threaded to the top of the fitting.
2. Unit shall have bottom blow down connection.

2.4 BOILERS

A. High efficiency condensing boilers shall operate on natural gas manufactured by Lochinvar, Viessman, Cleaver Brooks or approved equal. Refer to schedules for model number and performance data.

B. The BOILER shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The BOILER shall have a fully welded 316L stainless steel interior with a carbon steel shell fire tube heat exchanger. There shall be a single pressure vessel. Multiple pressure vessels are not acceptable. Fire Tube shall be of the Wave Fire Tube design and capable of transferring 16,000 to 20,000 Btu's per tube. A liquid impact die shall be used to form the Wave Fire Tube. There shall be no banding material, bolts, gaskets or "O" rings in the heat exchanger construction. The Wave Fire Tube shall be robotically welded to the tube sheets. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 6.5 psi at 180 gpm. The condensate collection basin shall be constructed of welded 316L stainless steel. The complete heat exchanger assembly shall carry a ten (10) year limited warranty.

C. The BOILER shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The BOILER shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard and the minimum efficiency requirements of the latest edition of the AHRI BTS-2000 Standard as defined by the Department of Energy in 10 CFR Part 431. The BOILER shall operate at a minimum of 96.2% thermal efficiency (models FB 751 – FB 2001) or 96% thermal efficiency (models FB 2501 – FB 6001), at full fire as registered with AHRI. The registered combustion efficiency must be equal to or greater than the registered thermal efficiency. All models shall operate up to 98% thermal efficiency with return water temperatures at 70°F or below at 20°F temperature rise. The BOILER shall be certified for indoor installation.

D. The BOILER shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. Two burner/flame observation ports shall be provided. The single burner shall be a premix design constructed of high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The BOILER shall be supplied with two gas valves designed

with negative pressure regulation and be equipped with a pulse width modulation blower system, to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The BOILER shall operate in a safe condition with gas supply pressures as low as 4 inches of water column on Natural and as low as 8 inches of water column on Propane. The FB 6001 shall be supplied with a proof of closure valve (POC) and shall prevent the boiler from firing if the POC valve seat is detected open. Upon a call for heat, once the POC valve seat is proven to be closed, the pre-purge cycle will begin and the POC valve will begin to open. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.

E. The BOILER shall utilize a 24 VAC control circuit and components. The control system shall have a display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The BOILER shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 50 psi (standard); outlet water temperature sensor (dual thermistor); return water temperature sensor; outdoor air sensor, flue temperature sensor (dual thermistor); high and low gas pressure switches, low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.

F. The BOILER shall feature the “SMART TOUCH™” control with CON-X-US which is standard and factory installed with an 8” liquid crystal touch screen display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities and PC port connection. A secondary control that is field mounted outside or inside the appliance is not acceptable. The BOILER shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The BOILER shall have a built-in “Cascade” to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal “Cascade” function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The control must include cascade redundancy to allow a member boiler to become the temporary leader if the original lead boiler shall loose communication with the members. The BOILER shall be capable of controlling an isolation valve (valve shall be offered by manufacturer) during heating operation and rotation of open valves in standby operation for full flow applications. The control must be equipped with standard BACnet MSTP and Modbus communication protocol with a minimum 55 readable points. The BOILER shall have an optional gateway device which will allow integration with LON or BACnet (IP) protocols.

G. The “SMART TOUCH™” control shall include CON-X-US communication platform that will allow remote access via a smart phone or Tablet. This will allow the ability to monitor and manage multiple Crest Boilers and send alerts via text or e-mail notifying of changes in system status. A user shall have the ability to check system status or re-program any boiler function remotely.

H. The “SMART TOUCH™” control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0 -10 VDC output signal shall control a variable speed boiler pump (pump to be offered by manufacturer) to keep a fixed delta t across the boiler regardless of the modulation rate. The BOILER shall have the capability to receive a 0 – 10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in

order to prevent flow related issues and erratic temperature cycling.

I. The BOILER shall have available as an option RealTime O2 Feedback™. The O2 sensor shall be made by a top automotive supplier and is only available through Lochinvar. The O2 sensor shall be located in the combustion chamber. The feedback shall be in real time and displayed via a gauge on both the boiler touchscreen and the CON-X-US communication platform.

J. The BOILER shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 30 data points for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Louver Proving Switch, Tank Thermostat, Remote Enable/Disable, System Supply Sensor, Outdoor Sensor, Tank Sensor, Modbus Building Management System signal and Cascade control circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 208V/3PH/60Hz. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.

K. The BOILER shall be installed and vented with a:
1. Vent system with Vertical rooftop exhaust with the combustion air intake in different pressure zones. The flue shall be Category IV approved Stainless Steel DOUBLE WALL AL29-4C sealed vent material terminating at the rooftop with the manufacturer's specified vent termination. A separate pipe shall supply combustion air directly to the boiler from the outside in a different pressure zone from that of the exhaust vent. The air inlet pipe must be sealed and may be other materials listed in the Installation manual. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet.

L. The BOILER shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. High altitude operation shall be certified at a minimum of 4,500 feet above sea level by a 3rd party organization.

M. The BOILER shall be suitable for use with polypropylene glycol, up to 50% concentration. The de-rate associated with the glycol will vary per glycol manufacturer.

N. STANDARD CONSTRUCTION
1. The BOILER shall be constructed in accordance with the following code requirements as standard equipment. Manufacturing of special models to meet the below code requirements is not acceptable.

2.5 BREECHING, COMBUSTION AIR INTAKE AND CHIMNEY (DOUBLE WALL AL29-4C)

A. Furnish and install, where indicated on plans, non-positive and positive pressure vent systems for condensing and non-condensing applications.

B. Standards:
1. Where applicable, products furnished under this section shall conform to the requirements of NFPA 54 and NFPA 211, and shall comply with UL 1738, Standard for Venting Systems for Category II, III, and IV Gas-Burning Appliances, and all other applicable standards.

2. All flue-gas carrying components of the vent system shall be obtained through one source.
3. Vent shall be warranted by the manufacturer against defects in material and workmanship for a period of one (1) year from the date of original installation. Any portion of the vent repaired or replaced under warranty shall be warranted for the remainder of the original warranty period.

C. Special Gas Vent:
1. Vent shall be factory-built special gas type, double wall, engineered and designed for use on Category I, II, III, and IV appliances, or as specified by the equipment manufacturer.
2. Maximum continuous flue gas temperature not to exceed 550 degrees Fahrenheit (288 degrees Celsius).
3. Vent shall be constructed with an inner conduit constructed of AL29-4C® or 29-4 (S44735) superferritic stainless steel with a minimum thickness of .015" for diameters 3"-8", .020" for diameters 10"-16", .025" for diameters 18"-24", and .035" for 26" and greater.
4. Vent shall be listed for an internal static pressure of 15" w.g. and tested to 37" w.g.
5. All inner wall conduit components shall be manufactured from AL29-4C® or 29-4 (S44735). The closure system shall be a mechanical locking strap closure system that is integral to the system.
6. Joints to be sealed with factory supplied sealant. Joints shall be designed to minimize collection of condensate in both horizontal and vertical runs. Joints shall not use screws or other lesser alloy fasteners that penetrate the inner conduit.
7. The outer wall casing shall be constructed of 430 stainless steel that shall not require additional surface preparation, such as painting, in order to withstand the outdoors or high humidity environments.
8. Inner conduit and outer wall casing shall be constructed with a one-inch air space between them and in such a fashion that prevents cross-alloy contamination.
9. Tees and elbows shall provide a pressure drop less than 15 feet equivalent horizontal vent.
10. Fittings that increase or decrease vent diameter shall be asymmetric in construction with a flat wall that maintains a straight line with adjoining parts in order to facilitate the unobstructed flow of all condensate.
11. All parts shall be compatible with other single wall and double wall products of the same manufacturer.
12. System is to be sized in accordance with the appliance manufacturer's specifications, NFPA 54-National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations, and other applicable codes.
13. System shall be design with parts that will allow for clearance to combustibles of 1" for diameters 6"-24" unenclosed in the horizontal and enclosed in the vertical; and for clearance to combustible of 2" for diameters 26"-32" unenclosed in the horizontal and enclosed in the vertical.
14. Manufacturer shall provide, if needed, any custom made part to aid in a quick and effective installation. Custom parts will meet all criteria 3.1.A through 3.1.N.

D. Sealant:
1. General Electric RTV106 High Temperature Sealant shall be used to seal all joints on systems where the maximum flue gas temperature will not exceed 550°F.

2. In lieu of high temperature sealant, a factory installed 550°F compatible gasket shall be used to seal the joints.

E. Illustrated installation manuals shall be supplied to the installer and shall be available for downloading from the manufacturer's website.

F. All components shall be installed in strict compliance with the manufacturer's instructions and all pertinent local, regional, national, and international building and mechanical codes and regulations.

O. Vent shall be Saf-T Vent® CI Plus as manufactured by Heat-fab, Inc. or approved equal."

P. Horizontal runs shall be pitched ¼" per ft towards the boiler(s) to allow condensate to return to the boiler(s) and drain out.

2.6 CABINET UNIT HEATERS

A. Cabinet unit heaters shall be of the size, type and capacity indicated on drawings. Equipment shall be as manufactured by Vulcan, Sterling, Rosemex or Rittling.

B. Cabinet unit heaters shall consist of a heating element with centrifugal fans driven by an electrical motor, filter, and where semi or fully recessed, they shall be flanged on four sides. They shall be capable of delivering the indicated heat emission with entering air at 60 degrees F. Each unit shall be provided with manual on-off switch and two-speed selector switch.

C. All cabinet parts shall be factory finished. Color to be determined by Architect.

2.7 CHEMICAL TREATMENT

A. Provide where shown on drawings and as specified herein the equipment necessary for chemical treatment and service as provided by New England Systems and Supply, Inc., Nutmeg, Metropolitan Refinery Company, Inc., Barclay Chemical Company, Inc., Betz Company or Water Services Laboratories, Inc., or approved equal.

B. The contract agreement satisfactory in form and substance to the Owner – executed between this Contractor and the chemical treatment company to furnish supervisory service to assure the use of proper chemical treatment to and for systems, installed under this contract, hot water, for a period of one (1) year from date of initial treatment thereof. The Contract: Assigned by this Contractor to the Owner on the date that the building is accepted by the Owner, so that chemical treatment will continue uninterrupted during the one year life of the contract. If the building is not accepted by the Owner prior to the expiration of the one year contract, arrangements shall be made by this Contractor to extend this contract until the building is accepted by the Owner.

C. Chemical treatment company shall perform the following through its agents:
1. Supervise initial cleaning of systems and equipment.
2. Supervise initial introduction of chemical treatment.
3. Furnish service calls by its agents at a frequency of not less than one (1) per thirty (30) days thereafter, during the one (1) year life of the contract.

4. Furnish all required chemicals for proper treatment of all systems hereinafter described, together with all necessary testing equipment and reagents for field analysis of the water during the aforementioned one year contract.
5. The chemical treatment company shall assume responsibility for field testing and control and regular addition of chemical treatment in whatever amounts are necessary on each of the systems hereinafter described, as provided by the chemical treatment company until the date of acceptance of the building by the Owner.
6. Some water circulating pumps shall have mechanical seals as specified in this section. It shall be the responsibility of the chemical treatment company to coordinate with the pump manufacturer and adjust the formulation of the water treatment chemicals to be assured that the normal life of the mechanical seals is not affected.
7. The chemical treatment supplier shall provide chemicals which are non-pollutants and meet Federal Water Quality criteria.
8. The chemical treatment company shall establish, document and submit to the Architect volumes of each system or sub-system for which treatment is provided.
9. The chemical treatment company shall provide start-up and training support to the owner. Training shall be coordinated with the Commissioning Agent. Refer to specification section 01 91 13 for additional requirements.

D. Hot Water Systems: Provide for each system one liquid chemical bypass type feeder of approximately 5 gallon capacity, complete with valves and fittings which shall be connected across each hot water heating system pump set.

E. Chemical cleaning solutions used shall not be harmful to materials of construction. After systems have been drained, flushed and refilled, a chemical test shall be made by the chemical treatment company to determine that cleaning solution remaining in system does not impart alkalinity to water in excess of 300 ppm. A written report to this affect shall be submitted to the Architect.

F. Initial Cleaning of Hot Water Piping System: Cutting oil, excess pipe joint compound, finely divided solids and other similar foreign materials shall be removed from all circulating water and steam piping systems before they are placed in operation. The cleaning materials used shall be supplied and applied by the chemical treatment company and all circulation, draining, flushing and refilling work shall be done by this Contractor, as directed by the chemical treatment company.

G. Refer to Piping Systems Flushing and Cleaning for additional requirements.

2.8 CONVECTORS

A. Furnish and install where shown on the drawings, convectors with inlet grilles and access doors of sizes, capacities and type indicated on the schedule. All convectors shall be complete with air vent chamber and key operated air cocks. Heating elements shall consist of seamless copper tubes, non-ferrous fins, cast iron headers and galvanized steel sideplates and tube supports. Each convector shall have installed in return line an approved balancing fitting with adjusting screw. All recessed convector casings on outside walls shall be entirely covered within recess with at least 1/2 inch insulation sheet securely secured to the casing. All exposed screw heads shall be tamperproof, Phillips, Allen or approved equal. All recessed and semi-recessed convector front panels shall be 14 gauge enameled steel and be

flanged on four sides. The convectors shall be as manufactured by Vulcan, Sterling, Rosemex or Rittling.

B. Convectors shall be factory finished. Color to be determined by Architect.

2.9 DUCTLESS SPLIT FANCOIL SYSTEM

A. Provide a complete split system type ductless fancoil air conditioning system consisting of compact mounted packaged evaporator sections with matching air cooled outdoor condensing unit. The units shall be listed by the Electrical Testing Laboratories (ETL) and bear the ETL label. All wiring to be in accordance with the National Electrical Code (NEC). The units shall be rated in accordance with ARI Standard 210 and bear the ARI label. A full charge of R-410a refrigerant shall be provided in the condensing unit. System SEER shall meet or exceed 1992 Federal Standards.
1. The system components shall be provided by a single manufacturer to provide for an integrated, 100% compatible installation. System shall be as manufactured by Mitsubishi Company, Sanyo Company or Trane.

B. The units shall have a manufacturer's warranty for a period of two (2) years from date of start-up or substantial completion, whichever occurs later. . The compressor shall have a warranty of six (6) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the site of installation.

C. The indoor unit shall provide a total minimum cooling capacity as scheduled on the drawings. The system efficiency shall be as scheduled on the drawings. The system net minimum total cooling capacity shall be rated at 67 degrees FDB indoor and 95 degrees FDB air entering the outdoor coil.

D. The indoor unit shall be completely factory assembled and wired. The casing shall be of galvanized sheet steel, phosphatized, bonderized and finished in a baked enamel white finish.
1. The evaporator fan shall be a high performance forward curve line flow fan direct driven by a single motor. The fan shall be statically and dynamically balanced and shall run on permanently lubricated bearings.
2. An adjustable change vane shall be provided with the ability to direct the air flow from horizontal to vertical. An adjustable guide vane shall be provided to manually change the air direction from left to right.
3. The evaporator coil shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested to 450 psig at the factory.
4. An insulated condensate pan with drain shall be provided under the coil.

E. The control system shall consist of multiple microprocessor sections. One microprocessor shall be factory wired and located within each indoor unit. It shall have the capability of sensing room temperature and indoor coil temperature; receive and process commands from the remote controller; and control the outdoor unit. The Contractor shall be responsible for required interlock wiring.
1. The microprocessor within the wall mounted remote controller shall display setpoint; provide two (2) manually selected modes of cooling, normal and economy operation at 2 degrees above setpoint; night set back operation of 4 degrees above setpoint; and manual or automatic fan speed control.

2. The optimum temperature shall be memorized for immediate recall as the system default setpoint whenever the system is used again.
3. The system shall be capable of automatic restart when power is restored after power interruption.
4. Automatic fan speed control shall be based upon the temperature difference between setpoint and room temperature maintaining lowest speed possible.
5. A remote control unit shall be wireless, using infrared, line of sight for control of system and shall include automatic ON/OFF timer; liquid crystal display, and temperature reset capability. Furnish and install, in the field, on the wall, a remote control unit holder.

F. The outdoor unit shall be completely factory assembled, piped and wired. The casing shall be fabricated of galvanized steel, phosphatized, bonderized and finished with baked enamel. The unit shall be furnished with direct drive, propeller type fans arranged for horizontal discharge.
1. The motor shall have inherent protection, be of the permanently lubricated type and resiliently mounted for quiet operation.
2. The fans shall be provided with a raised guard to prevent contact with moving parts.
3. Multiple compressors shall be provided, one for each indoor evaporator fancoil unit. The compressors shall be of the high performance rotary type with accumulator and internal thermal overloads. The compressors shall be mounted so as to avoid the transmission of vibration.
4. The refrigeration system shall have the capability to operate with maximum height difference of 25 feet and overall refrigerant tubing length of 160 linear feet between indoor and outdoor sections without the need for line size changes, traps, or additional oil. Refrigerant flow from the condenser to be controlled by means of capillary tubes.
5. The condenser coil shall be non-ferrous construction with smooth plate fins bonded to copper tubing. The coil shall be protected with an internal metal guard finish to match unit panels.
6. The unit shall be controlled by the microprocessor located in the matching indoor units.

2.10 ELECTRIC CEILING UNIT HEATER

A. The heating equipment shall include an electric, ceiling-mounted type CDF Series 500 fan-forced air heater suitable for large area heating as manufactured by QMark, a Marley Engineered Products Brand, Bennettsville, SC or approved manufacturer. Heater shall be UL listed. The heater shall be designed for surface, recess, or T-Bar mounting. For surface mounting, a QMark CDF-SE surface enclosure shall be used. For T-Bar mounting, a QMark CDF-RE recess enclosure shall be used. For recessed mounting in a permanent ceiling, a QMark CDFRE recess enclosure and CDF-TK trim kit shall be used. The heaters shall be factory wired for single-phase operation and field convertible to three-phase operation by removing one jumper wire. The heaters should be factory wired for full wattage and field convertible to 75% or 50% wattage by the removal of one or two wires respectively.

B. HEATER SECTION - The heater section shall consist of a 20 gauge steel chassis on which are mounted the heating elements, fan motor and blade, fan control, thermal cutout, and 3-pole contactor. Heater section shall be completely prewired.

C. HEATER ELEMENTS - The heating elements shall be guaranteed for five years and shall be of non-glowing design consisting of 80/20 NiCh resistance wire, enclosed in a steel sheath, to which steel plate fins are brazed. The elements shall cover the entire air intake area to ensure uniform heating of all discharged air.

D. MOTOR AND CONTROLS - The fan motor shall be impedanceprotected, permanently lubricated, and with totally-enclosed rotor. Fan control shall be bi-metallic, snap-action type and shall activate the fan immediately and continue to operate the fan after the thermostat is satisfied and until all heated air has been discharged. Thermal cutout shall be bi-metallic snap-action type designed to automatically shut off the heater in the event of overheating and reactivate the heater when temperature returns to normal.

E. OPERATIONAL CONTROLS - Thermostat, disconnect switch, and all interlock relays shall be installed within the heater enclosure.

F. RECESS ENCLOSURE - The back box shall be designed for duty as a recessed rough-in box in masonry, T-Bar, or frame ceiling construction. The back box shall be 20 gauge galvanized steel and shall contain knockouts through which field wiring leads are brought. Enclosures to recess into a maximum 7 inches of ceiling space. The louvered recess faceplate shall be of 20 gauge cold rolled steel, phosphatized, then electrostatically painted Navajo white by a baked enamel process.

G. SURFACE ENCLOSURE - The surface mounting plate shall be designed for duty as a rough-in box on masonry, T-Bar, or frame ceiling construction. The surface mounting plate shall be 20 gauge galvanized steel and shall contain knockouts through which field wiring leads are brought. Enclosure to extend a maximum of 6 inches into the heated space. The louvered surface wrapper shall be contoured aluminum extrusion and 20 gauge sheet metal combination with rounded corners. The surface wrapper shall be electrostatically painted Navajo white by a baked enamel process.

2.11 ELECTRIC UNIT HEATER

A. Unit mounts either horizontally or vertically. Totally versatile. For factories, warehouses, garages, stores, shipping rooms, power stations. Can be used for primary, supplementary, spot, or dual-system heating.

B. Wide range of optional control kits are field installable, increasing the MUH adaptability to the specification market.

C. Forced air unit heater with 10 power ratings; from 3KW to 50 KW heating output; 208, 240, 277 and 480V, 10,230 to 170,500 BTU/hr.

D. 32 compatible models (no need to try to assemble a heating system from 70 or 80 models!)

E. Heavy gauge die-formed steel housing. Two-toned, smartly styled with stainless steel louvers.

F. Advanced pull-through air flow design draws air across heating element for more even air distribution and cooler element operation.

G. Specially designed venturi outlet to meet that added throw as required in vertical position.

H. Branch circuit fusing (when required).

I. Completely enclosed fan motor.

J. 1- or 3-phase wiring on 5 through 10 KW 208/240V and 15 KW 208V units (field interchangeable).

K. Aluminum-finned, copper clad steel sheath heating element has longer useful life, because of cooler sheath temperature and faster heat dissipation.

L. 24V control transformer standard on most models, providing a safer and more accurate means of temperature control. 3KW and 5KW, 208-277V, have line voltage controls as standard (24V control available on made-to-order basis).

M. Automatic reset linear thermal cut-out, capillary type, provides protection over entire length of element areas (Manual reset protection available on made-toorder basis).

N. 2-speed fan selector switch (25 to 50 KW models).

O. Fan delay feature eliminates cold drafts. Element heats up before fan cuts in, then fan continues to distribute heat after element shuts off.

P. Ruggedly built, yet lighter weight for easier installation. No piping flutes, valves, or traps.

Q. Individually adjustable discharge louvers to control air flow.

R. Choice of optional diffusers for variety of air patterns, maximizing heat concentration and coverage in the vertical position.

S. Meets all UL, NEC, and OSHA requirements.

2.12 ELECTIC WALL HEATER

A. The heating equipment shall include electric, automatic fan forced air heater suitable for large area heating, as manufactured by QMark®, A Marley Engineered Products Brand, Bennettsville, SC or approved equal. The heater shall be designed for wall recess or surface mounting. Heaters shall be UL listed or equivalent (ETL).

B. HEATER ASSEMBLY: The heater assembly which fits into the back box shall consist of a fan panel upon which is mounted all of the operational parts of the heater.

C. HEATING ELEMENT: The heating element shall be of the non-glowing design consisting of a special resistance wire enclosed in a steel sheath to which steel plate fins are copper brazed. It shall be warranted for 5 years.

D. FAN AND MOTOR: Fan shall be five-bladed aluminum. Fan motor shall be totally enclosed.

E. FAN DELAY SWITCH: Fan control shall be of bi-metallic, snap-action type and shall activate fan after heating element reaches operating temperature. The fan shall

continue to operate after the thermostat is satisfied and until the heating element is cool.

F. THERMOSTAT: The tamper-proof thermostat shall be of the bi-metallic snap-action type with enclosed contacts. It shall be completely concealed behind the front cover to become tamper proof.

G. THERMAL CUTOUT: A manual-reset thermal cutout shall be built into the system to shut off the heater in the event of overheating.

H. POWER ON/OFF SWITCH: A double-pole, single throw ON/OFF switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front grille panel.

I. LOW VOLTAGE RELAYS: 24-volt and 120 volt low voltage relays shall be available as optional equipment to control 208, 240 or 277 volt heaters in conjunction with central energy control systems. The built-in thermostat can then be used as one of the thermostats in an automatic night set back operation.

J. BACK BOX: The back box shall be designed for duty as a recessed rough-in box in either masonry or frame installations, and is also used with the surface mounting frame in surface mounting installations. The back box shall be 20-gauge galvanized steel and shall contain knockouts through which power leads are brought.

K. FRONT PANEL: The front panel shall be of the bar grille type and shall be constructed of 16-gauge cold-rolled steel, welded into a uniform grille to direct the warmed air toward the floor. The front grille shall be surrounded by a decorative satin-finish aluminum “picture” frame.

L. THREE PIECE DESIGN: The heater shall be made up of a back box, a heater assembly and a front panel.

2.13 EXPANSION JOINTS

A. Expansion joints shall be provided where indicated on the drawings. Equipment shall be as manufactured by Advanced Thermal Systems, ADSCO Division of Yube Industries or approved equal.

B. Expansion joints shall have internal and external guides, fabricated steel body with 150 psig service ratings, single or double slide arrangement to suit the installation location. Bases shall be provided for mounting on framing or to other framing structure. Joints shall have flanged pipe ends on all sizes, polished duplex chrome/nickel plated sleeve sections and entire unit shall be provided with external packing application connections for addition of lubricant under full line pressure. Provide proper packing for both hot and cold lines, together with sufficient spare material and applicator for one year period.

C. Provide guides for expansion joints on the movement side of each expansion joint. Two guides shall be provided prior to each moveable section of expansion joint. Guides shall be ADSCO Model H, for high temperature and Model H-1TB for low temperature lines. Guides shall be located as recommended by the expansion joint supplier for his equipment to minimize lateral misalignment.

D. Provide fintube compensators where indicated on the drawings or every 50 feet on straight fintube runs. Compensators shall be enclosed bellows type with internal guides.

2.14 EXPANSION TANKS

A. Expansion tanks shall be of the types, sizes and capacities indicated on the drawings. Equipment shall be as manufactured by Taco, Bell and Gossett or Thrush.

B. Equipment shall be designed for 125 psig ASME working pressure and so labeled. Tanks shall be provided with gauge glass with tricocks and drain, tank drain, charging valve and mounting saddles or cradles.

C. Bladder-type tanks shall be designed for 125 psig ASME working pressure and be so labeled. Tanks shall be provided with tank drain, charging valve, replaceable bladder, lift ring and base support or cradle. Acceptance capacity shall be the capacity scheduled.

2.15 FANS (CENTRIFUGAL)

A. Centrifugal fans mounted in ceiling, wall or with inline duct configuration shall be of the sizes and capacities indicated on the drawings. Fans shall be centrifugal type manufactured by Greenheck, Acme, or Aerovent.

B. Fans shall be provided with damper and adapter kit for installing fan with an inline arrangement, where applicable a wall vent, or roof vent cap for installation on an insulated curb provided by the HVAC sub-contractor.

C. Provide solid state controller to allow full range control of fan speed.

D. Warranty: Manufacturer shall provide a full parts warranty for two (2) years from start-up or substantial completion, whichever occurs later.

2.16 FANS (ROOF)

A. Roof exhaust fans shall be of the centrifugal belt-driven or direct-drive type as indicated on drawings. Fans shall be of capacities and characteristics as scheduled on drawings and specified herein. Fans shall be as manufactured by Greenheck, Aerovent or ACME.

B. Construction of the fan housing shall be of heavy-gauge aluminum.

C. All spun parts shall have a rolled bead for added rigidity and shall be specially spun so as to seal the pores of the aluminum providing greater resistance against oxidation and deterioration.

D. The fan wheel shall be all-aluminum of the centrifugal blower type featuring backward-inclined blades and a tapered inlet shroud. Wheels shall be statically and dynamically balanced. Inlet cone shall be aluminum and of the centrifugal blower type. Motor and drives shall be enclosed in a weathertight compartment, separate from the exhaust air stream. Air for cooling the motor shall be supplied to the motor compartment by way of an air passage from an area free of contaminated exhaust fumes. Motors shall be of the duty, permanently lubricated, sealed ball-bearing type. Drives shall be sized for 165 percent of motor horsepower capabilities and of the cast-iron type, keyed to the fan and motor shafts. Variable pitch drives shall be standard. Fan shall be of steel construction, turned, ground, and polished to precise

tolerances in relationship to the hub and bearings. Drive belts shall be of the oil-resistant, non-static, non-sparking type with life expectancy of 24,000 hours.

E. Bearings shall be flanged and of the permanently lubricated, permanently sealed, ball-bearing type capable of over 200,000 hours bearing life. The entire drive assembly and wheel shall be removable as a complete unit, from the support structure without disassembling the external fan housing. The complete drive assembly shall be mounted on rubber vibration isolation.

F. Direct drive units shall be of identical construction as belt drive units, except for drives, belts, and fan shaft bearings.

G. Fans shall be licensed to bear the AMCA ratings seal for air and sound performance.

H. Fans shall be furnished with pre-fabricated 18 inch high roof curbs. Roof curbs shall have 2 inch raised cant strip and wood nailer. Curb shall be aluminum construction with all seams continuously welded the entire length. Curbs shall meet the one “G” acceleration criteria. Fans shall be furnished with automatic motor operated damper.

I. Provide solid state speed controller as a disconnect for direct drive fans, pre-wired and mounted. Provide pre-wired and mounted disconnect switch on belt drive fans.

J. Warranty: Manufacturer shall provide a full parts warranty for two (2) years from start-up or substantial completion, whichever occurs later.

2.17 FANCOIL UNITS

A. Furnish and install fancoil units where shown on the drawings and to the sizes and capacities as indicated in the schedule. Fancoil units shall be as manufactured by Greenheck, Nailor, Price, Airtherm, Krueger or approved equal.

B. Performance Data:
1. Unit capacities shall be certified in accordance with ARI Standard 441-70.
2. Units shall be sound tested and rated in accordance with ARI Standard 443-70.
3. Unit shall comply with National Electrical Code and approved by Underwriter’s Laboratories.

C. Basic unit includes chassis, coil, heavy-density faced-glass fiber insulation, air block-offs around coil, removable fan board/drain pan assembly, auxiliary drain pan, fan, fan housing, motor and filter. Chassis shall be of galvanized steel of molded, high impact thermoplastic with solderless connection (7/8 inch OD copper tubes). Unit shall have one-piece box construction pedestal base riveted to chassis.

D. Coils: 5/8 inch OD seamless copper tubes mechanically bonded to configurated aluminum fins with continuous fin collars and sleeved coil end supports. Maximum working pressure 300 psig, factory burst test 450 psi (air) and leak test 300 psi (air under water). Maximum entering water shall be 275 degrees F. Coils shall have female sweat connections to accept 5/8 inch OD copper tubing.

E. Auxiliary Heating Coils (L): 7/16 inch OD copper tubes mechanically bonded to configurated aluminum fins with continuous fin collars and sleeved end supports.

Maximum working pressure 200 psig. Maximum entering water 220 degrees F. Female sweat connections to accept 1/2 inch OD copper tubing.

F. Drain Pans: Vertical main drain pans shall be galvanized steel with molded, one-piece self-extinguishing polystyrene foam insulating liner.

G. Fans: Fan wheels centrifugal forward-curved, double width of molded, reinforced glass fiber material. Fan wheels and housings corrosion resistant. Fan housings of formed sheet steel.

H. Motors: High efficiency permanent split capacitor motors shall not exceed scheduled amperage, shall have integral thermal overload protection and start at 78 percent of rated voltage. Motors shall operate satisfactorily at 90 percent of rated voltage on all speed settings and at 10 percent over voltage without undue magnetic noise. Temperature rise by winding resistance method shall not exceed 60°C. (shaded pole) and 50°C (psc) on high speed and 65°C. (shaded pole) and 55°C. (psc) on reduced speeds.

CFM	AMPS AT HIGH SPEED
200	0.55
300	0.60
400	0.55
600	0.80

All motors shall be factory run tested in assembled unit prior to shipping.

Motor cords shall be quickly detachable at switch box by locking prolonged connector (optional on horizontal units).

I. Filters: Concealed from sight and removable without displacing front panels. Filters shall be 2” MERV 13 throw-away type.

J. Extended Motor Oilers: Plastic tubes shall terminate beneath discharge grille of vertical cabinet models. Tube openings shall be covered.

K. Piping Package: The piping package shall be arranged to pipe the two coils from the same end. Piping package shall be complete with four stop valves and automatic air vents for each coil. Piping package shall be completely factory mounted including two (2) three-way control valves of same manufacture as the automatic temperature control system.

L. Controls: Each unit shall have a factory-mounted and wired three-speed on/off switch.

M. Warranty: Manufacturer shall provide a full parts warranty for two (2) years from start-up or substantial completion, whichever occurs later.

2.18 FILTERS

A. MERV 8
1. Air Filters shall be Model Pre Pleat 62RM8 panel filters, as manufactured by Flanders Precisionaire or approved equal.
2. Each filter shall consist of an electrostatically charged synthetic only media, with corrosion-resistant expanded metal backing and moisture resistant

enclosing frame. The filter shall be 1", 2" or 4" nominal depth. The grid shall be 100% bonded to the media on the air exiting side to eliminate media vibration and pull away.

3. The grid shall be formed to provide a uniform V-wedge shaped pleat with the open area on the air exiting side for maximum utilization of the media and low airflow resistance. The filter shall be classified for flammability by Underwriters Laboratories, Standard 900 as Class 2.
4. The filter shall have a Minimum Efficiency Reporting Value of 8 by ASHRAE Standard 52.2.

B. MERV 13

1. Air Filters shall be Model Dominator High Efficiency Rigid Cell Extended Surface Filter, as manufactured by Purolator or approved equal.
2. Each filter shall consist of 100% synthetic media. The cell sides shall be high strength, high impact polystyrene plastic and the entire filter shall be completely incinerable. The filter shall be 4" nominal depth.
3. The filter shall be classified by Underwriters Laboratories, Standard 900 as Class 1.
4. The filter shall have a Minimum Efficiency Reporting Value of 13 by ASHRAE Standard 52.2.

2.19 FOUNDATIONS AND SUPPORTS

A. All mechanical equipment and systems shall be substantially supported without distortion or excessive vibration. The methods of support shall be as hereinafter described, except as otherwise noted on the drawings. This Contractor shall locate all equipment bases and shall provide all anchor bolts and templates to the General Contractor who shall form and set all concrete work and shall set all anchor bolts. Anchor bolts and nuts shall be galvanized.

B. Concrete housekeeping pads shall follow equipment plan shape and be 6 inches in height. Where equipment is set directly on housekeeping pads the space between equipment base and pad top shall be filled by the General Contractor with non-shrinking grout. Where equipment shape or mounting is such as to require an air space between equipment bases and pad, the pad shall then be furnished with a smooth troweled surface. All equipment shall be anchored to housekeeping pads or all intervening vibration isolator bases shall be anchored to the structure.

C. Where steel frame floor supports are indicated to be provided, such framing shall be all-welded type with two coats of red primer. The framing system shall be substantial type with members sized to prevent equipment distortion or excessive vibration. Framing shall be simple post and beam box type with diagonal bracing to prevent lateral movement. Beam members shall be positioned to align with equipment support points for proper bolting and posts shall be positioned to prevent excessive beam cantilevering. Posts shall be provided with baseplate anchored to the structure.

D. Where steel framing supports are indicated to be provided for roof mounted equipment (those without integral curbs for setting into roof structure) the same framing system as described above shall be used, except members shall be galvanized and bolted together. Posts shall be positioned to align both framing and roof structural members with pitch pockets at roof penetrations.

E. Ground-mounted equipment shall be supported with framing system similar to roofing application described above except that posts shall be set on poured-in-

place concrete piers with galvanized anchor bolts. Concrete piers shall be provided by the General Contractor.

2.20 GRAVITY VENTILATORS

A. Gravity ventilators shall be roof mounted air intake louver houses as manufactured by Cook, Greenheck, or Penn Ventilator Company.

B. Louver houses shall have heavy gauge extruded 6063-T5 aluminum blade of the storm blade style with corners metered and welded. Roof and curb caps shall be formed of minimum 0.051 gauge aluminum unit base to be minimum 0.080 gauge. The entire assembly braced by heavy mill gauge galvanized steel interior upright angles at the corners and along the sides. Manufacturer's catalog ratings shall be based upon tests conducted in an industry approved testing laboratory with air volumes and losses as shown.

C. Per ANSI-A58.1 testing standards, each ventilator must be rated for 100 MPH wind load and 101.5 lbs. per square foot snow load.

D. Furnish 1/2" thick sprayed on plastic coating to eliminate condensation on underside of roof. Intake ventilators to be 200% free area. Relief vents to be 150% free area.

E. All seams to be continuously welded. Equip all ventilators with aluminum bird screen.
   1. Provide a roof curb of matching construction details, coordinated with the roof construction within which it is to be installed. Curb shall be equipped with a two position, electrically driven damper at the integral utility shelf within the curb, for each gravity ventilator.

F. Provide entire aluminum assemblies in three-coar, fluoropolymer color, to be selected by the Architect from manufacturer's standard range of colors and gloss.
   1. Surfaces to be acid chromate-fluoride-phosphate pre-treated.
   2. Provide manufacturer's standard three-coat, thermo-cured system composed of specially formulated inhibitive primer, fluorocarbon color coat and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinyl resin by weight; complying with AAMA 605.2.
   3. Provide with five (5) year warrantee.

2.21 HOT WATER REHEAT COILS

A. Hot water reheat coils shall be of the sizes and capacities indicated on the drawings. Coils shall be as manufactured by Heatcraft, McQuay, Trane or Carrier.

B. Coils shall be ARI rated and suitable for 250 psig test pressures.

C. Coils shall be constructed with welded steel headers, staggered copper tubes with spirally wound mechanically bonded aluminum fins. Coils shall be provided with mounting flanges for insertion into the ductwork. Independently support all coils.

2.22 INSULATION MATERIALS (GENERAL REQUIREMENTS)

A. All insulation materials to be furnished for installation under this section shall be as manufactured by Owens-Corning, Certainteed, Knauf, or Schiller Company.

B. Shop drawings shall be submitted for all insulation system materials to be furnished

for installation under this section. Submittals shall include descriptions of the application of all materials to be used for each insulation class and catalog cuts of all materials furnished.

C. All insulation materials to be furnished for installation under this section shall conform to fuel contributed flame spread and smoke developed limits set forth in NFPA Standard 90A as determined by NFPA 255, ASTM E84 or UL723 tests.

2.23 INSULATION MATERIALS (EQUIPMENT)

A. Equipment shall be insulated as specified and as indicated on the drawings.

B. Insulation shall be applied to equipment in accordance with insulation class. Thickness and special jacketing indicated below.

Hot water heat exchangers, hot water expansion tanks, and hot water air separators shall have 1½ inch thick Class 142 insulation.

Class 142
Insulation shall consist of minimum 6 pound rigid fiberglass blocks cut to fit equipment shape and secured with 20 gauge annealed steel wire or bands. Voids and seams shall be filled using insulating cement. Over insulation tightly stretch wire lath, wired and anchored securely in place with all edges tied to prevent lifting and separating. Over lath apply 1/2 inch thick insulating cement plaster in two coats consisting of scratch and troweled smooth finish coat. Finish shall consist of 6 ounce canvas jacket trimmed to fit, tightly wrapped, sized and secured with lagging adhesive.

2.24 INSULATION (PIPING)

A. Piping systems shall be insulated as specified herein and as indicated on the drawings.
Insulation Materials In
Inches for Pipe Sizes

Fluid	Fluid Temp. Range F.	Run-outs Up to 1”	≤ 1.5”	> 1.5”	Class
Hot Water	105-200	1/2	1½	2	104
Coil Drains	Any	3/4	3/4	3/4	Inside 104 Outside 107
Refrigerant Piping	Any	1/2	1/2	1.0	107

Runouts not exceeding twelve (12) inches in length.

Note: Provide 0.016 inch thickness embossed aluminum protective jacketing on all insulated piping within mechanical rooms within 6 feet of floors.

B. Insulation shall be omitted from the following piping:
1. Equipment vent piping.
2. Equipment drain piping beyond shut off valve.

3. Piping within fintube covers.

Class 104
Piping: Insulation shall consist of high density (minimum #4) molded fiberglass sectional pipe insulation with a minimum R value of 4.0 H. degrees F. ft.²/BTU per inch, with factory applied all-service jacket with vapor barrier, butt and lap end strips shall be self-sealing or secured with vapor seal adhesive. Mechanical Room piping shall be covered with PVC Piping Insulation Cover

Fittings, Valves and Flanges: 2 inch size and smaller shall be insulated with 1 pound density and secured with 20 gauge annealed steel wire. Then apply insulating and finish cement to match the adjacent pipe insulation thickness and then have two (2) 1/8 inch thick smoothing and finishing coats of vapor seal adhesive applied using intermediate glass fabric reinforcing. Vapor seal adhesive shall lap adjacent pipe cover. Fittings may be insulated with two layers of fiberglass with PVC covers. Mechanical Room fittings, valves and flanges shall be covered with PVC Piping Insulation Cover.

Valves, Fittings and Flanges: 2½ inch size and larger shall be insulated using sections of high density fiberglass molded sectional pipe insulation cut to fit, secured with 20 gauge annealed steel wire. All voids and pockets shall then be filled with insulating cement and finish cement. Finish shall be two 1/8 inch thick smoothing and finishing coats of vapor seal adhesive applied using intermediate glass fabric reinforcing. Vapor seal adhesive shall alp adjacent pipe cover. Mechanical Room fittings, valves and flanges shall be covered with PVC Piping Insulation Cover.

Class 107
Tubing and Piping: Insulation shall consist of flexible type foamed plastic pipe insulation with flame spread rating of 25 or less and smoke development rating of 50 or less per ASTM E84-75 test, integral vapor barrier. Insulation shall be slit type, field sealed with companion adhesive.

Fittings, Valves and Flanges: Tubing Systems – Fittings shall be made by miter cutting of adjacent straight piping runs and sealing joints with companion adhesive. Valves shall be insulated by using a combination of nested pipe insulation and sheets to form a complete enclosure with all joints sealed with companion adhesive. Flanges shall be insulated by using sheets cut to fit pipe side of flange and wrapping sheets around flange perimeter. All joints shall be sealed using companion adhesive. Piping Systems – Fittings shall be insulated using nested sections of pipe insulation mitered to form a square corner and sealing joints with companion adhesive. Valves and flanges shall be insulated as described for tubing systems.

C. PVC Piping Insulation Cover:
1. Piping insulation cover shall be of nominal thirty (30) mil UV stabilized PVC preformed to appropriate shapes for straight piping, fittings, valves and accessories. Solvent welding type adhesive shall form a permanent chemical bond between surfaces and shall present a continuous vapor barrier across the joint.
2. Mechanical Room piping insulation cover shall be of nominal thirty (30) mil colored PVC preformed to appropriate shapes for straight piping, fittings, valves and accessories. Solvent welding type adhesive shall form a permanent chemical bond between surfaces and shall present a continuous vapor barrier across the joint. The following color coding shall be utilized:

- Hot Water Supply & Return: Red

3. PVC piping insulation cover shall incorporate the following characteristics.

Typical Properties	Test Method	Value
Service Range	N.A.	0°F. to 150°F
Specific Gravity	ASTM D-792	1.48
Flame Spread	ASTM E-84-97a	25
Smoke Developed	ASTM E-84-97a	50

Typical Properties	Test Method	Value
Flexural Strength	ASTM D-638	11,500 psi
Tensile Modulus	ASTM D-638	470,000 psi
Elongation at Yield	ASTM D-638	3% MD
Flexural Modulus	ASTM E-790	460,000 psi
Electrical Conductance	D-257	Non-conductor
Gardner-SPI Impact	D-3679	8 lb/mil (30 mil sample)
Abrasion	Taber Method	10,000 revolutions, CS-17 wheel, 1,000 gr weight
Water Vapor Transmission	ASTM E96-95	0.009 perms

2.25 INSULATION (SHEET METAL)

A. Sheet metal work shall be insulated as specified herein and as indicated on the drawings.

B. Insulation shall be applied to the following:
1. All air conditioning systems ductwork and associated equipment exposed to view; all systems outside air plenums, ducts and louver boxes; all system exhaust air plenums, ducts and louver boxes from louver connections back to automatic dampers. All portions of heating and ventilating and air conditioning unit casings not internally insulated, all air conditioning systems return air fans and all equipment shall have Class 131 insulation.
2. All concealed air conditioning system supply and return air ductwork and associated equipment including terminal box reheat coil casings, shall have Class 135 insulation.
3. Insulation liner shall be provided where indicated on the drawings. Refer to sheet metal work.
4. All sound attenuators in insulated system ductwork shall be insulated. Sound attenuator sections furnished with Rooftop air handling units shall be insulated in field when not furnished insulated by the unit manufacturer.
5. Acoustically lined ductwork shall be wrapped with class 135 insulation such that the total insulation system achieves a minimum “R” value of R-6.

C. Kitchen grease ductwork shall have 3 inch Class 130 insulation.

D. Insulation shall be omitted from the following sheet metal work:
1. Toilet, locker and storage exhaust ductwork except where noted on drawings.

E. All louver plenums, louver blank-off plates and ductwork which will conduct air shall

have insulation thickness increased to a minimum of 2 inches or as indicated on drawings.

F. All supply and return ductwork located outside shall have rigid board insulation with thickness increased to a minimum of 3 inches, 19 R-value, and be provided with a weatherproof cover in addition to the vapor barrier.

1. Class 130
   a. Insulation shall consist of a UL listed duct wrap system complying with UL 1978 and ASTM E-119. Blanket material shall be in alumina (45% ±) composite incorporating the following characteristics.
   b. Service Range: 0°F to 2300°F
   c. Melting Point: 3200°F
   d. R Value @ 70°F: $4.5\frac{Hr.Sq.Ft.°F.Inch}{BTU}$
   e. R Value @ 283°F: $9.9\frac{Hr.Sq.Ft.°F.Inch}{BTU}$
   f. Flame Spread: 5 (ASTM E84/UL-723)
   g. Smoke Developed: 5 (ASTM E84/UL-723)
   h. The blanket shall have a foil facing, adhered to the blanket mat, incorporating the following characteristics:
   i. Tensile Strength: M.D. 40#/IN (ASTM D-828)
      C.D. 40#/IN (ASTM D-828)
   j. Puncture Resistance: 100 Units (Min) (ASTM D-781)
   k. Self adhesive filament tape shall be of the high performance type equal to 3M Company *898.
   l. Banding material, 3/4" wide, minimum 0.015" thick, carbon steel for construction requirements of zero clearance to combustibles or 1 hour ratings. Stainless steel banding shall be used for 2 hour requirements (SS wire ties or 1/4" SS hose clamps may be substituted for hanger insulation only).
   m. Tensioning tool for banding material manufactured by Okle or by Signoide Company; seals such as those manufactured by Okle or by Signode Company; and crimping tool such as those manufactured by Okle or Signode.
   n. 10 gauge, 4" to 5" long, copper coated steel pins; 1½" x 1½" galvanized steel speed clips; capacitor discharge stud gun (110/115) such as that manufactured by AGM.
   o. Grease duct access door hardware; 4½" x 5" long, 1/4" wing nuts and 1/4" metal washers; 4" long steel hollow tubing to fit threaded rods.
2. Class 131
   a. Insulation shall consist of 1½ inch thick rigid fiberglass board with reinforced foil vapor barrier cut to fit duct shape and applied by impaling insulation on pins attached to duct surface. Insulation shall have a minimum installed "R" value of R-6. Pins shall be located approximately 1 per square foot of surface. Insulation shall be secured on pins using metal washers with excess pin length trimmed. Seal seams and all vapor barrier penetrations using 4 inch wide reinforced foil tape self-sealing type or secured using vapor seal adhesive.
   b. Note: Flanges protruding from sheet metal shall be covered with 4 inch wide insulation board strips and sealed with 4 inch wide

reinforced tape secured with vapor seal adhesive.

c. Finish shall consist of pre-sized glass fabric jacket applied to insulation surface and secured with lagging adhesive. All plenums and ducts within 5 feet of floors shall have edges reinforced with metal corner beads applied to insulation and sealed with 4 inch reinforced foil tape secured with vapor seal adhesive prior to finish.

3. Class 135

a. Insulation shall consist of minimum 2 inch thick flexible fiberglass blanket with reinforced foil vapor barrier with a minimum installed "R" value of R-6. Insulation shall be tightly wrapped around duct and secured using bonding adhesive covering not less than 50 percent of sheet metal surface. Seams and penetrations shall be sealed by using 4 inch wide reinforced foil tape self-sealing type or secured with vapor seal adhesive. The bottom of ducts over 24 inches wide shall have additional support for blanket consisting of pins attached to duct surface at a rate of 1 per 2 square feet, evenly spaced. Insulation shall be impaled on pins and secured using mechanical washers with excess pin length trimmed.

G. Ductwork Weatherproof Insulation Cover:

1. Weatherproof insulation cover shall be a self-adhering roll-type roofing membrane consisting of a laminated assembly of aluminum facing, two (2) layers of styrene-buadiene-styrene and a nominal forty (40) mil layer of rubberized asphalt adhesive. Asphalt adhesive compound shall be pressure sensitive, protected by a release paper u ntil installation. Composite assembly shall incorporate the following characteristics.

Typical Properties	**Test Method**	**Value**
Service Range	N.A.	-25°F. to 150°F.
Heat Aging	ASTM D-794	No visible blistering, de-lamination or deterioration
Flame Spread	ASTM E-84-97a	0 (NFPA Class "A")
Smoke Density	ASTM E-84-97a	5
Tear Strength	ASTM D-1424	680 gr MD 640 gr CD
Tensile Strength	ASTM D-1000	500 p si MD 625 psi CD
Elongation	ASTM D-1000	296% MD 228% CD
Static Uplift	ASTM E-907	No damage or failure evident @ 75 psf for 1 minute
Wind Driven Rain	South Florida Test 5683	No leakage, damage or failures evident @ 100 MPH
Lap Joint Tensile Strength	MFM Method	Exceeds material strength
Lap Joint Peel Strength	MFM Method	11 lb/in (180° angle)
Abrasion	Taber Method	10,000 revolutions, CS-17 wheel, 1,000 gr weight
Low Temperature Flexibility	MFM Method	100,000 cycles @ 10°F with no cracking

Typical Properties	Test Method	Value
Q-U-C Accelerated Weathering	Q Panel Co. UV Chamber per Rubber Manufacturer's Association	4,000 hr exposure surface and lap joints, no effect
Reflectivity	Photo-volt meter	129 (black surface ≈ 29)
Water Vapor Transmission	ASTM E96-95	0.009 perms

2.26 MOTORS

A. This section identifies basic requirements for motors. It includes motors that are factory-installed as part of equipment and appliances as well as field-installed motors.

B. Quality Assurance:
1. Comply with NFPA 70 "National Electrical Code".
2. NRTL Listing: Provide NRTL listed motors.
   a. Term "Listed": As defined in "National Electrical Code", Article 100.
   b. Listing Agency Qualifications: "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
3. Comply with NEMA MG 1: "Motors and Generators".
4. Comply with UL 1004: "Motors, Electric".

C. All motors provided for this project shall comply with the requirements of this section, except as otherwise indicated.
1. Motors 1/2 HP and Larger: Polyphase
2. Motors Smaller than 1/2 HP: Single phase.
3. Frequency Rating: 60 Hz.
4. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
   a. 120V Circuit: 115 V – motor rating.
   b. 208V Circuit: 200 V – motor rating
   c. 240V Circuit: 230 V – motor rating.
   d. 480V Circuit: 460 V – motor rating.
5. Service factors indicated for motors are minimum values and apply at frequency and utilizing voltage at which motor is connected. Provide motors which will not operate in service factor range when supply voltage is within 10 percent of motor voltage rating.
6. Capacity: Sufficient to start and operate connected leads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100 percent of rated capacity.
7. Temperature Rise: Based on 40 degree C. ambient except as otherwise indicated.
   a. Enclosure: Totally Enclosed Air Over

D. Polyphase Motors:
1. General: Squirrel-cage induction type conforming to the following requirements except as otherwise indicated.
   a. NEMA Design Letter Designation: "A" or "B"
2. Multi-Speed Motors: Separate winding for each speed.
3. Premium Efficiency Motors: Nominal efficiency equal to or greater than that stated in NEMA Standard Publication MG 1-2003, Tables 12-12 and 12-13

respectively.

4. Variable speed motors for use with solid-state drives: Energy efficient, squirrel-cage induction, design B units with ratings, characteristics, and features coordinated with and approved by drive manufacturer.
5. Internal thermal overload protection for motors: For motors so indicated, protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to the temperature rating of the motor insulation.
6. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading of the application.
7. Rugged Duty Motors: Totally enclosed with 1.25 minimum service factor. Provide motors with regreasable bearings and equipped with capped relief vents. Insulate windings with nonhygroscopic material. External finish shall be chemical resistant paint over corrosion resistant primer. Provide integral condensate drains.
8. Motors for reduced in-rush starting: Coordinate with indicated reduced in-rush controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.

E. Single-Phase Motors:
1. General: Conform to the following requirements except as otherwise indicated.
2. Energy Efficient Motors: One of the following types as selected to suit the starting torque and other requirements of the specific motor application:
   a. Permanent Split Capacitor
   b. Split-Phase Start, Capacitor-Run
   c. Capacitor-Start, Capacitor-Run
3. Shaded-Pole Motors: Use only for motors smaller than 1/20 HP.
4. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.
5. Bearings, belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, pre-lubricated sleeve bearings may be used for other single phase motors.

2.27 PACKAGED ROOFTOP UNITS

A. MANUFACTURERS
1. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include the below. Being a listed equal does not allow deviations from the specification.
   a. Valent VXE (Basis of Design)
   b. Greenheck RVE
   c. Addison

B. MANUFACTURED UNITS
1. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake with 2" aluminum mesh filter assembly, exhaust air blower, energy wheel, dx coil, hot gas reheat coil, phase and brownout protection, motorized dampers, motorized/two position

recirculating damper, hot water heating coil, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection.

2. Units shall be provided with a one (1) year parts only warranty from unit startup or eighteen (18) months from shipment, whichever comes first.
3. Units shall be provided with a five year compressor parts only warranty.
4. Units shall be provided with a five-year energy recovery wheel parts only warranty.

C. SUBMITTAL

1. Product Data: For each type or model include the following:
   a. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA certified chamber.
   b. All sound power data for SA discharge, RA inlet, EA outlet, and radiated.
   c. Motor ratings, electrical characteristics and motor and fan accessories.
   d. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
   e. Estimated gross weight of each installed unit.
   f. Installation, Operating and Maintenance manual (IOM) for each model.
   g. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.
   h. Energy wheel performance data for both summer and winter operation at design conditions (temperatures and airflows).
   i. Electrical consumption data and construction specification for electric heater (if applicable), to include heat output, warranty and safety certifications.
   j. Controls device list stating devices factory furnished and installed by unit manufacturer as well as devices factory furnished and shipped loose for field install by ATC.
   k. Confirmation of AMCA certified blower, ETL certification per U.L. 1995 (unit must bear ETL sticker), and energy wheel AHRI certification per Standard 1060. Manufacturer to present supporting documentation of these certifications if required/requested.
2. Compliance:
   a. Specification Compliance: A detailed spec compliance at the start of the submittal shall be provided. This should specifically list any and all deviance from the spec by including a full copy of this specification with applicable callouts and highlights. Any deviations not called out on the specification compliance will need to be brought into compliance prior to the project completion at the expense of the manufacturer or manufacturer's local representative. Any submittal without a spec compliance will be immediately returned without review.
   b. Schedule Compliance: The submittal shall include a master schedule of performance for all the units. All data shown on the schedules (including notes and sound data) for the air handling

units shall be incorporated so that the reviewing engineer can quickly review all the data in one location. All schedule performance and notes shown on the plans shall be either confirmed or called out as a deviation. Any submittal without a schedule compliance will be immediately returned without review.

D. CABINET
1. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
   a. Internal assemblies: 22 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
2. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   a. Materials: Rigid urethane injected foam. Foam board not acceptable.
      1) Thickness: 2 inch (50.8 mm)
      2) Thermal Resistance R13
      3) Thermally broken
      4) Meets UL94HF-1 flame requirements.
      5) Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
   b. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
      1) Thickness: 2 inch (50.8 mm)
      2) Thermal Resistance R8
      3) Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
      4) Location and application: Divider panels between outdoor air and return air/exhaust air streams.
3. Unit shall have coating that is compliant with ASTM B117 Non-Scribe Rated for a minimum of 2,500 hours. If unit factory paint/coating is not ASTM B117 Non-Scribe Rated for a minimum of 2,500 hours then the manufactures rep shall use a third party coating to meet this requirement.
4. Roof Insulation: 2 inch (50.8 mm) fiberglass located above the 1 inch (25.4 mm) foam panel.
5. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvannealed steel.
6. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.
7. Motorized recirculating air damper for all partial recirc units and two position recirculation air damper for all 100% outdoor air units. Recirculation damper shall be factory installed.
8. Unit duct connections shall match those shown on plans. Verify any horizontal supply and return connections.

E. FANS AND MOTORS
1. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene

vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

2. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.
3. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
4. Fan: Direct drive, airfoil plenum fan with aluminum wheel statically and dynamically balanced. Prop or belt-drive fan not acceptable due to low static capabilities.
5. Blades: Welded aluminum blades only.
6. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".
7. Blower motors greater than 1/2 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.
8. Exhaust fans must be capable of operating at full economizer airflow at the total return air airflow with the resulting total static pressure.
9. Factory installed motor shaft groundings on all fans.
10. Both the supply and exhaust fan shall be equipped with factory furnished and installed fan airflow monitoring stations

F. COMPONENTS

1. Energy Wheel: (All RTUs except RTU-3,5) Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette.
    a. Unit energy wheel shall be sized for the full volume of scheduled outdoor and exhaust air without any air bypassing the energy.
    b. The energy wheel shall be an integral part of the unit from the manufacturer, mounted perpendicular to the base of the unit. No field assembly, ducting, or wiring shall be required with energy recovery option.
    c. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five year parts only warranty.
    d. The wheel media shall be a polymer film matrix in a stainless steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable.
    e. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing.
    f. Energy recovery wheel bypass should be provided on all partial recirc units with an energy recovery wheel.

g. Energy wheel to have factory furnished and wired VFD to single point power.
h. Latent energy shall be transferred entirely in the vapor phase with no condensation.
i. The energy wheel is to have a five year parts only warranty.
j. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.
k. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.

2. Filtration:
   a. MERV 8 pleated filter on the outside air stream.
   b. MERV 8 and MERV 14 disposable pleated filters shall be provided in the supply final air stream.
   c. MERV 8 filters in the exhaust air stream.
   d. 1 full set of spare outside air, supply air, and return air disposable filters shall be provided. There should be a total of 2 full sets of disposable filters provided.
3. Hot Water Heating Coil shall be factory installed and meet the design requirements.
   a. Coil shall be rated in accordance to AHRI standards.
   b. Coil casing shall be constructed of 16 gage galvanized steel.
   c. Coil tubes shall be constructed of 1/2" diameter, 0.016" thick seamless copper tubing.
   d. Coil fins shall be constructed of 0.0060" thick aluminum.
   e. Unit shall ship with a loose control valve to be field installed by installing contractor.
   f. Coil to be coated with ElectroFin® coil coating.
4. DX Cooling Coil shall be factory installed and meet the design requirements.
   a. Coil shall be rated in accordance to AHRI standards, designed to withstand 250 psig working pressure at 300 degrees F, and pressure tested to 600 psig.
   b. Refrigeration systems with more than one circuit shall have interlaced evaporator coils.
   c. Coil casing shall be constructed of 16 gage galvanized steel.
   d. Coil tubes shall be constructed of 1/2" diameter, 0.016" thick seamless copper tubing.
   e. Coil fins shall be constructed of 0.0060" thick aluminum.
   f. Coil to be coated with ElectroFin® coil coating.
   g. Drain pan
      1) Drain pan shall be constructed of a minimum of 18 gage 201 stainless steel.
      2) Drain pan shall be double-sloped to ensure condensate removal from unit.
      3) Drain pan shall extend a minimum of 8” past the evaporator coil to ensure condensate retention.
      4) P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.
5. Reheat Coil: Reheat coil with factory installed modulating hot gas reheat valve. Hot gas reheat is required to be done internal to the unit. Piping back to a remote condensing unit is not accepted.

a. Coil shall be rated in accordance to AHRI standards, designed to withstand 250 psig working pressure at 300 degrees F, and pressure tested to 600 psig.
b. Coil casing shall be constructed of 16 gage galvanized steel.
c. Coil tubes shall be constructed of 5/16" diameter, 0.012" thick seamless copper tubing.
d. Coil fins shall be constructed of 0.0060" thick aluminum fins.
e. All controls devices required to control unit reheat per the controls drawing(s) shall be factory furnished by unit manufacturer. All devices shown interior to the unit shall be factory furnished and installed by unit manufacturer. Loose devices shall be furnished by the unit manufacturer and ship loose for field installation by project ATC.
f. Coil is to be coated with ElectroFin® coil coating.

6. Condenser System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. The condenser coils are coated with ElectroFin® coil coating. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Condenser section is to be in a packaged.
   a. Fan blades must be constructed of aluminum or a composite material and have a geometry designed and documented to reduce sound and energy when compared to a traditional rectangular blade fan. Traditional rectangular blade fans are not allowed due to increased noise generated and increase power utilized.
   b. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up.
   c. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector.
   d. Lead condenser fan will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point. Motors shall be UL Recognized and CSA Certified.
   e. Single condenser fan running at max RPM and design static pressure shall not exceed an A-weighted sound power level of 75 db at free inlet/outlet test conditions.
   f. Fans may be full width or partial width. Fans modified to partial width through the use of banding or other blade reduction method are not acceptable.
   g. Fans shall be mounted on minimum 1” tall neoprene isolators.
   h. Hail Guards: Protects the condensing unit from damage due to extreme weather conditions such as hail and flying debris.

7. Compressors: The refrigerant compressor(s) shall be inverter hermetic scroll-type compressors and shall be equipped expansion valves, EXV(s) or TXV(s).
   a. Compressed refrigerant system shall be fully charged with R-410A refrigerant and contain the following items:
      1) Suction and discharge service valves.
      2) Suction and discharge isolation valves.
      3) Reverse rotation protection.
      4) Oil level adjustment.
      5) Oil filter.
      6) Filter drier
      7) Short cycling control.

8) High and low pressure limits.
9) Crankcase heaters (where applicable).

b. Compressors shall be installed using manufacturer's recommended rubber vibration isolators.
c. Capacity control shall be provided through the use of a single inverter scroll compressor. Additional compressors, if required, shall be fixed stage scroll compressors.
d. Compressors shall be provided with a five (5) year parts only warranty. This warranty will begin on the ship date of the unit.

8. Motorized Dampers
   a. Frame shall be constructed of a 16 gage galvanized steel hat-channel.
   b. Blades shall be constructed of 16 gage galvanized steel strengthened by three longitudinal 1 inch deep “vee” grooves.
   c. Blades shall be symmetrical relative to its axle pivot point.
   d. Axle bearings shall be synthetic sleeve-type and rotate inside extruded holes in the damper frame.
   e. Blade seals shall be extruded vinyl permanently bonded to the appropriate blade edges.
   f. Frame shall include flexible stainless steel compression-type jamb seals.
   g. Modulating spring-return actuators shall be provided by the factory, installed on the damper, and wired to the control center. Each damper shall have a dedicated actuator. Single actuators with gear trains are not acceptable.
   h. Damper leakage shall be no more than 3 cfm/sq.ft. at 1 in.wg static pressure.
   i. All control devices necessary per unit controls drawing(s) shall be provided by unit manufacturer. All devices interior to the unit shall be factory furnished and installed by unit manufacturer. Loose devices that are to be installed exterior to the unit shall be furnished by the unit manufacturer and ship loose for field installation by project ATC.
9. Outside Air Flow Monitoring: Non 100% outdoor air units shall have a factory furnished and installed outside air flow monitoring station with the following capabilities:
   a. Airflow sensor accuracy to be a minimum 3% (4% Max) of reading from 0 to 2,000 fpm.
   b. Temperature accuracy to be at minimum +/- 0.15F from -20F to 160F.
   c. Analog outputs to be field configured 0-10VDC for communication with BAS.

G. ELECTRICAL
1. Units shall have a single point of power via non fused disconnect.
2. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. Units shall be equipped with a Unit Disconnect Switch.
3. Unit shall be wired according to NEC and listed per ETL. ETL listing shall cover all components of the ventilator and not be limited to the control panel. All major electrical components shall be UL or ETL listed.
4. Service receptacle: 120 VAC GFCI service outlet shall be factory furnished and installed. Power to GFCI shall be factory furnished from the unit

manufacturer. Install shall be performed so that power to the GFCI is sourced upstream of the main Single Point Power disconnect.

5. Vapor Tight Lights: Provide service lights mounted in the unit to be used during times of routine maintenance. The lights must be wired by others on the jobsite, as they will not be wired through the unit control center.
6. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

H. PACKAGED UNIT CONTROLS

1. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons. See Mechanical Control Sequences drawings for more details.
2. Dehumidification hot gas reheat
3. Unit supply fan shall be configured for Constant Volume Setpoint.
4. Unit exhaust fan shall be configured
   a. Constant Volume Setpoint (100% outdoor air units)
   b. OA Damper Tracking (partial recirc units)
5. Outside Air / Return Air damper control shall be configured
   a. Constant Position Setpoint (100% outdoor air units)
   b. CO2 Sensor (partial recirc units)
6. Economizer control shall be temperature / enthalpy.
7. Note RTU-4 shall have two modes of operation depending on the kitchen hood operation. Manufacturer to include a factory provided auxiliary digital output in order for the BMS to disable the exhaust fan during.
8. Dirty filter sensor shall be factory installed.
9. Operating protocol: The DDC shall be factory-programmed for BACNetIP.
10. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.
11. Airflow monitoring required in the supply, and exhaust airstreams.
12. Airflow monitoring required in the outdoor air stream for non 100% OA units.
13. Unit shall be provided with a space thermostat measuring temperature. Thermostat shall have an LCD display and push buttons allowing for setpoint adjustments.
14. Refer to controls drawing(s) of associated Rooftop Units. All controls devices are to be factory furnished. All devices shown interior to the unit shall be factory furnished and installed by unit manufacturer. Loose devices shall be furnished by the unit manufacturer and ship loose for field installation by project ATC.

I. FACTORY VERIFICATION TESTING

1. Unit shall be thoroughly run tested prior to shipment from the factory.
2. Factory run test report shall be provided at the request of the engineer, contractor, or owner.
3. Testing Procedures (the non-applicable devices should be removed from this list)

a. Unit shall be subjected to and pass a dielectric (hipot) test.
b. All motorized dampers shall be cycled one full stroke while installed in the unit using the factory-provided motorized actuators.
c. Supply fan
   1) Visually inspect ramp-up, ramp-down, and rotation direction of fan when enabled.
   2) Verify fan pressure proving switch operation.
   3) Measure and record current draw through supply fan motor(s).
d. Exhaust fan
   1) Visually inspect ramp-up, ramp-down, and rotation direction of fan when enabled.
   2) Verify fan pressure proving switch operation.
   3) Measure and record current draw through exhaust fan motor(s).
e. Energy recovery wheel
   1) Visually inspect energy recovery wheel cassette is free to rotate within cassette.
   2) Visually inspect energy recovery belt drive mechanism.
   3) Enable energy recovery wheel motor and ensure proper rotation.
   4) Measure and record current draw through energy recovery wheel motor.
f. Condensing fans
   1) Ensure fans rotate freely without obstruction.
   2) Energize fans and ensure proper rotation.
   3) Measure and record the amount of current draw through each condensing fan.
g. Refrigeration system
   1) Measure and record subcooling and superheat on circuit A with hot-gas reheat valve closed (0%) after 15 minutes of steady-state operation.
   2) Measure and record subcooling and superheat on circuit A with hot-gas reheat valve open (100%) after 15 minutes of steady-state operation.
   3) Measure and record subcooling and superheat on circuit B after 15 minutes of steady-state operation.

4. Test report shall be provided prior to unit startup and available from the factory upon request.

2.28 PIPE, HANGERS, SUPPORTS AND ANCHORS

A. Provide all necessary labor, supervision, materials, equipment and services required to furnish and install all pipe supports, hangers, anchors and other suitable supporting appliances necessary to support firmly and substantially all parts of the apparatus described in this specification. Equipment shall be as manufactured by B-Line, Uni-Strut, Grinnell or Carpenter & Patterson.
   1. Pipe shall be adequately supported by pipe hanger and supports and restrained by anchors. Hangers for insulated pipes shall be sized to accommodate insulation thickness.

B. Steel pipe hangers, anchors and supports shall have the manufacturer's name, part number, and applicable size stamped into each part for identification.

C. Hangers, anchors and supports shall be designed and manufactured in

conformance with the following standards as appropriate.

1. ASTM B633: Specification for Electro-deposited Coatings of Zinc on Iron and Steel.
2. ASTM A123: Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip
3. ASTM A653 G90: Manufacturers Standardization Society: Pipe Hangers and Supports – Materials, Design and Manufacture
4. MSS SP69: Manufacturers Standardization Society: Pipe Hangers and Supports – Selection and Application

D. Hangers:
   1. Uninsulated pipes 2 inches and smaller:
      a. Adjustable steel swivel ring (band type) hanger.
      b. Adjustable steel swivel J-hanger.
      c. Malleable iron ring hanger or hinged ring hanger.
      d. Malleable iron split-ring hanger with eye socket.
      e. Adjustable steel clevis hanger.
   2. Uninsulated pipes 2½ inches and larger.
      a. Adjustable steel clevis hanger.
      b. Pipe roll with sockets.
      c. Adjustable steel yoke pipe roll.
   3. Insulated Pipe – Hot Services (including steam piping):
      a. 2 Inch and Smaller Pipes:
         1) Adjustable steel clevis with galvanized sheet metal shield.
      b. 2½ Inch and Larger Pipes:
         1) Adjustable steel yoke pipe roll with pipe covering protection.
         2) Pipe roll with sockets with pipe covering protection saddle.
   4. Insulated Pipe – Cold Services:
      a. 5 Inch and Smaller Pipes:
         1) Adjustable steel clevis with galvanized sheet metal shield.
      b. 6 Inch and Larger Pipes:
         1) Pipe roll with sockets with pipe covering protection saddle.
         2) Adjustable steel yoke pipe roll with pipe covering protection.

E. Pipe Anchors:
   1. Provide a complete system of accessories to transmit thermal expansion forces to the building structure for redirection to the piping expansion compensation system. Anchors shall consist of structural attachments, framing members for translating forces to and from the building structure and plates welded to the appropriate piping sections.
   2. Structural attachments shall be as appropriate for the point of connection intended. Verify anchor connection points with Project Structural Engineer prior to fabrication.
   3. Framing members shall be sized to accept the forces associated with the Contractor's proposed piping system arrangement with a minimum factor of safety of 3.0.
   4. Framing point of attachment to the appropriate piping section shall be of a minimum thickness of 1/4" and shall increase by 1/16" in thickness for each two-pipe size increases above three inches in diameter (3"Φ). Framing point of attachment to the appropriate piping section shall be of a minimum length of 16" and shall increase by 2" in length for each two pipe size

increases above three inches in diameter (3" Φ).

1. Welds to connect framing point of attachment to the appropriate piping section shall be full penetration fillet welds parallel to the central axis of the piping. All welding processes, including but not limited to procedures and welding operator qualifications, shall be in strict accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code (edition, including any addenda, in effect at the time of the contract execution).

F. Pipe Clamps:
   1. Provide pipe clamps with weld-less eye nuts to allow flexibility in the hanger assembly to adjust for horizontal movement. Provide double bolted pipe clamps for insulated lines.

G. Multiple or Trapeze Hangers:
   1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A570 Gr. 33 structural steel channel, 1⅝ x 1⅝" minimum, or stronger.
   2. Mount pipes to trapeze with 2 piece pipe straps sized for outside diameter of pipe.
   3. For pipes subjected to axial movement:
      a. Strut mounted roller support. Use pipe protection shield or saddles on insulated lines.
      b. Strut mounted pipe guide.

H. Wall Supports:
   1. Pipes 4 Inches and Smaller:
      a. Carbon steel hook.
      b. Carbon steel J-hanger.
   2. Pipes Larger than 4 Inch:
      a. Welded strut bracket and pipe straps.
      b. Welded steel brackets, with roller chair or adjustable steel yoke pipe roll. Use pipe protection shield or saddles on insulated lines.

I. Floor Supports:
   1. In mechanical spaces where weight of piping or other apparatus makes it impractical to support same suspended only from structure above, flanged pipe standards shall be installed to support the weight of the piping, valves and fittings. Main passageways and access space must not be obstructed.
   2. Hot piping under 6 inch and all cold piping:
      a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. Pipe saddle shall be screwed or welded to appropriate base stand.
   3. Hot piping 6 inches and larger:
      a. Adjustable roller stand with base plate.
      b. Adjustable roller support and steel support sized for elevation.

J. Vertical Supports:
   1. Steel riser clamp sized to fit outside diameter of pipe.

K. Copper Tubing Supports:
   1. Hangers shall be sized to fit copper tubing outside diameters.
      a. Adjustable steel swivel ring (band type) hanger.
      b. Malleable iron ring hanger, or hinged ring hanger.
      c. Malleable iron split-ring hanger with eye socket.

d. Adjustable steel clevis hanger.

2. For supporting vertical runs use epoxy painted or plastic coated riser clamps.
3. For supporting copper tube to strut use epoxy painted pipe straps sized for copper tubing, or plastic inserted vibration isolation clamps.

Note: Copper plating of hangers is for purposes of identification only. This superficial coating shall not be designed to provide significant protection in corrosive areas.

L. Plastic Pipe Supports:
1. V-bottom clevis hanger with galvanized 18 gauge continuous support channel.

M. Supplementary Structural Supports:
1. Design and fabricate supports using structural quality steel bolted framing materials as manufactured by B-Line or Uni-Strut.
2. Channels shall be roll formed, 12 gauge, ASTM A570 Grade 33 steel, 1⅝" x 1⅝" or greater as required by loading conditions. Submit designs for pipe tunnels and pipe galleries to Engineer for approval.
3. Clamps and fittings shall be specifically designed and listed for use with the strut system.

N. Upper Attachments:
1. Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
   a. C-Clamps shall have locknuts and cup point set screws. Top flange c-clamps shall be used when attaching a hanger rod to the top flange of structural shapes. Refer to manufacturer's recommendations for setscrew torque. Retaining straps shall be used to maintain the position on the beam where required.
   b. Center loaded beam clamps shall be used where specified. Steel clamps, malleable iron or forged steel beam clamps with cross bolt shall fit beams.
2. Concrete Inserts:
   a. Cast in place spot concrete inserts shall be used where applicable, either steel or malleable iron body. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes.
      1) Arrange pipe hangers, and auxiliary framing if required, to limit the maximum pipe load, with pipes fully insulated and filled with water, to not exceed 1500 pounds on any one slab insert.
      2) Inserts shall be spaced not closer than 4 feet o.c. in either direction. Where pipe inserts are closer together than 4 feet o.c. notify the Architect for review.
   b. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A570 Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a minimum load rating of 2,000 lbs/ft. in concrete. Select channel nuts suitable for strut and rod sizes.
   c. Provide inserts for placement in form-work before concrete is

poured.

d. Provide inserts for suspending hangers from reinforced concrete slabs and sizes of reinforced concrete beams.
e. Where concrete slabs form finished ceilings, provide inserts to be flush with slab surface.
f. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

O. Vibration Isolation and Supports:
1. Refer to Section “Vibration Isolation and Seismic Restraints” for vibration isolation requirements.
2. All horizontal runs of pipe in all mechanical equipment rooms, and for a distance of fifty (50) equivalent pipe diameters beyond the respective mechanical equipment rooms, shall be isolated from building structure by means of units designed for insertion of rids. Selection of correct isolators for each application shall be made by the vibration isolation manufacturer subject to approval of the Architect.

P. Accessories:
1. Hanger rods shall be threaded both ends, or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain or perforated straps shall be allowed.
2. Shields shall be 180° galvanized sheet metal, 12” minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe.
3. Pipe protection saddles shall be formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inches shall have a center support rib.

Q. Finishes:
1. Hangers not in direct contact with copper pipe shall be zinc plated in accordance with ASTM B633, SC3 or have an electro-deposited epoxy finish.
2. Strut channels shall be pre-galvanized in accordance with ASTM A653 G90 or Strut channels shall be electro-deposited epoxy finish.
3. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123.
4. Hangers and strut located in corrosive areas shall be Type 316 stainless steel with matching stainless steel hardware.
5. Hangers and clamps for support of bare copper piping shall be painted with electro deposited copper colored epoxy.

R. Support Spacing:
1. Horizontal steel piping shall be supported in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

NOMINAL PIPE SIZE	ROD DIAMETERS	MAX. SPACING
1/2” - 1½”	3/8”	7’0’
1½”	3/8”	9’0”
2”	3/8”	10’0”
2½”	1/2”	11’0”
3”	1/2”	12’0”
4”	5/8”	14’0”

2. Horizontal copper tubing shall be supported in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

NOMINAL TUBE SIZE	ROD DIAMETERS	MAX. SPACING
1/2" – 3/4"	3/8"	5'0'
1"	3/8"	6'0"
1¼"	3/8"	7'0"
1½"	3/8"	8'0"
2"	3/8"	9'0"
2½"	1/2"	10'0"
3"	1/2"	11'0"
4"	1/2"	12'0"

S. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non-adhesive isolation tape. Galvanized felt isolators sized for copper tubing may also be used.

T. Install hangers to provide a minimum 1/2 inch space between finished covering and adjacent work.

U. Place a hanger within 12 inches of each horizontal elbow.

V. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every other floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

W. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified herein above. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to schedule herein above.

X. Do not support piping from other pipes, ductwork or other equipment which is not building structure.

2.29 PIPING MATERIALS

A. All piping materials installed under this section shall be new and shall consist of the following materials of construction:

System of Section	Piping Class
Hot Water Supply and Returns	2
Make-Up Water	20
Relief Valve and Vent Lines	2
Drain Lines	2
Cooling Coil and Louver Condensate Pan Drains	20
Chemical Feed	9
Refrigerant Piping	12

Note: Class 20 piping may be used in lieu of Class 2 piping for two-inch (2") and smaller diameter piping for hot water and any size drain line.

B. Class 2 Piping System

	2 Inches and Smaller	2-1/2 Inches and Larger
Construction	Screwed construction with screwed or flanged connections to equipment.	**Grooved jointed or** Butt-welded construction with flanged connections to valves and equipment.
Piping	Carbon steel, Schedule 40, ANSI B36.10, ASTM A120.	Carbon steel, Schedule 40 to 8"; Schedule 30 for 10" to 18"' Schedule 20 for 20" to 24"; ANSI B36.10, ASTM A53, Grade A or B (except that all steam and hydronic heating systems piping shall be Schedule 40).
Fittings	Malleable iron, 150 lb. class screwed ends, ANSI B16.3, ASTM A197.	Carbon steel, schedule to match piping, butt-weld ends, ANSI B16.9, ASTM A234, Grade WPA.
Couplings	Same as "Fittings" above.	
Unions	Malleable iron, 300 lb. class, screwed ends, ANSI bronze-to-bronze type, ANSI B16.5, ASTM A181, Grade 1.	Forged steel, 150 lb. ANSI Standard weld-neck type flange, ANSI B16.5, ASTM A181, Grade 1.
Flanges	Forged steel, 150 lb. ANSI standard screw-on type, ANSI B16.5, ASTM A181, Grade 1.	Same as "Unions" above.

C. Class 9 Piping System

	2 Inches and Smaller	2-1/2 Inches and Larger
Construction	Screwed construction with screwed or flanged connections to equipment.	Butt-welded construction with flanged connections to valves and equipment.
Piping	Stainless steel, Schedule 40, ANSI B36.26, ASTM A312, Grade TP 304L.	Stainless steel, Schedule 40, ANSI B36.26, ASTM A312, Grade 304L.
Fittings	Forged stainless steel, 2000 lb. ANSI standard, screwed type, ANSI B16.11, ASTM A182, Grade F304.	Forged stainless steel, Schedule 40, butt-welded ends, ANSI B16.9, ASTM A182, Type 304L.
Couplings	Same as "Fittings" above.	
Unions	Forged stainless steel, 2000	Forged stainless steel, 300 lb.

	lb. ANSI standard, socket-welded stainless steel seats, ASTM A182, Grade F304.	ANSI standard, weld-neck type flange, ASTM A182, Grade F304.
Flanges	Forged stainless steel, 300 lb. ANSI standard, socket-welded type, ASTM A182, Grade F304.	Same as "Unions" above.

D. Class 12 Piping System

	All Pipe Sizes
Construction	Hard brazed joints.
Piping	Copper tubing, Type ACR, hard drawn; cleaned, dehydrated and capped for refrigeration service, ANSI B70.1, ASTM A280. **5/8" OD and Smaller: Soft Copper tubing is acceptable.**
	All Pipe Sizes
Fittings	Wrought copper, brazed joint type, ANSI B16.22.
Couplings	Same as "Fittings" above.
Brazing Alloy	East Flo, Sil Fos, Phos. Co. minimum 1100 ºF melting temperature ASTM B260.

E. Class 20 Piping System

	2 Inches and Smaller	2-1/2 Inches to 8 Inches
Construction	**Pressed fitting or** Soldered joint construction with threaded adaptors.	Screwed construction with flanged connections to valves and equipment.
Piping	Copper, Type L, hard drawn, ANSI H23.1, ASTM B88.	Carbon steel (galvanized), Schedule 40, ANSI B36.20, ASTM A120.
Fittings	Cast bronze or wrought copper, solder joint type, ANSI B16.19 or B16.22.	Cast iron (galvanized), 125 lb. class, screwed ends, ANSI B16.3, ASTM A197.
Couplings	Same as "Fittings" above.	Same as "Fittings" above.
Unions	Wrought copper, solder joint	Malleable iron fittings

type, ANSI B16.19 or B16.22. (galvanized), 125 lb. ANSI standard, screw-on type, ANSI B16.1.

F. Flange Bolts and Nuts
1. Cl to Cl, Cl to CS, Cl to CB and CB to CB.
2. Bolts: ANSI, B181, ASTM A307, Grade B, square head, coarse threaded series, Class 2B fit.
a. CS to CS
b. Stud Bolts: ASTM A193, Grade B7, Class 2A fit.
c. Nuts: ANSI B18.2.2, ASTM A194, Grade B7, heavy hexagonal series, semi-finished, Class 2B fit.

G. Gaskets: For all pipe classes except as note:
1. Gaskets: Flat ring 1/16-inch thick rubber, Garlock Style 3100 graphite or equal. ADA rated for service.
2. For make-up water service and cooling tower water.
a. Gaskets: Full face 1/16-inch thick rubber, Garlock 22 or equal.
b. For fuel oil service:
1) Gaskets - Garlock 2021.

H. Solder for Class 20 Piping: 95-5 tin antimony or 95.5 lead-tin conforming to ASTM B32, allow Grade 5A.

2.30 REFRIGERANT PIPING AND SPECIALTIES

A. Summary:
1. Extent of refrigeration piping, fittings, valves and accessories is indicated (on the drawings and by the requirements of this section and section 15B.03 “General Requirements – Mechanical”).
a. Refrigeration piping is specified on a performance basis and the Contractor is responsible for the design and preparation of shop drawings covering all refrigeration piping work.
2. Related Sections: Refer to other Division 15 sections for the following:
a. Mechanical Insulation

B. Quality Assurance:
1. Codes and Standards: Provide refrigeration piping conforming to the requirements of the following:
a. Air Conditioning and Refrigeration Institute (ARI).
b. American National Standards Institute (ANSI).
c. American Society for Testing and Materials (ASTM).
d. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
e. Manufacturer’s Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

C. Submittal:
1. Refer to Section 15B.02, “Submittals” for basic information relating to submittal requirements.
2. Product Data: Submit manufacturer’s technical product data on the following:
a. Refrigerant Valves
b. Refrigerant Specialties

D. Refrigerant Piping:
1. Refrigerant Piping: Dimensions and material requirements for pipe, pipe fittings and components shall conform to ASHRAE 15 and ANSI B31.5 and shall be compatible with fluids used and capable of withstanding the pressures and temperatures of the service.
a. Tubing used for refrigerant service shall be cleaned, sealed, capped, or plugged prior to shipment from the manufacturer's plant.
2. Composite Pipe Option
a. At contractor's option the use of "Multi -Flex Pipe" may be used for pipe up to 1-1/8" and units up to 5 tons. It shall be capable of a temperature range from -40*F-220*F and a working pressure of 650psi.
b. Pipe must carry the following approval: ICC-ES LC 1035-2013 report PMG-1221.
c. Pipe must be in Compliance with the following codes:
2015- (IMC) International Mechanical Code
2015- (IRC) International Residential Code
2012- (UMC) Uniform Mechanical Code
d. Pipe shall carry a 25 year warranty against defects in material and workmanship." Multi-Flex Pipe" is represented by Green Technology Associates of Hingham, MA.

E. Valves and Accessories:
1. Valves: Provide valves designed, manufactured and tested specifically for refrigerant service.
a. Internal parts shall be removable for inspection or replacement without applying heat or breaking pipe connections. Threaded ends of valves shall conform to ANSI B2.1.

F. Execution – General:
1. Installation: Install piping components to ensure proper and efficient operation of the equipment and controls and in accordance with manufacturer's printed instructions.
a. Provide proper supports for the mounting of vibration isolators, stands, guides, anchors, clamps and brackets.
b. Provide piping connected to equipment with vibration isolators with flexible connections which shall conform to vibration and sound isolation requirements for the system.
c. Conform to ASHRAE 15 and ANSI B31.5.

2.31 PRESSURE GAUGES

A. Pressure gauges shall be of sizes, types and capacities specified herein and located as indicated on the drawings. Equipment shall be as manufactured by Ashcroft, Trerice or Manning, Maxwell, Maxwell and Moore.

B. Except as otherwise indicated, all gauges shall be 4½ inch diameter stainless steel case and ring phosphor bronze bourbon type, 1 percent full scale accuracy and bottom connection. Gauges for panel mounting shall have stainless steel flush mounting ring and back connection. Gauges for fluid handling service shall have isolating cock and also fitting with pulsation dampeners and red setpoint indicators at pump inlets and outlets. Gauges for steam service shall have coil syphon and isolating cock. All cocks shall be rated at 150 WSP except on HP steam service, 250 WSP.

C. Gauge range shall be as follows:
1. Hot Water 0-100 PSIG

Note: Mount all gauges so as to be read from floor. Provide two (2) spare gauges for each range indicated.

2.32 PUMPS

A. Pumps shall be of sizes, types, capacities and arrangements indicated on Drawings. Equipment shall be manufactured by Taco, Bell and Gossett, Grundfos or Armstrong.

B. Equipment shall be complete shop-assembled packages with pump, motor drive couplings, pump base assemblies and accessories. All equipment shall be shop primed and finish painted. All pumps shall be field checked for alignment and corrected prior to start-up. This Contractor shall be responsible for insuring compatibility of chemical treatment program with pump seals used. Pumps shall not overload their drivers along any point of their entire operating curves. All pumps shall have suction and discharge flanges drilled and tapped for pressure gauge installation. All pumps shall be capable of operating at water temperatures from 35 degrees F. to 250 degrees F. All pumps shall have drip bases. Drip bases to be piped to floor drain and shaft seal drains shall be piped to drip base by this Contractor.

C. Inline Suction Pumps: Pumps shall be base mounted, single stage, double suction design with a foot mounted volute to allow servicing of the impeller and bearing assembly without disturbing piping connections.
1. Shall be rigidly coupled pipe-mounted types. Pump features shall include bronze impeller, alloy steel shaft, 100,000 hour ball bearings, cupro-nickel steel shaft sleeves, stuffing boxes, mechanical seals, 250 PSI test vertically split casings, flanged suction and discharge connections, rigid pump/driver coupling, coupling guard, motor driver and rigid pump-driver mounting baseplate and frame.
2. Pump volute shall be Class 30 cast iron, suitable for 175 PSI working pressure, with integrally-cast pedestal support feet. The impeller shall be cast bronze enclosed, double suction type, dynamically balanced, keyed to the shaft and secured by a locking cap screw.
3. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225 deg. F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal. Seals shall be capable of serviceability without disconnecting the pump from its piping.
4. Pump shall be rated for minimum of 175 psi working pressure. Volute shall have gauge tappings at the suction and discharge nozzles and vent and drain tappings at the top and bottom.
5. Pump bearing bracket shall have oil lubricated bronze journal and thrust openings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibrations shall be employed.
6. Motor shall meet NEMA specifications and shall be of the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by the Contractor after installation prior to start-up.
7. Each pump shall be factory tested per Hydraulic Institute Standards. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

D. End Suction Pumps: Pumps shall be base mounted, single stage, end suction design with a foot mounted volute to allow servicing of the impeller and bearing assembly without disturbing piping connections.

1. Pump volute shall be Class 30 cast iron with integrally-cast pedestal support feet. The impeller shall be cast bronze enclosed type, dynamically balanced, keyed to the shaft and secured by a locking cap screw.
2. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225 deg. F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.
3. Pump shall be rated for minimum of 175 psi working pressure. Volute shall have gauge tappings at the suction and discharge nozzles and vent and drain tappings at the top and bottom.
4. Base plate shall be of structural steel or fabricated steel channel with fully enclosed sides and ends, and securely welded cross members. Grouting area shall be fully opened. A flexible type, center drop-out design coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor. Coupler shall be shielded by a coupler guard securely fastened to the base.
5. Motor shall meet NEMA specifications and shall be of the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by the Contractor after installation.
6. Each pump shall be factory tested per Hydraulic Institute Standards. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.
7. Shall be flexible coupled base-mounted types. Pump features shall include bronze impeller, alloy steel shaft, 100,000 hour ball bearings, cupro-nickel steel shaft sleeves, stuffing boxes, mechanical seals, 250 PSI test vertically split casings, flanged suction and discharge connections, flexible pump/driver coupling, coupling guard, motor driver and rigid pump-driver mounting baseplate and frame.

D. Shop Drawings shall include complete dimension drawings of all equipment furnished, together with individual pump curves, and electric data.

2.33 RADIANT HEATING PANELS

A. Radiant heating panels shall be of the types, sizes and capacities indicated on the Drawings. Radiant heating panels shall be as manufactured by Sunel, Aerotech or Airtex.

B. Radiant heating panels shall be constructed of extruded aluminum with a approximate overall thickness of 0.115 inches. The panel shall consist of an assembly of five inch (5") strips to the width indicated on the drawings. The strips shall have a 0.495 inside diameter copper tube expanded within a circular cavity in the extrusion for an intimate 360º contact of copper tube to aluminum extrusion under all operating temperature conditions. Ends of tubes shall be swagged to 0.503 inches inside diameter for proper soldering fit of 3/8-inch Type"L" soft copper tubing. Panel size shall be as indicated on the drawings. Panel size shall be as indicated on the drawings. Panel face configuration and color shall be as selected by the Architect. The panel finish shall be two (2) coats of baked enamel painted after assembly.

C. Radiant heating panels shall be installed by a qualified Contractor.

1. Ceiling panel contractor qualifications:
   a. Be regularly and continuously in the business of installing radiant ceilings for a period of no less than five (5) ears prior to the bid date of this project.
   b. Have installed no less than twenty-five (25) radiant panel installations.
   c. Be certified by the manufacturer, in writing, as the authorized installing contactor.
   d. Provide a list of installations as per Paragraph 1.b above.
2. Testing
   a. The Radiant Ceiling Panel Subcontractor shall perform hydrostatic text on all circuits of radiant panels. The test shall assure that here are no leaks in the system up to 150 psi.
3. Others
   a. All supply and return piping to within twenty-four inches (24") of the radiant circuits and valves, strainers, unions, air vents, gauges and the like shall be furnished and installed by the Mechanical Contractor. Final connections shall be made by the Mechanical Contractor.
4. Installation
   a. Panels shall be installed in openings provided by others. Panels shall be trimmed and notched where required, to fit neatly at walls, columns and other projections.
   b. All interconnections shall be made by the radiant panel installed. Interconnections shall consist of 6'0" "loops".
   c. Insulation as specified shall be installed over all active radiant panels.
   d. Specified clips to hold down panels and wire hangers (for panels 24" wide or wider) shall be installed.
   e. All panels shall be left free of finger marks or other foreign matter.

2.34 REGISTERS, GRILLES AND DIFFUSERS

A. Registers, grilles and diffusers shall be of model, size and capacity and furnished as scheduled on the drawings. Equipment shall be as manufactured by Nailor, Krueger or Metal-Aire and shall be supplied with white baked enamel finish except where noted otherwise.

B. All supply registers shall be furnished with individually adjustable face louvers. Registers and grilles shall be supplied with white baked enamel finish except where noted otherwise.

C. Diffusers, registers and grilles for installation in walls or plastered ceilings shall be provided with sponge rubber frame gaskets and Phillips head screws for attachment of device frame to building construction.

D. The diffuser shall be provided with a removable core permitting easy access to core sections. Diffuser neck shall extend no less than 1 inch above the core to accommodate an internal duct connection to prevent leakage to ceiling space. Diffusers shall be assembled in patterns which provide one, two, three or four-way air discharge with each side delivering a quantity of air proportional to the area served.

E. When indicated by manufacturer’s model number on the equipment schedule, the ceiling diffusers shall be of the restricted multi-orifice jet induction and air mixing

type consisting of louver sections with built-in diffusing vanes. The vanes shall be arranged to discharge air from adjacent louvers at an angle of 45 degrees in opposite directions to ensure rapid mixing of primary and room air. Each individual diffusing vane shall be welded in place and mechanically fastened to adjacent louver sections to make a rigid unit. The vanes shall extend to the discharge edges of the louvers. Where louver sections join core frame, the louver ends shall be welded to core frame. The leaving edge of each louver shall be hemmed and the louver ends shall be rounded and hemmed before welding the core frames.

F. All duct connections to registers, grilles and diffusers shall have all interior surfaces with the line of sight or within 4 feet of the opening painted with dull black paint.

2.35 SHEET METAL WORK

A. General: Ductwork systems shall be fabricated and installed in accordance with recommendations contained in the SMACNA “HVAC Duct Construction Standards”, Third Edition 2005, and as herein specified. Tables and figures referred to hereinafter are taken from the SMACNA publication.

B. Duct Pressure Classes: As shown on drawings. Where no specific duct pressure class designations are provided on drawings, the 2 inch water gauge pressure class is the basis of compliance with the standards, regardless of velocity in the duct, except when the duct is variable volume supply or designated exhaust. All variable volume ducts upstream of VAV boxes have a 3 inch WG basis of compliance when the drawings do not give pressure class. All AC unit discharge plenums of VAV systems shall have a 6 inch WG basis and the ductwork to the first branch take-off a 4 inch WG basis of compliance when the drawings to do indicate a pressure class. Negative pressure ductwork between lab hoods and exhaust fan inlet shall be 5 inch water gauge pressure class. Snaplock construction is not permitted. Refer to NFPA for Smoke Exhaust Ductwork Gauge Requirements.

C. Casings and Plenums: Casing and plenum sheet metal gauges, reinforcing and construction details shall be in accordance with Figures 6-1 through 6-12. Intake and exhaust plenums shall be sealed liquid tight and drained. Where through-louver drainage cannot be achieved, a 1 inch drain connection with serviceable 3 inch deep trap, shall be provided within a heated space to prevent freezing, and piped to the nearest floor drain. Bottom of plenums shall pitch toward drainage openings.

D. Hangers and Supports: Ductwork sheet metal supports shall be in accordance with Chapter IV, including all plenum and casing sheet metal which is suspended.

E. Sealing: All duct joints and air device connections shall be sealed in accordance with Table 1-2 except that all supply systems shall be sealed Class A. The sealant shall be Hardcast 550 with imbedded fabric, except for joints with dissimilar metals then a lead gasket shall be provided. Louver plenums shall be sealed water tight to a height of 12 inches above the plenum bottom.

F. Branch Take-Offs: Branch main take-offs for round ductwork shall be 45 degree lateral tap and where terminal boxes occur, shall be 45° angle entry in accordance with Figure 2-6.

G. Elbows: Elbows for round ducts shall be stamped type elbows with centerline radius equal to 1.5 times duct diameter. Where space is limited, the centerline radius may be reduced to 1.0 times the diameter for only those ducts entering into corridor ceiling spaces from vertical duct shafts. Elbows for rectangular and oval ductwork

shall have a centerline radius equal to 1.5 times the duct width.

1. Where space is restricted and as approved in writing by the Engineer, square throat elbows with single or double thickness turning vanes may be used. Elbows shall be in accordance with Figure 2-2 except that throat types RE-4, RE-6, RE-7, RE-9 and RE-10 are specifically prohibited. Provide an access door upstream of all square throat elbows with single (or double) thickness turning vanes.

H. Transitions and Offsets: Transitions in round ducts shall be conical reducers. Transitions in rectangular ducts shall be in accordance with Figure 2-7 except that offset type 1 and offset type 2 are specifically prohibited.

I. Flexible Connections: Flexible connectors shall be installed to provide alignment of equipment and devices with ducts in operating positions. Provide on the inlet and outlet side of all air moving equipment incorporating rotating elements. Connections shall be of glass fiber reinforced neoprene captured by a fingered metal band at each edge. Maintain a maximum three inch (3") separation and a minimum 1½ inch separation between the connected devices such that a standard four inch (4") connector will be installed slack.

J. Access Doors: Access doors in sheet metal ducts shall be provided with sash locks. Access doors in casings and plenums shall be provided with Type 2 locks (handles). All doors shall be hinged. Door insulation shall match adjacent casings. Doors shall be provided on all plenum and mixing sections, fire dampers, smoke dampers, combination fire/smoke dampers, reheat coils (inlet side), air valves and terminal filter equipment.

K. Volume Dampers: Volume dampers shall be in accordance with SMACNA except that, in addition to those indicated on drawings, each branch main and branch shall be provided with damper typical to locations indicated in Figure 2-1. Additional dampers shall be provided where shown on plans, details and where specified elsewhere. Damper gauge to be two (2) gauges heavier than the duct in which they are mounted. Provide with locking quadrants or push rods and pillow blocks as appropriate. Dampers shall be sufficiently large to extend the full width of the branch duct to which it is attached. Provide scooped profile.

L. Fire Dampers and Smoke Dampers: Fire and smoke dampers shall be in accordance with National Fire Code NFPA 90A Standard requirements and bear an Underwriters label. Dampers shall be installed in accordance with manufacturer's installation instructions. Dampers shall be UL listed, labeled, and shall be dynamic-static designed in accordance with UL Standard 555. Dampers shall be listed to support the appropriate fire rating required for wall and/or floor penetrations served. Dampers in lined ducts shall be in accordance with Figure 2-22. Where required as a condition of damper listing, provide slip joint. To permit breakaway, no screws, rivets, bolts or other fasteners shall be used; each joint shall have an access door as applicable. Provide an access door in the duct to service fusible link. Access doors for insulated ducts shall be double wall insulated sandwich type. Fire dampers shall be out of air stream Type B or C. Combination fire/smoke dampers may be used in lieu of separate dampers. All smoke dampers and combination fire/smoke dampers shall be furnished with electric actuators, and appropriate UL label. Provide 10 gauge welded sleeve where dampers can not be placed directly into the fire and/or smoke wall.

1. All smoke dampers and fire/smoke dampers shall be supplied with electric/electronic actuators, 165 degree F. "McCabe Link" (for use in

general HVAC ductwork), 185 degree F. “McCabe Link” (for use in smoke control exhaust ductwork). All fire/smoke dampers shall be capable of being reset remotely. All fire/smoke dampers shall be supplied with one (1) end switch that will indicate both full closed and full open. All fire/smoke dampers shall fail open upon loss of control signal. All smoke dampers shall fail closed upon loss of control signal.

2. Except where specifically noted otherwise, the maximum permissible pressure drop for any fire damper at air flow quantity required by Design Documents shall not exceed 0.1 inches of water.
3. Except where specifically noted otherwise, the maximum permissible pressure drop for any smoke damper assembly at air flow quantity required by design documents shall be as follows:
   a. Up to 1,000 FPM 0.05 Inches of Water
   b. 1,000 to 2,000 FPM 0.10 Inches of Water
   c. Over 2,000 FPM 0.20 Inches of Water
4. Damper sizes shall be adjusted accordingly where required to reduce pressure drop.
5. Installed dampers found to have pressure drops in excess of specified values shall be replaced at no additional cost to the Owner.

M. All fire, smoke and combination fire/smoke dampers shall be dynamically rated for the following conditions:
1. Fan (VAV) Discharge to Terminal Units 3,500 FPM
2. Fan (CV) Discharge to Reheat Coils 1,500 FPM
3. Terminal Box/Reheat Coil Discharge to
   a. Terminal Device 1,000 FPM
4. Return/Exhaust Terminal Device
   a. Register to fan inlet 1,800 FPM

N. Exposed Ductwork: All ductwork exposed to view, except in mechanical rooms, shall not be cross-broken or beaded. Where reinforcement can not be eliminated by using heavy duty gauge, it shall be internal. Seams shall be of non-standing type and duct shall be cleaned and degreased to accept application of paint.

O. Flexible Ductwork: Shall be manufactured in accordance with UL-181, Class 0 and the amended Standards of NFPA 90A. The flexible ductwork shall be tested and listed by UL under these standards.
1. Ductwork shall be fabricated of minimum 0.0065” thick, grade 3003 aluminum alloy incorporating a “0” temper.
2. Spiral construction shall incorporate a continuous grooved seam, flat pipe lock, doubled over, to create an effective triple locking joint. Double locking seams shall not be accepted.
3. Corrugations formed into the spiral tape impart rigidity and shall support duct flexibility. Corrugations shall not exceed 3% of the nominal duct diameter.
4. Joints for securing to ductwork and/or equipment collars shall incorporate a reinforcing band around the circumference of the flexible duct and its connection point. Self-tapping sheet metal screws shall extend through the reinforcing band through the connecting collar, sandwiching the flexible ductwork between. Final air sealant shall be provided by Hardcast 550 with imbedded fabric.
5. Where associated ductwork is specified to be insulated, matching thickness insulating jacket, complete with vapor barrier, shall be used.
6. Length of flexible duct shall not exceed 48 inches except where specifically

noted otherwise on drawings.

7. Flexible ductwork shall not be used in conjunction with ductwork rated for 6 inches WG and higher. Flexible duct shall not be installed to penetrate any walls, ceilings, roofs, or floors.
8. The intent of this specification section is to allow the use of flexible ductwork as a final connection to a terminal device. Bends shall not exceed 90 degrees or have a radius less than inside diameter of duct.

P. Exhaust systems serving bathrooms, shower rooms and similar rooms where the exhaust air may contain a high moisture content shall be constructed of aluminum and shall be sealed watertight and pitched to prevent any accumulation of moisture. Provide a trapped drain at all low points and at the base of each riser.

Q. Exhaust systems serving laboratory exhaust hoods shall be constructed of Type 316 stainless steel with externally welded, liquid tight joints, unless indicated otherwise on the drawings.

R. Fabricate kitchen hood exhaust ducts and supports, used for smoke and vapor removal from cooking equipment, of 16-ga minimum welded carbon steel where concealed, and of 18-ga minimum welded stainless steel where exposed. For duct construction, comply with SMACNA "HVAC Duct Construction Standards", and NFPA 96 "Standard for Ventilation Control and Fire Protection of Commercial Cooling Operations" 1994 edition.

S. Provide 24 gauge piping sheet metal protective covers, shields or saddles to protect piping insulation. Protective covers shall totally encapsulate any and all exposed HVAC piping within six feet (6') of finished floor. Shields and saddles shall extend a minimum of six inches (6") ahead and behind the projected footprint of the pipe support addressed and shall completely cover the lower 180° arc of the insulated piping.

T. Acoustic Liner:
1. All ductwork noted on plans t be acoustically lined, shall have one-inch (1") thick "ToughGard R" duct liner with enhanced surface. Acoustical liner shall be composed of rotary-type glass fibers for superior acoustic performance. The fibers shall be bonded together with a thermosetting resin into a insulation blanket which is overlaid with a durable, water repellent, fire-resistant black composite air stream surface.
2. Acoustic liner shall comply with ASTM C1071 for air velocities up to 6000 FPM.
3. Acoustic liner shall comply with ASTM C1104 for vapor sorption.

Note: Duct dimensions shown are of clear inside dimensions after application of liner.

2.36 SLEEVES, INSERTS AND OPENINGS

A. General:
1. All penetrations for piping, ductwork and conduit in the building walls, floors and roof shall have sleeved or boxed openings except for interior wall of gypsum board and stud construction which are not fire or smoke rated.
2. The HVAC Subcontractor shall be responsible for informing this Contractor of the construction schedule as to permit orderly inclusion of all sleeves, openings and inserts. The HVAC Subcontractor shall furnish and install all sleeves, boxed openings and inserts as the work progresses. If the HVAC

Subcontractor fails to provide the sleeves, boxed openings and inserts, he shall bear the cost of modifications necessary for their inclusion.

3. All cutting and patching shall be done by this Contractor. The HVAC Subcontractor shall not cut into any building construction without first having received permission from the Architect.

B. Sleeves:
1. This Contractor shall furnish all sleeves for the work and furnish all labor for installation.
2. Sleeves through exterior building walls or through concrete construction shall be Schedule 40 (galvanized) steel pipe. Sleeves through interior fire or smoke rated walls of gypsum and stud construction shall be 10 gauge sheet metal.
3. Sleeves shall be sized to provide a total of not less than 1/2 inch clearance around the piping, duct or conduit together with any insulation cover.
4. Sleeves for setting into walls shall be flush with finished construction. Sleeves for setting into floors shall be imbedded in concrete slab and extend approximately 1 inch above finished floors. Sleeves through floors of mechanical rooms shall be 12 gauge and shall extend 4 inches above the floor. Sleeves shall be provided with lugs or flanges to permit firm attachment to the building construction. Wall sleeves shall not be used as support points.
5. All sleeved openings within the building shall be sealed airtight using fire barrier caulking with a UL classification for use as a fire barrier penetration seal for walls and floors with up to a three-hour fire rating, expanded into place for the full depth of the sleeve. Sleeved openings through exterior walls and floor shall also be sealed outside using waterproof mastic.

C. Inserts:
1. Inserts or other type anchoring devices shall be provided for the support of piping, ducts, or equipment in masonry or concrete construction. Inserts shall be as specified under pipe supports.
2. The HVAC Subcontractor shall furnish and install all inserts.

D. Openings:
1. Openings shall be framed or boxed by the HVAC Subcontractor.
2. Floor openings into mechanical rooms shall be provided with 4 inch high concrete curbs around the entire opening perimeter. All wall openings shall be flush with both surfaces.
3. Fire damper frames to be set into masonry or concrete construction shall be set into place at the time of the construction of the respective floor or wall. Exterior plywood covers shall be applied to both sides of fire dampers to prevent damage prior to making duct connections.
4. Openings for the passage of ducts and piping shall have 1/2 inch clearance all around the finished piping or duct and insulation. Boxed openings for gang piping shall be provided with 18 gauge sheet metal on both sides of penetration secured to the opening perimeter cut to fit the pipe shape and the clearance space within the opening filled with fire barrier caulking with a UL classification for use as a fire barrier penetration seal for walls and floors with up to a three-hour fire rating, expanded into place so as to make the penetration airtight.

E. Escutcheon Plates: Escutcheon plates shall be provided for all pipe penetrations into finished spaces as follows:

1. Pipe penetrations shall have chromium plated spun or pressed brass two-piece hinged escutcheon covers sized to fit the piping and insulation (if any) outside diameter and cover pipe sleeve.
2. Duct penetrations shall be 28 gauge stainless steel strips fastened with stainless steel screws or bolts and sized to cover the duct with any insulation and the wall opening. Round ducts shall be provided with escutcheon plates as indicated above for piping.
3. Penetrations through finished floors shall have matching finish extension escutcheon sleeves sized to the escutcheon and finished in a neat, workmanlike manner.

2.37 SOUND ATTENUATORS

A. Silencers shall be of the size, configuration, capacity and acoustic performance as scheduled on the drawings. All silencers shall be factory fabricated and supplied by the same manufacturer. Silencers shall be Kinetics, Vibro-Acoustics, IAC, United McGill or VAW.

B. Alternate manufacturers must request and obtain written approval by the Engineer to bid the project at least 10 days prior to the bid due date. As a condition of pre-approval, alternate manufacturers must submit to the Engineer a minimum of twenty (20) different HVAC silencer test reports. Each report shall be for a silencer tested in full accordance with the ASTM E-477-99 silencer test standard in an aero-acoustic test facility which is NVLAP accredited for the ASTM E477-99 standard. Each test shall have been conducted within the last 12-month period. A copy of the laboratory's NVLAP accreditation certificate must be included with the submitted reports. Any changes to the specifications must be submitted and approved in writing by the Engineer at least 10 days prior to the bid due-date.

C. Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings.

D. Elbow Silencers: All elbow silencers, including models REFL shall be constructed with an HTL casing and 22 gauge galvanized perforated steel. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48" shall have at least two half splitters and one full splitter.

E. Rectangular Silencers:
1. All rectangular silencers shall be constructed with a 22-gauge galvanized steel outer casing and 26 gauge galvanized perforated steel liner.

F. Acoustic Media:
1. Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly. Media shall be bacteria and fungus resistant, resilient such that it will not crumble or break, and conforming to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.

G. Media Protection;

1. Media shall be encapsulated in glass fiber cloth to help prevent shedding, erosion and impregnation of the glass fiber.

H. Silencer materials, including glass fiber, shall have maximum combustion ratings as noted below when tested in accordance with ASTM E84, NFPA 255 or UL 723.
1. Flamespread Classification: 15
2. Smoke Development Rating: 5

I. Elbow silencers shall have high transmission loss (HTL) walls externally applied and completely sealed to the silencer casing by the silencer manufacturer to assure quality controlled transmission loss. The HTL walls shall consist of media, airspace, mass and 10-gauge outer protective metal skin to obtain the specified room noise criteria. Standard acoustical panels will not be accepted as HTL walls. If requested by the Engineer, breakout noise calculations for each air handling and fan system shall be provided with the silencer submittal to insure compliance with the room noise criteria. Breakout noise calculations shall be based on the sound power levels of the specified equipment.

J. Silencers shall be constructed in accordance with ASHRAE and SMACNA Standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges noted in "Section B Materials" are minimums. Material gauges shall be increased for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.
1. Casings shall be lockformed and sealed, except as noted in Section B Materials, to provide leakage resistant construction. Airtight construction shall be achieved by u se of a duct-sealing compound supplied and installed by the Contractor at the job site.
2. All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.

K. Acoustic Performance:
1. Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule.
2. Silencer generated noise shall not be greater than that listed in the silencer schedule.
3. Acoustic performance shall include dynamic insertion loss and generated noise for forward flow (air and noise in same direction) or reverse flow (air and noise in opposite direction) in accordance with the project's air distribution system requirements.
4. All silencer ratings shall be determined in a duct-to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with the ASTM E-477-99 test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.

L. Silencer pressure drops shall not exceed those listed in the silencer schedule. Silencer pressure drop measurements shall be made in accordance with the ASTM E-477-99 test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.

M. The manufacturer shall supply certified test data for each scheduled silencer. The data shall include dynamic insertion loss, generated noise and pressure drop for forward or reverse flow, matching the project's air distribution system requirement.

All ratings shall be conducted in the same facility and shall utilize the same silencer.

1. Test facilities and test reports shall be open to inspection upon request from the Engineer. Silencer performance must have been substantiated by laboratory testing according to ASTM E477-99 and so certified when submitted for approval. The aero-acoustic laboratory must be NVLAP accredited for the ASTM E477-99 test standard. A copy of the accreditation certificate must be included with the submittals. Data from non-NVLAP accredited test facilities will not be accepted.

2.38 STRAINERS

A. Strainers shall be provided where shown on the drawings and as specified herein. Equipment shall be as manufactured by Sarco, RP&C, Mueller, Armstrong or Barnes and Jones.

B. Strainers shall be provided on inlets to all pressure regulating valves, temperature control valves and makeup water control valves. Strainer baskets shall be heavy duty perforated type with openings sized as recommended for the line size and service by the manufacturer. All strainers 2½ inch size and larger shall be provided with blow-down valves. Blow-down valves shall be ball valves, exception high and medium pressure steam service where gate valves specified for service shall be used. Blow-down valves shall have short nippled outlets angled down toward floor. Strainers on horizontal steam lines shall have to be installed with basket section installed horizontally and blow-down connections rotated to basket low point.

C. Strainers for all services, except as otherwise specified, shall conform to the following:
   1. Strainers on lines 2 inches and smaller shall have 250 working steam pressure bronze bodies with screwed ends.
   2. Strainers on lines 2½ inches and larger shall have 125 working steam pressure semi-steel bodies with flanged ends.

D. Strainers for high pressure steam and medium pressure steam service shall conform to the following:
   1. Strainers on lines 2 inches and smaller shall have 600 pound cast steel
   2. Strainers on lines 2½ inches and larger shall have 300 pound cast steel bodies with flanged ends

2.39 SUPPLEMENTAL SUPPORT SYSTEM

A. This Contractor shall provide all supplemental supports required to direct equipment and materials support loads to approved structural load bearing points. All mechanical equipment and systems shall be substantially supported without distortion or excessive vibration. The methods of support shall be as hereinafter described, except as otherwise noted on the drawings.

B. The supplemental support system shall be substantial type with members sized to prevent equipment distortion or excessive vibration. The HVAC Subcontractor shall provide support components such that all equipment shall operate without objectionable noise or vibration being transmitted to the structure.

C. The supplemental support system shall conform to requirements of this specification. Manufacturer's published characteristics referenced are intended as a guide only. The supplier shall verify support elements submitted are in accordance with specified materials and construction and are appropriately sized to accept and

direct the proposed loading.

D. All supplemental support elements shall be by one (1) manufacturer: Unistrut, B-Line or Telestrut. The acceptable standard or quality shall be as follows:
   1. Framing Members:
      a. Nominal Size: 1⅝" x 1⅝" "U" channel
      b. Body: Mild Carbon Steel, ASTM A570 Grade 33
      c. Gauge: 12 Gauge (0.105" thick)
      d. Slot Width: 7/8" nominal
      e. Pre-Punching: 9/16" Diameter, 1⅞" on center, 3 sides
      f. Finish: Hot-Dipped Galvanizing, G90 weight, ASTM A123
      g. Conformance: Metal Forming Manufacturers Association (MFMA) Standard Publication MFMA-1.
   2. Fittings:
      a. Nominal Size: 1⅝" (length per device)
      b. Shape: Per Service from Manufacturer's Standard Catalog
      c. Body: Hot Rolled Mild Carbon Steel, ASTM A570, Grade 33
      d. Gauge: 1/4" Nominal Thickness
      e. Hole Size: 9/16" Nominal
      f. Finish: Hot Dipped Galvanizing, G90 weight, ASTM A123
      g. Conformance: Metal Forming Manufacturer's Association (MFMA) Standard Publication MFMA-1
   3. Accessories:
      a. Nominal Size: Per Service from Manufacturer's Standard Catalog
      b. Shape: Per Service from Manufacturer's Standard Catalog
      c. Body: Hot Rolled Mild Carbon Steel, ASTM A570, Grade 33
      d. Gauge: 1/4" Nominal Thickness
      e. Hole Size: 9/16" Nominal
      f. Conformance: Metal Forming Manufacturer's Association (MFMA) Standard Publication MFMA-1.
      g. Rollers: Gray Cast Iron
   4. Nuts and Bolts:
      a. Nominal Size: 1/2" diameter x (Size per device)
      b. Body: Mild carbon steel, ASTM A570, Grade 33, and Case Hardened
      c. Threading: Coarse, Unified & American, UNC Classes 2A and 2B
      d. Mounting: Spring or non-spring
      e. Finish: Electro-Galvanized, G90 weight, ASTM A123
      f. Conformance: Metal Forming Manufacturer's Association (MFMA) Standard Publication MFMA-1

E. Supplemental support system members shall be positioned to align with equipment support points for proper bolting.

2.40 TERMINAL BOXES

A. Single duct type with hot water coils:
   1. Terminal Casing
      Furnish and install Enviro-Tec, Nailor or Metal-Aire, single duct terminals of sizes and capacities (CFM) indicated on the drawings. Terminals shall be constructed of not less than 24 gauge zinc-coated steel, mechanically assembled and sealed to form an air-tight casing; maximum air leakage of 2 % at 3" w.g. Spot-welded casings are not acceptable. Interior walls of the terminal casing shall be lined with 1/2 -inch dual-density fiberglass with 4 pounds per cubic foot skin density, rated for a maximum air velocity of 4500

fpm. Insulation must meet all requirements of UL 181 and NFPA 90-A. Raw edges exposed to the airstream shall be coated and sealed. Sound power data shall be submitted with no corrections or noise reduction factors applied.

2. Air Control Valve Assembly
Terminal air control valve shall be dual-wall construction, consisting of two (2) metal thicknesses with ½-inch dual-density insulation sandwiched between, creating an effective radiated sound barrier. Insulation shall be as specified for terminal casing. The control blade of the air valve shall be 16-gauge, designed to operate through a 45-degree arc. Multi-blade dampers and single blade volume controllers (operating through 90º) are not acceptable. The control blade shall be bolted or welded to a continuous shaft which rotates in self-lubricating nylon bearings. Blade shall close against a closed-cell gasket seat; it shall be preloaded to insure a tight seal. Blade shall not deflect at inlet pressures up to 6" w.g. Eliptical or oval dampers are not an acceptable substitution.

3. Controls
Terminal unit control shall be furnished by the ATC Contractor and factory installed by the terminal box manufacturer. See ATC Specification Paragraph 2.54. The terminal box manufacturer shall bear all costs associated with mounting the controls. Terminal boxes shall be provided with a sheetmetal control enclosure. Provide a factory-applied typed label unique to each VAV terminal box indicating DDC address, TAG, maximum flow setting, minimum flow setting.

4. Pressure-Independent Models with Pressure Differential Controller
Pressure differential reset controller shall maintain setpoint (CFM) within 5%, regardless of system pressure change. CFM limiting devices are not acceptable. The reset controller shall constantly monitor thermostat input, air flow (CFM), and system static and total pressures in a manner as to minimize under-or over-controlling in relation to the space temperature requirements. The reset controller shall be capable of field adjustment of minimum and maximum CFM settings without the use of tools. Flow curve for field balancing shall be affixed to terminal casing. Differential flow taps and factory-set CFM shall be provided is so noted at terminal schedule on the drawings. Controller shall maintain pressure independence to as low as .03" w.g. Averaging sensor shall be mounted in the inlet of the terminal and shall provide a minimum of one air pickup point for each 2-1/2" of inlet diameter. Single-point differential sensors are not acceptable.

5. Hot Water Coil
Terminals shall include a hot water coil. Coil shall be attached to the terminal with slip-and-drive connection, to allow removal for maintenance or cleaning. Coil shall be constructed of pure aluminum fins of .005" to .010" thickness, with die-formed spacers. Fins shall be mechanically fixed to .017" copper tubes for maximum heat transfer. Coils shall be tested at 320 p.s.i.g. air-under-water.

2.41 THERMOMETERS

A. Thermometers shall be of sizes, types and capacities specified herein, and shall be located as indicated on the drawings. Equipment shall be as manufactured by Taylor Company, Mueller Company or Foxboro Company.

B. Thermometers shall be industrial type with 9 inch scale, red perma colored liquid, black scale divisions on white background, union hub, separable brass well and adjustable swivel base. Provide extension wells on insulated lines. Locate wells so

as to provide minimum restriction to flow.

C. Thermometer ranges shall be as follows:

Hot Water (All)	30-240 Degrees F.
Makeup Water	0-110 Degrees F.

Note: Mount all thermometers so as to be read from the floor. Provide two (2) spare thermometers of each range indicated.

2.42 UNIT HEATERS

A. Unit heaters shall be of sizes, capacities for the throw and mounting heights indicated on the drawings. Equipment shall be of manufacturer and size scheduled on the drawings, or approved equal as manufactured by Sterling, Vulcan, Rosemex or Rittling.

B. Horizontal unit heaters shall have direct driven propeller fan, steel fan guard, vertically adjustable louvers, horizontally adjustable fins and built-in motor thermal overload protection.

C. Vertical unit heaters shall have direct driven propeller fan, steel fan guard, adjustable outlet diffusers and built-in motor thermal overload protection.

2.43 VALVES

A. All valves shall conform to requirements of this specification for the services indicated. Manufacturer's numbers referenced are intended as a guide only. The supplier shall verify valves submitted are in accordance with specified materials and construction.

B. All valves of a given type shall be by one (1) manufacturer. The acceptable standard of quality shall be as follows.

C. Gate Valves: Jenkins, Grinnell or Crane

Nominal Size	Through 2"	2½" and above
Service	Hot Water	Hot Water
Pressure Rating	125 PSIG Steam, 200 PSIG WOG	125 PSIG Steam, 200 PSIG WOG
Body	ASTM B-62 Bronze; Threaded	ASTM A-126 Class B; Flanged
Bonnet	ASTM B-62 Bronze; Rising Stem	ASTM A-126 Class B; Bolted OS&Y
Bolts	N.A.	ASTM A-307
Gaskets	N.A.	Non-Asbestos Graphite/Aramid Fiber
Packing	Non-Asbestos Graphite/Aramid Fiber	Non-Asbestos Graphite/Aramid Fiber
Stem	ASTM B-371 Alloy C69400 or ASTM B-99 Alloy C65100 H04	ASTM B-16 UNS-C36000
Wedge	ASTM B-62 Bronze	ASTM A-126 Class B Cast Iron
Conformance	WW-V-54 Class A, Type I & MSS-SP-80	WW-V-58 Class 1, Type 1 & MSS-SP-70

D. Globe Valves: Jenkins, Grinnell or Crane

Nominal Size	Through 2”	2½” and above
Service	Hot Water	Hot Water
Pressure Rating	125 PSIG Steam, 200 PSIG WOG	125 PSIG Steam, 200 PSIG WOG
Body	ASTM B-62 Bronze; Threaded	ASTM A-126 Class B; Flanged
Bonnet	ASTM B-62 Bronze; Rising Stem	ASTM A-126 Class B; Bolted OS&Y
Bolts	N.A.	ASTM A-307
Gaskets	N.A.	Non-Asbestos Graphite/Aramid Fiber
Packing	Non-Asbestos Graphite/Aramid Fiber	Non-Asbestos Graphite/Aramid Fiber
Stem	ASTM B-371 Alloy C69400	ASTM B-16 UNS-C36000
Seat Disc	ASTM B-62 Bronze	ASTM B-584 Alloy C84400 Bronze or ASTM A-126 Class B Cast Iron
Seat Ring	N.A.	ASTM B-584 Alloy C84400 Bronze
Conformance	WW-V-51 Class A, Type I & MSS-SP-80	MSS-SP-85

E. Butterfly Valves: Jamesbury, Grinnell or Rockwell

	Two-Way	Three-Way
Nominal Size	3” and above	3” and above
Service	Bubble Tight, Dead End for Hot Water	Bubble Tight, Dead End for Hot Water
Pressure Rating	125 PSIG Steam, 200 PSIG WOG	125 PSIG Steam, 200 PSIG WOG
Body	ASTM A-395 60-40-18 or ASTM A576 65-45-12 Ductile Iron; Lug Style	ASTM A-395 60-40-18 or ASTM A576 65-45-12 Ductile Iron; Lug Style
Liner	Ethylene Propylene Diene Monomer	Ethylene Propylene Diene Monomer
Disc	ASTM A-351	ASTM A-351
Disc Coating	Ethylene Propylene Diene Monomer	Ethylene Propylene Diene Monomer
Shaft	ASTM A-276 Type 316 Stainless Steel	ASTM A-276 Type 316 Stainless Steel
Bearings	ASTM B-584 Alloy C93200 Bronze	ASTM B-584 Alloy C93200 Bronze
Bushings	ASTM B-584 Alloy C93200 Bronze	ASTM B-584 Alloy C93200 Bronze

Operator	Infinite Lever w/Memory Stop (to 6"φ); Chain Wheel w/Gear Operator (above 6"φ)	Chain Wheels w/Gear Operators Interconnected
Conformance	MSS-SP-67 & 46CFR56.20-15(b)(1)	MSS-SP-67 & 46CFR56.20-15(b)(1)

F. Ball Valves: Jamesbury, Grinnell or Watts

Nominal Size	To 3" φ
Service	Hot Water
Pressure Rating	125 PSIG Steam, 400 PSIG WOG
Body	ASTM B-584 Alloy 845 Bronze, Threaded (to 2"φ) or Soldered (2½"φ & 3"φ)
Thrust Washer	Reinforced Polytetrafluoro ethylene
Ball	ASTM B-584 Alloy 845 Bronze; Full Port
Seats	Reinforced Polytetrafluoro ethylene (Teflon)
Stem	ASTM B-371 Alloy 694 Silicon Bronze
Packing	Reinforced Polytetrafluoro ethylene (Teflon)
Packing Nut	ASTM B-16
Operator	Infinite Lever w/Memory Stop
Conformance	WW-V-35, Type II, Class A, Style 3

G. Swing Check Valves: Grinnell or Watts

Nominal Size	2½" and above
Service	Hot Water
Pressure Rating	125 PSIG Steam, 200 PSIG WOG
Body	ASTM A-126 Class B; Flanged
Bonnet	ASTM A-126 Class B; Bolted
Bolts	ASTM A-307
Gaskets	Non-Asbestos Graphite/Aramide Fiber
Disc	ASTM B-584 Alloy C84400 Bronze
Hanger	ASTM B-584 Alloy C84400 Bronze
Seat Ring	ASTM B-584 Alloy C84400 Bronze
Conformance	MSS-SP-71 Type I

H. Silent Check Valves: Grinnell or Watts

Nominal Size	2½" and above
Service	Hot Water
Pressure Rating	125 PSIG @ 200°F., 230 PSIG WOG
Body	ASTM A-48 Class 35; Globe Style, Flanged
Stem	ASTM A-582 Alloy S30300 Stainless Steel
Disc	ASTM B-584 Alloy 836 Bronze
Spring	ASTM A-313 T304 Stainless Steel
Seat Ring	ASTM B-584 Alloy 836 Bronze
Conformance	N.A.

I. Temperature Control Valves: Shall be provided by the Automatic Temperature Control Subcontractor in conformance with the standards specified above. Valves shall be installed by the HVAC sub-contractor in accordance with the requirements

of the ATC Subcontractor.

J. Valves five inches (5") and larger shall be independently supported.

K. Sprocket Wheels and Chains: Sprocket wheels and chains shall be furnished and installed on all hand operated valves 2½ inches in diameter and larger which can not be operated from any mechanical room floor.

2.44 VARIABLE FREQUENCY DRIVES

A. General
1. The Contractor shall provide a complete adjustable frequency controller as indicated on the drawings.
2. The Contractor shall be responsible for the installation and start-up of the equipment covered by this specification.
3. The adjustable frequency controller shall be furnished by a single vendor who has actively been manufacturing adjustable frequency controllers for a period of at least five (5) years.
4. Complete drawing shall be furnished for approval and shall consist of master wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the adjustable frequency controllers. Suitable outline drawings showing details necessary to located conduit stub-ups and field wiring shall be furnished for approval before proceeding with manufacture.
5. The adjustable frequency controller shall be UL and CSA certified and shall comply with the latest applicable standards of ANSI, IEEE, NEMA and national Electrical Code.
6. Adjustable frequency controller manufacturer shall maintain and staff engineering service, within one hundred (100) actual miles of the site, to provide start-up service, emergency service calls, repair work, service contracts, maintenance and troubleshooting training of customer personnel.

B. Construction
1. The adjustable frequency controller shall be rated 460 volt, 3 phase, with feature and options as specified.
2. The adjustable frequency controller shall be rated for the motor HP as shown on the drawings. The controllers shall provide digitally-based speed adjustment of three phase motors. The adjustable frequency and voltage output shall provide constant volts per hertz excitation of the motor up to 60 hertz.
3. The adjustable frequency controllers shall have a 110% overload rating for one (1) minute, every ten (10) minutes and a 140% overload rating for two (2) seconds, every fifteen (15) seconds.
4. The controller shall be capable of converting incoming 3 phase, 460 volt (+10%) and 60 hertz (+/- 2 hertz) power to a fixed potential DC bus level. The DC voltage shall be inverted by a full wave diode bridge rectifier or a pulse width modulated (PWM) inverter to an adjustable frequency output. The controller shall maintain power factor at .95 or greater at any speed or load. The controller shall have a minimum efficiency of 95% at rated load. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan (variable torque) control.
5. The adjustable frequency AC controller shall employ a full wave rectifier to prevent line notching, for conversion of AC power to DC power. The inverter section shall use Insulated Gate Bipolar Transistors (IGBT) (p -n

substrate) as switching devices. The IGBT, operating as a MOS-gated, input inverted Darlington transistor with a MOSFET (n -n substrate in n-channel enhancement mode) input shall support high input impedance, low drive power and fast (40+k/sec) switching speeds. The bipolar output stage shall enable low conduction losses with high currents. A DC bus choke and DC capacitors shall control internal harmonic generation.

a. Silicon controller rectifies (SCR's), current source inverters and paralleling of devices are unacceptable.

6. Sine wave approximation and voltage vector control shall be used to allow operation at rated motor shaft output at nominal speed with no de-rating. This voltage vector control shall be designed to minimize harmonics to the motor to maximize motor efficiency and life.
7. The inverter shall operate in an ambient temperature of 0ºC to 40ºC for elevations up to 3,300 feet above sea level and humidity of 0% to 95% non-condensing.
8. The controller enclosure shall be NEMA 1, wall-mounted. The controller shall have easily removable assemblies and shall be front accessible. No side clearance shall be required for cooling of wall mount units and all power and control wiring shall be done from the bottom.
9. All enclosures shall be not less than 16-gauge steel with surfaces to be thoroughly cleaned and phosphatized prior to painting. They shall be primed with a corrosion-resisting coating. Cabinet finish paint to be ANSI 161.
10. Doors shall include plastic device holders for mounting up to six (6) operator devices. Factory mounted operator devices shall be factory wired.
11. The operating handle of the disconnect switch shall always remain connected to the breaker and shall not be mounted on the door. The position handle shall indicate ON, OFF or TRIPPED condition of the circuit breaker. The handle shall have provisions for padlocking in the Off position with at least three (3) padlocks. Interlock provisions shall prevent unauthorized opening or closing of the controller door with the disconnect handle in the ON position.
12. All logic control boards shall be interchangeable.
13. The VFD and options shall be tested to ANSI/UL Standard 508. the complete VFD, including all specified options, shall be listed by a nationally recognized testing agency such as UL, ETL.
14. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for sixty (60) seconds and 220% of rated current for up to one (1) second while starting.
15. Drive shall be capable of operating a motor up to 1,000 feet away without de-rating or field modification. Provide detuning output filters and shielded cabling.

C. Interface

1. Start, stop and speed control potentiometer terminations.
2. Linear independent timed acceleration and deceleration adjustable.
3. Non-isolated process signal follower for 0-10 VDC control of output frequency.
4. Variable torque performance from 2 to 60 hertz.
5. Frequency stability of 0.5% for twenty-four (24) hours with voltage regulation of +/-2% of maximum rated output voltage.
6. Individual door-mounted lights or LED's for indication of run, power on and interruption due to over-current, over-voltage, over-frequency, under-voltage, over-temperature and phase loss.
7. 115 volt AC isolated control power for operator devices.
8. Motor slip dependent speed regulation.

9. Logic power carryover during utility loss shall be sufficient to extend double the interval required for internal losses to decay the load inertia to zero.
10. Insensitive to input line rotation.
11. Fixed dwell time at start to increase motor starting torque.
12. Auto restart to automatically restart on phase loss, over-voltage and under-voltage trips only.
13. Local/Hand, Stop/Reset and Remote/Auto selector switches shall be provided to start and stop the drive and determine the speed reference.
14. Provide a 24 VDC, 40 mA max, output signal to indicate that the drive is in Remote/Auto mode.
15. Digital manual speed control. Potentiometers are not acceptable.
16. Lockable, alphanumeric backlit display keypad. VFD's up to 300 HP shall use the same control panel.
17. A quick setup menu with preset parameters shall be provided on the drive.
18. The drive shall be fitted with RS 485 serial communications port and be supplied with software to display all monitoring, fault, alarm and status signals. The software shall allow parameters changes to be made to the drive settings, as well as storage of each controller's operating and setup parameters.
    a. The drive shall be fully able to communicate with PLC's, CDS's and DDC's. DDC's shall be able to monitor drive feedback signals which shall include, but shall not be limited to:
        1) Output Speed/Frequency
        2) Current (in amperes)
        3) Torque
        4) Power
        5) Kilowatt-Hours
        6) Relay Outputs
        7) Diagnostic Faults
19. The RS 485 serial communications port and software shall allow parameter changes to be made to the drive settings, as well as storage of each controller's operating and setup parameters.
    a. Serial communications shall include, but shall not be limited to:
        1) Run-Stop Control
        2) Speed Set Adjustment
        3) Proportional-Integral Controller Adjustment
        4) Current Limit
        5) Acceleration/Deceleration Time Adjustment.
20. Set point control interface (Proportional-Integral-Derivative (PID) control) shall be standard in the unit.
21. Floating point control interface shall be provided to increase/decrease speed in response to switch closures.
22. An elapsed time meter with kWh meter shall be provided.
23. The following displays shall be accessible from the control panel in actual units.
    a. Reference Signal Percent
    b. Output Frequency
    c. Output Amps
    d. Motor Horsepower
    e. Motor Electrical Demand (kW)
    f. Motor Electrical Energy Consumption (kW-hr)
    g. Output Voltage
    h. Drive Temperature (% until trip)
    i. Motor speed expressed in engineering units per application (in percent speed, GPM, CFM).

24. Drive will sense the loss of lead and signal a no load/broken belt warning or fault.
25. The VFD shall store in memory the last three (3) minimum faults and record all operational data.
26. Minimum six (6) programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
27. Minimum six (6) programmable relay outputs shall be provided for remote indication of drive status.
28. Two (2) programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include 0-10 VDC, 0-20 mA and 4-20 mA.
29. Two (2) programmable analog outputs shall be provided for indication of drive status. These outputs shall be programmable for output speed, voltage, frequency, amps and input kW.
30. The VFD shall accept an external contract closure command. Through an integrally mounted Interface Terminal Block (ITB), to automatically disable the VFD and transfer the motor to full line signal. Automatic by pass shall be used to permit the facility fire alarm system to override the normal VFD operation and default to nominal motor speed.

D. Protective characteristics
1. Input AC circuit breaker with an interlocked pad lockable handle mechanism.
2. AC input line current limiting fuses for fault current protection of AC to DC converter section.
3. Electronic cover-current trip for instantaneous overload protection.
4. AC input line under-voltage and phase loss protection.
5. Over-frequency protection.
6. Over-temperature protection.
7. Surge protection form input line transients.
8. Electrical isolation between the power and logic circuits, as well as between the 1150 volt AC control power and the static digital sequencing.
9. Ability to withstand output terminal line-to-line short circuits without component failure.
10. dV/dT and dI/dT protection for converter semi-conductors.
11. Class 20 I^2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications.
12. Protection against input transients, loss of AC line phase, short circuit, ground fault, over voltage, under voltage, drive over temperature and motor over temperature. The VFD shall display all faults in plain English. Codes are not acceptable.
13. Protect VFD from sustained power or phase loss. The VFD shall incorporate a five (5) second control power loss ride through to eliminate nuisance tripping.
14. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
15. Drive shall have semi-conductor rated input fuses to protect power components.
16. The drive shall be fitted with output line reactors to limit the rate of output voltage rise over time (dv/dT), reduce motor operating temperature and RFI and EMI. To prevent breakdown of the motor winding insulation, the dV/dT must be below 1500 V/μsec per IEC recommendations. The supplier shall include with the quotation the dV/dT values of the drive.

17. Drive shall be capable of starting into a rotating load operating forward or reverse up to full speed. VFD shall be capable of accelerating or decelerating to set point without safety tripping or component damage (flying start).
18. VFD shall be rated for 100,000 amp interrupting capacity (AIC).

E. Independent Adjustability
1. VFD shall have an adjustable carrier frequency of 1 to 12 kHz through 75 HP and 3 kHz (fixed) above 75 HP.
   a. Minimum Speed: 4 to 60 hertz.
   b. Maximum Speed: 40 to 90 hertz/
2. Three (3) variable-torque V/Hz patterns shall be provided with the ability to select a constant torque start pattern for each of them.
   a. Volts per hertz: Adjustable from 3.83 to 11.5 volts per hertz.
3. Twenty (20) preset speeds shall be provided.
4. Minimum two (2) acceleration and two (2) deceleration ramps shall be provided. The shape of these curves shall be adjustable.
   a. Acceleration: .5 to 30 hertz per second with ranges of 2-120 seconds for 0-60 Hz.
   b. Deceleration: .5 to 30 hertz per second with ranges of 2-120 seconds for 0-60 Hz.
   c. The VFD shall also accept remote input acceleration and deceleration rams via direct digital programmable inputs.
5. If VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset and restart.
   a. Over voltage.
   b. Under voltage.
   c. Current limit.
   d. Inverter overload.
   e. Motor overload.
   f. Loss of input signal.

   The number of restart attempts shall be selectable from 9 to 5 (minimum) and the time between attempts shall be adjustable for 0 to 120 seconds.
6. Four (4) current limit setting shall be provided.
7. Low frequency Boost: Up to 60 volts at 2 Hz.

F. Bypass
1. Provide a manual by pass consisting of a door interlocked main fused disconnect pad lockable in the off position, a built-in motor starter and a four position DRIVE/OFF/LINE/TEST switch controlling three contactors.
   a. The DRIVE position shall allow the motor to be operated at an adjustable speed form the drive.
   b. The OFF position shall allow the motor and drive to be disconnected.
   c. The LINE position shall allow the motor to be operated at full speed form the AC power line. Power shall be disconnected from the drive, so that service can be performed.
   d. The TEST position shall allow the motor to be operated at full speed from the AC line power. This shall allow the drive to be given an operational test while continuing to run the motor at full speed in bypass.
2. External normally closed dry contact shall be interlocked with eh drives safety trip circuitry to stop the motor whether the DRIVE or BYPASS mode in case of an external safety fault.

G. Required Options
1. Full time adjustable current limit shall sense an overload on the motor when current exceeds a preset limit. Output frequency, and therefore motor speed, shall be reduced. If current decreased with speed, the speed shall decrease until current drops below the limit. Once current is reduced to normal, the frequency shall return to the original setting.
2. AC output contactor.
3. Motor over current relay.
4. Isolated process signal follower for use with grounded input process signal.
5. Output load ammeter, voltmeter and speed indicating meters.
6. Door mounted NEMA 4 operator controls with heavy duty industrial rated devices.
7. Process control output signal of 0-10 VDC, proportional to controller frequency, including gains and bias adjustments.
8. Controller status relay with two (2) Form C relay pairs, rated 2 amps resistive at 115 volt AC for indication of "ON" condition.
9. Bypass contactor arrangement with overload relay complete with all control circuitry to disconnect the controller from the motor and reconnect the motor to line power, after a suitable time delay, when initiated manually.

H. Quality Assurance
1. To ensure quality and minimize infantile failures at the job site, the complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and the load and speed shall be cycled during the test.
2. All optional features shall be functionally tested at the factory for proper operation.
3. Provide a written copy of the factory start-up results for inclusion in the close-out documentation.

I. Compliance to IEEE-519
1. The variable (adjustable) frequency drive manufacturer shall provide calculations specific to this installation showing that the Total Harmonic Distortion for the VFD's, reflected into the electrical distribution system is limited to the level defined by IEEE-519 (latest edition) for general systems. Harmonic analysis shall be included with VFD submittal to support the request for approval from the Engineer.
   a. The calculations shall proceed from Owner-provided power quality and harmonics information for all retrofit, renovation and restoration projects.
2. The VFD manufacturer shall conduct on-site harmonic measurements before and after start-up of the VFD's. Results of the measurements, showing the harmonic contribution of the VFD's, shall be provided to the Engineer as part of the Project Commissioning, prior to Final Acceptance by the Owner.
3. If site measurements show that the IEEE-519 levels have been exceeded:
   a. New Facilities:
      1) The VFD manufacturer shall provide proper filtering to attain the IEEE-519 levels, at no additional cost to the Owner.
   b. Existing Facilities:
      1) Should the quality of the existing power be consistent with the Owner-provided information, the VFD manufacturer

shall provide proper filtering to attain the IEEE-519 levels, at no additional cost to the Owner.

2) Should the quality of the existing power be inconsistent with the Owner-provided information, the VFD manufacture shall provide recommendations concerning proper filtering to attain the IEEE-518 levels, for consideration by the Owner.

4. Three phase alternating current input line reactors shall be provided as a minimum with all VFD's. The line reactors are to provide attenuation of the line side voltage transients, and shall prevent overload trips or other unnecessary VFD shutdowns, and provide a reduction in harmonic distortion.
5. Inlet line reactors shall be:
   a. 2-1/2% line impedance (minimum).
   b. 150% continuous current rating for one (1) minute.
   c. Saturation rating of not less than 2.5 times the continuous current rating.
   d. UL listed.

J. Approvable Manufacturers: The variable (adjustable) frequency AC drives shall be manufactured by Graham, Square D, Asea Brown Boveri, Cutler Hammer or Mitsubishi.

K. The HVAC Subcontractor shall provide written confirmation of coordination of drives and motor starters of all equipment with the Electrical Subcontractor.

L. Warranty: Manufacturer shall provide a full parts warranty for two (2) years from start-up or substantial completion, whichever occurs later.

2.45 VIBRATION ISOLATION AND SEISMIC RESTRAINTS

A. Provide vibration isolation and seismic restraint systems as identified by the requirements of this section and the contract documents. Attention is directed to the structural, architectural, mechanical and electrical documents which identify HVAC equipment and systems requiring vibration isolation treatment and seismic restraint.

B. The HVAC Subcontractor shall provide vibration isolation components such that all equipment shall operate without objectionable noise or vibration being transmitted to the structure.

C. The HVAC Subcontractor shall provide seismic restraint of non-structural building components (HVAC). Restraint systems are intended to withstand the stipulated seismic accelerations applied through the component’s center of gravity.

D. The work in this section includes the following:
1. Vibration isolation elements for equipment.
2. Equipment isolation bases.
3. Piping flexible connectors.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic restraint designs and installation supervision.
7. Conform to vibration isolation and seismic restraint types herein specified.

E. Examine the contract documents for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of

mechanical equipment.

F. Conform to the requirements of the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Handbooks, “HVAC Applications” 1995 Edition; Chapter 43 “Sound and Vibration Control”, and Chapter 50 “Seismic Restraint Design”.

G. Isolators and restraints of the same type shall be the product of the same manufacturer. The manufacturer shall publish and maintain a full line of materials, engineering and application data and operating and maintenance instructions.

H. Seismic Certification and Analysis:
1. Seismic restraint calculations must be provided for all connections of equipment to the structure. All performance of products with restraints must be supported with manufacturer’s data sheets or certified calculations.
2. Seismic restraint calculations must indicate specific code paragraph references (see CODE AND STANDARDS REQUIREMENTS) for each acceleration criteria. Seismic calculations shall indicate the component values required to determine the force to be restrained ($F_p = A_V C_C P a_c W_C$). Specifically, A_V value from Contour Map, USE GROUPS, SEISMIC HAZARD EXPOSURE GROUP, SEISMIC PERFORMANCE CATEGORIES, MECHANICAL, ELECTRICAL COMPONENT AND SYSTEM SEISMIC COEFFICIENT (C_C) Attachment Amplification Factor (a_c) AND PERFORMANCE CRITERIA FACTOR (P) must be determined and the resultant values shall be clearly indicated in the certified calculations. Note: For roof mounted equipment both the seismic acceleration and wind load shall be calculated, the highest load shall be utilized for the design of the restraints and isolators.
3. Seismic restraint calculations must be provided for all connections of equipment to the structure. Performance of all products associated with restraints must be supported with manufacturer’s data sheets or certified calculations.
4. Seismic restraint calculations must be based on the acceleration criteria shown in **TABLE A** acting through the equipment’s center of gravity.
5. For roof mounted equipment both the seismic acceleration and wind loads (30 psf) shall be calculated, the highest load shall be utilized for the design of the restraints and isolators.
6. Certification of calculations to support seismic restraint designs must be stamped by a professional engineer registered to practice in the Rhode Island, with at least five years of seismic design experience.
7. Analysis must indicate calculated dead loads, derived loads and materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or weld length.
8. An in-force $1,000,000.00 coverage limit Seismic Design Errors and Omissions insurance certificate must accompany submittals. Manufacturer’s product liability insurance certificates are not an acceptable substitution.

I. Manufacturer of vibration isolation and seismic control equipment shall assume the following responsibilities:
1. Determine vibration isolation and seismic restraint sizes and locations.
2. Provide equipment vibration isolation and seismic restraints as specified. Furnish manufacturer’s product data covering each isolator and restraint type for style, characteristics, and finish.
3. Guarantee specified isolation system deflections.
4. Provide installation instructions, drawings and field supervision to insure

proper installation and performance of systems.

5. Isolator quantities, dimensions, deflections, capacities and type shall remain the responsibility of the manufacturer and the Contractor.

J. Provide project specific catalog cuts and/or data sheets on the vibration isolators and restraints proposed for inclusion on this project. Reference each and every "TYPE" and detail each compliance with this specification.
   1. Provide an itemized list of all isolated and non-isolated equipment. Provide detailed schedules showing isolator and seismic restraints proposed for each piece of equipment, referencing material and seismic calculation drawing numbers.
   2. Show base construction for equipment; include dimensions, structural member sizes and support point locations.
   3. When walls and slabs are used as seismic restraint locations, details of acceptable methods for duct and pipe must be included.
   4. Indicate isolation devices selected with complete dimensional and deflection data before condition is accepted for installation.
   5. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
   6. Coordination or contract drawings shall be marked-up with the specific locations and types of restraints shown for all pipe and duct. Rod bracing at various installation angles and assigned load at each restraint location shall be clearly delineated. Any and all tributary loads shall be considered for proper restraint sizing.
   7. For ceiling suspended equipment provide minimum/maximum installation angle allowed for restraint system as well as braced and unbraced rod lengths at each allowable installation condition.
   8. Calculate thrust for fan heads, for axial and centrifugal fans, to determine whether thrust restraints are required.

K. Housekeeping pad attachment shall be by the project Structural Engineer. Material and labor required for attachment and construction shall be by the Division 3 subcontractor.
   1. Housekeeping pads shall be coordinated with the Seismic Restraint vendor and sized to provide a minimum edge distance of 10 bolt diameters of clearance all around the outermost anchor bolt to allow for the use of full anchor ratings.

L. Supplementary support steel and connections shall be provided by the HVAC Subcontractor for all equipment, piping, ductwork, including roof mounted equipment, as specified.

M. The HVAC sub-contractor shall provide restraint attachment plates to the General Contractor, to be cast into housekeeping pads, concrete inserts, and double sided beam clamps by the Division 3 Subcontractor, in accordance with the requirements of the Seismic Restraint vendor.

N. Definitions:
   1. The term EQUIPMENT will be used throughout this specification and it includes ALL non-structural HVAC components within the facility and/or serving this facility, such as equipment located in out buildings or outside of the main structure on grade within five feet of the foundation all. Equipment buried underground is excluded. Entry of services through the foundation walls is included. Equipment requiring vibration isolation and seismic

restraint includes, but is not limited to, the following:
a. Air cooled condensing units
b. Rooftop air handling units
c. Air separators
d. Boilers
e. Cabinet heaters
f. Ductwork
g. Fans (all types)
h. Motor control centers
i. Piping
j. Pumps (all types)
k. Rooftop units
l. Tanks (all types)
m. Unit heaters
n. Variable frequency drives
o. Chillers
p. Cooling towers
q. NOTE: HVAC equipment and systems not listed herein above are still included in this specification.

2. Life Safety Systems defined:
   a. All systems involved with fire protection such as fire dampers.
   b. All systems involved with and/or connected to emergency power supply including smoke evacuation.
   c. All medical and life support systems.
   d. Fresh air relief systems on emergency control sequences including air handlers, ductwork, and dampers.
3. Positive attachments are those locations at which equipment, piping, and ductwork are tied to the facility structural elements by incorporating:
   a. Cast-in or wedge type expansion anchors, or
   b. Double sided beam clamps, or
   c. Welded or through bolted connections to the structure.
4. Transverse bracing are those restraints applied to limit motion perpendicular or angular to the centerline of the pipe or duct.
5. Longitudinal bracing are those restraints applied to limit motion along the centerline of the pipe or duct.

O. Substitution of internally or externally isolated and restrained equipment in lieu of the isolation and restraints specified in this section is acceptable provided all conditions of this section are met. The equipment manufacturer shall provide a letter of guarantee from their Engineering Department stamped and certified per the section on Seismic Restraints and Analysis stating that the seismic restraints are in full compliance with these specifications. Letters from field offices or representatives are unacceptable.
1. All costs for converting to the specified vibration isolation and/or restraints shall be borne by the equipment manufacturer in the event of non-compliance with the preceding.
2. In the event that the equipment is internally isolated and restrained, the entire unit assembly must be seismically attached to the structure. This attachment and certification thereof shall be by this section.

TABLE A

"G" FORCES FOR VARIOUS CONDITIONS
(SEISMIC ZONE 2 - AV > 0.1 ≤ 0.2

PIPE AND DUCT	RIGIDLY MOUNTED EQUIPMENT	FLEXIBLY MOUNTED EQUIPMENT	ALL LIFE SAFETY
.25	.40	.40	.60

P. All vibration isolation and seismic devices described in this section shall be the product of a single manufacturer. Mason Industries shall be considered the Base Manufacturer of these specifications for the purposes of establishing a standard of equality; products of other manufacturers are acceptable provided their systems strictly comply with intent, structural design, performance and deflections of the Base Manufacturer.

Q. Seismic Restraint and Vibration Isolation Devices:
1. All isolation and seismic restraint devices shall be capable of accepting, without failure, the “G” forces as determined by the seismic certification and calculations as described in this section of the specifications.
2. Corrosion protection for outdoor applications shall be as follows:
   a. Springs cadmium plated, zinc electroplated or electrostatically deposited, baked enamel powder coated.
   b. Hardware cadmium plated.
   c. All other metal parts hot spray or hot dipped galvanized.
3. Seismic Restraint Types:
   a. All seismic restraint devices shall maintain the equipment in a captive position and shall not short circuit isolation devices during normal operating conditions.
   b. All seismic restraint devices shall have provisions for bolting and/or welding to the structure.
   c. Welding of springs to isolator housing and base plans is strictly prohibited.
   d. TYPE I: Spring Isolator – Restrained
      1) Spring shall have a minimum outer diameter to overall height ratio of 0.8:1 at rated deflection.
      2) Reserve deflection (from published load ratings to solid height) of 50% of the rated deflection.
      3) Ductile top cut with adjusting bolt tapped for equipment attachment locking cap screw.
      4) Minimum 1/4” thick neoprene acoustical base pad or cup on underside, unless designated otherwise.
      5) Integral restraining bolts with elastomeric cushions preventing metal-to-metal contact.
      6) Internal spring adjusting nut or bolt with leveling capability.
      7) Built-in all-directional limit stops with minimum 1/4” clearance under normal operation.
      8) Mountings shall have Anchorage Preapproval “R” number from California OSHPD, certifying the horizontal and vertical seismic load ratings.
      9) Cast or aluminum housings, (except ductile iron) are not acceptable.
         a) Mason Industries, Type SLR
   e. Type II: Where required, each corner or side of equipment base

shall incorporate a seismic restraint snubber having an all directional resilient pad limit stop. Restraints shall be fabricated of plate, structural members or square metal tubing. Angle bumpers are not acceptable.

1) Mason Industries Type Z-1225/Z-1011

f. Type III: Restraints for suspended systems:

1) Vibration isolated systems shall be braced with multiple 7 x 19 strand galvanized cable rope.
   a) Mason Industries Type SCB
2) Non-isolated systems shall be braced with structural steel strut type with approved fastening devices to equipment and structure.
   a) Mason Industries Type SSB
3) Steel angles (by HVAC Subcontractor) shall be provided to prevent rod bending of hung equipment where indicated by the Seismic Restraint vendor's submittals. Steel angles shall be attached to the rods with a minimum of three ductile iron clamps at each restraint location. Welding of support rods to angles is not acceptable. Rod clamp assemblies shall have Anchorage Preapproval "R" number from California OSHPD.
   a) Mason Industries Model SRC
4) Pipe clevis cross braces are required at all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the clevis cross bolt. Clevis cross braces shall have Anchorage Preapproval "R" number from California OSHPD.
   a) Mason Industries Model CCB

g. Type IV: Double deflection neoprene isolator encased in ductile iron or steel casing.

1) Mountings shall have Anchorage Preapproval "R" number from California OSHPD, certifying the horizontal and vertical seismic load ratings.
   a) Mason Industries Type RC or BR

h. Type V: Rigid attachment to structure utilizing wedge type expansion anchors for bolting and steel plates, either cast-in or anchored with wedge type expansion bolts, for welding. Powder shots are not acceptable. Concrete anchor bolt spacing shall be in accordance with manufacturer's published standards.

4. Vibration Isolator Types:

a. Type A: Spring Isolator – Free Standing

1) Spring shall have a minimum outer diameter to overall height ratio of 0.8:1 at rated deflection.
2) Reserve deflection (from published load ratings to solid height) of 50% of the rated deflection.
3) Ductile top cut with adjusting bolt tapped for equipment attachment locking cap screw.
4) Minimum 1/4" thick neoprene acoustical base pad or cup on underside, unless designated otherwise.
   a) Mason Industries Type SLF

b. Type B: Spring Isolator – Restrained

1) Spring shall have a minimum outer diameter to overall height ratio of 0.8:1 at rated deflection.

2) Reserve deflection (from published load ratings to hold height) of 50% of the rated deflection.
3) Ductile top cup with adjusting bolt tapped for equipment attachment locking cap screw.
4) Minimum 1/4" thick neoprene acoustical base pad or cup on underside, unless designated otherwise.
5) Integral restraining bolts with elastomeric cushions preventing metal-to-metal contact.
6) Internal spring adjusting nut or bolt with leveling capability.
7) Built-in all-directional limit stops with minimum 1/4" clearance under normal operation.
8) Mountings shall have Anchorage Preapproval "R" number from California OSHPD, certifying the horizontal and vertical seismic load ratings.
   a) Mason Industries Type SLR, SSLFH

c. Type C: Spring Hanger Isolator
1) Spring shall have a minimum outer diameter to overall height ratio of 0.8:1 at rated deflection. Spring element shall have a steel upper spring retainer and a lower elastomer retainer cup with an integral bushing to insulate lower support rod from the hanger box.
2) Reserve deflection (from published load ratings to solid height) of 50% of the rated deflection.
3) Steel hanger box shall be capable of 30 degree misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.
   a) Mason Industries Type 30

d. Type D: Double deflection neoprene isolator encased in ductile iron or steel casing.
1) Mountings shall have Anchorage Preapproval "R" number from California OSHPD, certifying the horizontal and vertical seismic load ratings.
   a) Mason Industries Type RC or BR

e. Type E: Elastomer Hanger Isolator
1) Molded neoprene element with an integral bushing to insulate lower support rod from the hanger box.
2) Steel hanger box shall withstand three times the rated load without failure.
   a) Mason Industries Type HD

f. Type F: Combination Spring/Elastomer Hanger Isolator
1) Spring and neoprene elements in a steel hanger box with the features as described for Type C and E isolators.
   a) Mason Industries Type 30N

g. Type G: Pad type elastomer isolator
1) Neoprene pad shall have 0.75" minimum thickness, deflection rating of 0.1 inch under rated load. Supports shall be connected in the center by a 1/8" tear strip to facilitate trimming to desired size in two inch increments.
2) 1/16" galvanized steel plate between multiple pad layers.
3) Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.
4) When bolting is required for seismic compliance, neoprene and duck washers and bushings shall be provided to

prevent short circuiting of bolt.
a) Mason Industries Type Super Waffle (SW) pad

h. Type H: Pad type elastomer isolator
1) Laminated canvas duck and neoprene maximum loading 1000 psi, minimum 1/2" thick.
2) Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.
3) When bolting is required for seismic compliance, neoprene and duck washers and bushings shall be provided to prevent short circuiting.
a) Mason Industries Type HL Pad

i. Type I: Thrust Restraints
1) A spring element same as Type A shall be combined with steel angles, backup plates, threaded rod, washers and nuts to produce a pair of devices capable of limiting thrust movement of air moving equipment to 1/4".
2) Restraints shall be easily converted in the field from a compression type to tension type.
3) Unit shall be factory pre-compressed.
a) Mason Industries Type WB

j. Type J: Telescoping Riser Guide
1) Telescoping arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of Type H pad.
a) Mason Industries Type VSG

k. Type K: Resilient Pipe Anchors and Guides
1) All directional acoustical pipe anchor, consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of Type H pad.
2) Vertical restraints shall be provided by a similar material arranged to prevent vertical travel in either direction.
3) Allowable loads on neoprene pad shall not exceed 500 PSI and the design shall be balanced for equal resistance in any direction.
a) Mason Industries Type ADA

l. Type M: Flashable restrained isolator
1) Shall have all features of Type B isolator.
2) Shall have waterproof spring covers for adjustment or removal of springs.
3) Unit shall have a structural top plate for welding or bolting of supplementary support steel.
4) Isolator shall accept 2" roofing insulation and be flashed directly into the waterproofing membrane.
5) To be complete with wood nailer and flashing.
a) Mason Industries Type RFS.

m. Type P: Elastomer Isolator
1) Double deflection neoprene compression mountings shall have all metal surfaces neoprene coated.
2) Non-skid top and bottom surfaces.
3) Threaded bolting sleeves shall be embedded in the isolator.
4) Drilled tie-down bolt holes shall be provided in the base plate.
a) Mason Industries Type ND

5. Equipment Bases:

a. All curbs and roof rails are to be bolted or welded to the building steel or anchored to the concrete deck to attain specified acceleration criteria and shall also be capable of resisting a minimum psf wind loads (non-simultaneous).

b. Type B-1: Integral Structural Steel Base:
   1) Constructed of structural members to prevent base flexure at equipment startup and misalignment of driver and driven units. Perimeter members shall be a minimum of 1/10th the longest unsupported span.
   2) Centrifugal fan bases shall be complete with motor slide rails and drilled for driver and driven units.
   3) Height saving brackets shall be used to reduce operating height and maintain 1" operating clearance under base.
      a) Mason Industries Type MSL, WFSL

c. Type B-2: Concrete Inertia Base
   1) Steel concrete forms for floating foundations. Bases for pumps shall be large enough to support elbows and/or suction diffusers. The base depth shall be a minimum of 1/12 the longest unsupported span, but not less than 6" or greater than 12".
   2) Forms shall include concrete reinforcement consisting of steel bars or angles welded in place on 8" centers both ways in a layer 1½" above the bottom.
   3) Isolators may be set into pocket housings which are an integral part of the base construction or utilize height saving brackets set at the proper height to maintain 1" clearance below the base.
   4) Base shall be furnished with steel templates to hold anchor bolt sleeves and anchors while concrete is being poured.
      a) Mason Industries Type KSL or BMK

d. Type B-3: Spring Roof Curb
   1) Spring isolation curbs that bear directly on the roof support structure and are flashed and waterproofed into the roof's membrane waterproofing system. Equipment manufacturer's or field fabricated curbs shall not be used.
   2) All spring locations shall have removable waterproof covers to allow for spring adjustment and/or removal. Disassembly of the weather and air seal to gain access to the isolators is not acceptable.
   3) Springs shall have all of the features of Type B.
   4) Curbs shall have continuous sheet metal sides and have provision for 2" insulation to be installed and furnished by the Roofing Contractor.
   5) Waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curb's waterproofing membrane and joined at the corners by EPDM bellows.
   6) Wood nailer and flashing shall be provided.
   7) Shall have a California OSHPD Seismic Anchorage Preapproval "R" number.
   8) Shall include a means of incorporating a sound barrier package, supported from the top isolated rail consisting of two layers of waterproof gypsum board furnished and installed by the General Contractor.

9) Contractor shall have the option of ordering the curb built to the roof pitch or field leveled in accordance with all seismic provisions of this section.
10) Overhung condensing units (when applicable) shall be supported by Type B isolators and spanning (width) steel support angle. These isolators shall in turn be supported on a field built curb.
a) Mason Industries Type RSC

e. Type B-4: Flashable Roof Rail System – Isolated
1) Continuous structural support rails that combine equipment support and isolation mounting into one unitized assembly.
2) Rails shall incorporate Type B springs which are adjustable, removable and interchangeable after equipment has been installed.
3) The system shall maintain the same installed and operating height with or without the equipment load and shall be capable of being utilized as a blocking device.
4) The entire assembly shall be an integral part of the roof's membrane waterproofing.
5) Unit to be supplied with continuous upper and lower galvanized flashing.
a) Mason Industries Type RIR

f. Type B-5: Not Used.

g. Type B-6: Non-isolated roof curb
1) Same as B-3 without spring isolation.
a) Mason Industries Type URC

h. Type B-8: Non-isolated.
1) Same as continuous support rails, Type B-4 without the spring isolation.
a) Mason Industries Type RUR

i. Type B-9: Steel Rails
1) Steel members of sufficient strength to prevent equipment flexure during operation.
2) Height saving brackets to reduce operating height.
3) Rails shall be cross braced at support and equipment attachment points when used in seismic zones.
a) Mason Industries Type R, ICS

6. Flexible Connectors:
a. All connectors shall be installed on the equipment side of shutoff valves; horizontal and parallel to equipment shafts whenever possible. Piping shall be supported and/or anchored to resist pipe movement beyond the allowable movement of the flexible connector.
b. Installations must include check valves and/or other design and installation precautions to reduce the threat to life safety when subjected to the specified seismic accelerations.
c. Type FC-1: Spherical Elastomer Connector
1) Manufactured of peroxide cured EPDM in the covers, liners and polyester tire cord frictioning. Curing must take place in steel molds closed within heated hydraulic presses.
2) Solid steel rings shall be used within the raised faced rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable.
3) Sizes 2" and larger shall have two spheres reinforced with

a molded-in ductile iron external ring between spheres. Bolted-on strap type reinforcing are not acceptable. Flanges shall be split ductile iron with hooked or similar interlocks. Sizes 16" to 24" may be single sphere.

4) Threaded one piece bolted flange assemblies with female threaded ends for sizes 3/4" to 1½".
5) Rated at 250 psi up to 170° F. with a uniform drop in allowable pressure to 170 psi at 250° F. for sizes through 14". 16" through 24" single sphere minimum ratings are 180 psi at 170° F and 130 psi at 250°F.
6) Factory tested at 150% of rated pressure for 12 minutes before shipment. Safety factor to burst and flange pullout shall be a minimum of 3:1.
7) Concentric reducing expansion joints with equal ratings and features may be substituted.
8) Connectors shall be installed in piping gaps equal to the length of the connector under pressure.
9) Control rods are required in unanchored installations where the installation exceeds the pressure requirement without control rods.
    a) Control rods shall have 1/2" thick neoprene washer bushings large enough in diameter to take the thrust at 1,000 psi maximum on the washer area.
10) Connectors bolted to Victaulic type coupling or gate, butterfly or check valves to have a minimum 5/8" flange spacer installed between the connector and the coupling flange. Connectors must mate to a flat faced flange in all instances.
    a) Mason Industries SAFEFLEX Type SFU, SFEJ, SFDEJ or SFDCR

d. Type FC-2: Flexible Stainless Steel Hose
1) Stainless steel hose and braid rated with 3:1 safety factor.
2) 2" diameter and smaller with male nipples, 2½" and larger with fixed flat faced steel flanges.
3) Lengths shall be: 9" for 2½" through 4"; 11" for 5" and 6"; 12" for 8"; 13" for 10"; 14" for 12" through 16".
    a) Mason Industries Type BSS

e. Type FC-3: Upbraided Exhaust Hose
1) Low pressure stainless steel annularly corrugated with one floating and one fixed flanged end.
2) Maximum temperature of 1500 degrees F.
    a) Mason Industries Type SSE

f. Type FC-4: Flexible Bronze Braided Hose
1) Metal hose and braid rated with a minimum 3:1 safety factor. (Minimum 150 PSI)
2) Copper tube ends.
    a) Mason Industries Type BBF

2.46 WATER FLOW MEASURING DEVICES

A. Flow meter fittings shall be installed as indicated on the drawings and in the following piping systems and locations for balancing and testing purposes:
1. Each hot water pump or common manifold for paralleled pumps with full stand by.

B. Venturi fittings for 3/4 inch through 2 inch flow fittings shall have NPT connections for threaded pipe and the 2½ inch through 10 inch flow fittings shall fit between a pair of pipe flanges with gaskets, nuts and special bolts. All flow fittings shall have "slide valve" enabling fitting to be used with portable flow meter, gauge, purge and drain attachment and cleaning attachment and when withdrawn shall automatically close the "slide valve".

C. Provide combination balancing valve and flow device where indicated on the drawings or specified. Flow device - valve assembly shall have ball valve construction of bronze, suitable for use as bubble-tight service valve, calibrated balance setting indicator plate, shrader valve connections with caps for meter hose connections. Units shall be Taco circuit setters.

2.47 WATER SYSTEM ACCESSORIES

A. Equipment shall be sized for the service indicated on the drawings. Equipment shall be as manufactured by Bell & Gossett, Armstrong, Taco, or Thrush.

B. Piping system air vents shall be provided with indicated on drawings and at high points of all hot water piping sections. Vents shall be as manufactured by Bell & Gossett, Armstrong, Taco, or Thrush. Any vents not accessible shall be piped to an accessible location.
1. Air vents, except where noted otherwise, shall be manual air vents suitable for 150 PSIG system pressure as manufactured by Bell & Gossett #4V coil-operated type.
3. Air vent at the high point of each system shall be high capacity industrial automatic air vents of the float type with drain connection for water overflow as manufactured by Armstrong, Model #1-AV, B&G 107 or Spirax Sarco 13W.

C. Provide adjustable type water make-up pressure regulating valves for each water system indicated on the drawings and not noted to be furnished under Section 23 00 00. Valves shall be as manufactured by Bell & Gossett #6; Taco #335 or Thrush #21.
1. Valves shall be suitable for minimum of 125 psi inlet pressure and shall be adjustable to the system pressure.
2. Valves shall be provided with assemblies consisting of inlet pressure gauge, shut-off valves, inlet strainer, outlet pressure gauge and quick fill bypass with globe valves.

2.48 AUTOMATIC TEMPERATURE CONTROLS

A. General
1. This is a proprietary specification. Furnish and install, as hereinafter specified, a native BACnet, Direct Digital Control (DDC), automatic temperature control system as manufactured by KMC or approved equal.

2. The DDC Contractor shall be fully licensed at the time of bid to do business in the job site area. The DDC Contractor must be either a wholly owned factory branch office or a fully licensed dealer of the manufacturer's listed above with a technical staff, complete spare parts inventory, and test and diagnostic equipment to keep systems in operation 24 hours per day, seven days per week. He shall have emergency service available in the local area

for temperature control systems for which he is currently performing on-call emergency service 24 hours per day, seven days per week. Wholesale, distributor, or representative type ATC Contractors are unacceptable. This requirement will be strictly enforced.

B. Scope of Work

1. The ATC contractor shall furnish and install all equipment, accessories, and wiring required for a complete and functioning web-based building management system.
2. The control system shall consist of, but not limited to all temperature controls as specified herein including all CPU's, DDCP's, CRT's, printers, sensors, software, thermostats, valves, actuators, dampers, damper operators, relays, control panels, and other accessory equipment and appurtenances, including electrical wiring, to fulfill the intent of the specifications and provide for a complete and operable system.
3. Provide actuators for equipment such as dampers where such actuators are not provided by the equipment manufacturers. Refer to floor plans for location and numbers of required actuators. Actuators shall be Belimo, or equal. Coordinate requirements with the HVAC subcontractor.
4. All materials and equipment used shall be standard components, regularly manufactured for this type of work and shall not be custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.
5. The Contractor shall furnish and install all control and interlock wiring for chillers, boilers, fuel oil, day tanks, alarms, and emergency generators unless specifically and clearly stated to be provided by others.
6. The ATC contractor shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and systems operation and to verify the quantities and types of dampers, operators, alarms, and bells he has to provide. Numerous references to the ATC contractor are made throughout this specification identifying work to be performed under the HVAC section in addition to work specifically indicated under this paragraph. It will be assumed that, if no specific inquiries are made during the bidding period, the HVAC/ATC subcontractors have reviewed all requirements and interfaces between equipment and controls, to result in a complete, integrated and fully operational HVAC system.
7. The Automatic Temperature Control Contractor shall provide one (1) copy of the BMS software.
8. The electrical contractor shall furnish and install power meters. The automatic temperature control contractor shall network the power meters into the building management system and shall provide point mapping of all available data to the new workstations. Exact location of meters shall be coordinated with electrical sub-contractor. (Addendum # 3)

C. Work by Others

1. Automatic temperature control valves, duct humidifiers and separable wells for immersion elements furnished by the control manufacturer shall be installed by the HVAC sub-contractor under the ATC contractor's supervision.
2. Automatic dampers that are specified to be furnished by the ATC contractor shall be installed by the HVAC subcontractor, under the ATC contractor's supervision.
3. Concrete foundations shall be provided by the general contractor. The HVAC sub-contractor shall furnish dimensional drawings to the general

contractor.

4. All finished painting required for the temperature control piping and equipment, shall be by the general contractor.
5. All cutting and patching necessary for the installation of the temperature control system, shall be by the HVAC sub-contractor.
6. Installation of duct smoke detectors shall be by the HVAC subcontractor, under the ATC contractor's supervision.

D. Submittals and Shop Drawings
1. Submit shop drawings and obtain written review comments before ordering or installing any equipment or material.
2. Submit shop drawings of all equipment. Shop drawings shall consist of but not limited to manufacturer's scaled drawings, valves and damper schedules, cuts and catalogs, including descriptive literature which shall indicate the construction, material, physical dimensions and complete operating data. All ATC shop drawings shall also contain a written description of the Sequence of Operations, enumerating and describing the function of each component.
3. Submit the following for approval:
   a. Control drawings with detailed wiring diagrams, network riser diagrams as well as bills of materials (with quantity of devices, ranges and voltages) and written sequences of operation, for each system type.
   b. Valve and damper schedules showing sizes, configurations, capacities, pressure drops and locations of equipment. Include type and quantities of actuators.
   c. Data sheets for control system components.
   d. Complete software information including names of software packages provided, control sequences performed, complete information on user programmability (commands, language details, and programming sequences), and detailed printouts of the actual software within each DDCP including user definable comment statements inserted throughout the program to guide a novice operator through the various sequences of the actual program.
   e. Graphics samples in full color clearly indicating level of detail to be provided on this project.
   e. Calculations for valve coefficients (CVs).
   f. Operators user's manuals.
   g. Complete point-to-point check-out procedures to ensure that all physical points are consistently tested and verified for this project.

E. Equipment Operation Instruction and Maintenance Manuals
1. On completion and acceptance of the work, furnish for approval three copies of written instructions on the proper operation and maintenance of all equipment and apparatus furnished under this section.
2. Each manual shall be provided with an index sheet listing the contents in alphabetical order and shall contain but not limited to the following material:
   a. Updated copies of all submittal data and shop drawings as specified previously.
   b. Manufacturer's instructions regarding the installation, maintenance and calibration of each component used in the ATC system installed by the ATC contractor.
   c. Copies of all warranties and guarantees issued by each equipment manufacturer.

d. "As-built" interconnecting wiring diagrams and wire lists of the field installed system with complete, properly identified numbering of each system component and device.

e. A set of "User's Manual" detailing the operation of the Building Management and Control System (BMCS). The manual shall describe the hardware operation as well as provide instructions in computer access and programming. This manual shall be submitted under separate cover. The User Manual shall be written for an inexperienced user. It shall describe in layman's language, the functions and procedures of "using" the system.

F. Acceptance Testing

1. At substantial completion of the work, the ATC contractor shall prepare a punch list of all items remaining to be completed or corrected. The failure to include any items on such list does not alter the responsibility of the ATC contractor to complete all work in accordance with the contract documents. This list shall be delivered to the engineer prior to the ATC contractor's request for formal acceptance testing.
2. Additionally, the ATC contractor shall provide an equipment list and point list to the engineer prior to formal acceptance testing. Each material item and point must be initialed by the installing DDC technician that the item has been physically inspected for proper installation, functionality, and database entry.

   The verification form shall be similar to the following:

DDC Floor	Point Cabinet #	Point Name	Point Type	Point Address	Sensor On/Off	Oper. Reading	Test Initials	Test Time	Test Date

3. The engineer will prepare a list of items to be corrected or completed that shall include the punch list items identified by the ATC contractor, and any additional items found to be incomplete or incorrect. All items on both lists shall be completed or corrected before acceptance testing may proceed. The ATC contractor shall notify the engineer when he is ready to proceed with the acceptance test that system is complete and operates as required by the contract documents.
4. Acceptance Test Procedure:
   a. The ATC contractor shall demonstrate and verify in writing in the presence of the Engineer that all functions of the ATC and BMCS systems are operating as specified in the contract documents, including any required change orders. The final checkout will include, but not be limited to, the following items:
      1) Verification of the location, calibration and proper wiring/connection of all BMCS input and output devices.
      2) l BMCS software and output functions shall be tested individually.
      3) The proper operation and calibration of all ATC devices and actuators shall be verified individually.
      4) When system performance is deemed satisfactory by the Architect, system parts shall be accepted for beneficial use. Warranty shall begin. All minor deficiencies found will be noted in writing by the Engineer. All deficiencies so noted shall be corrected by the ATC contractor before the final acceptance will be issued.

5) The ATC contractor shall allow sufficient time to complete the acceptance test procedure.

b. Acceptance testing shall be coordinated with the Commissioning Agent. Refer to specification section 01 91 10 for additional requirements.

G. Training/Owner's Instruction

1. The ATC contractor shall provide three copies of an operator's user's manual describing all operating and routine maintenance service procedures to be used with the system as specified previously. The ATC contractor shall instruct the Owner's designated representatives in these procedures during the start-up and test period. The duration of the instruction period shall be no less than 40 hours and shall take place at the site. The training sessions shall be delineated such that at least 16 hours of training occur after the completion of system testing and balancing and commissioning. This training shall include instruction in the use and operation of the point editor function and graphics.
2. Training sessions shall be coordinated with the Commissioning Agent. Refer to specification section 01 91 10 for additional requirements.

H. Warranty

1. The ATC contractor shall guarantee the control system free from defects in material and workmanship and guarantee performance of the systems as required by the contract documents for one year of normal use and service beginning on the date the Owner has accepted the system.
2. The ATC contractor shall through the warrantee period, schedule visits to the site in order to provide two seasonal system review sessions with the building operators. The intent is for system review to take place at the time of seasonal system changeover. The contractor shall establish diagnostic trend logs on the OWS for the purposes of evaluating all major systems in the building, and a sample of terminal systems. Following any calibrations and adjustments the logs shall be submitted to the Architect for review.

I. Products

1. The Building Management and Control System (BMCS) shall consist of Network Level 1 controllers and Level 2 DDC controllers to monitor and control equipment per the control sequences. Level 1 controllers shall provide overall system coordination, accept control programs, perform automated DDC and energy management functions, control peripheral devices and perform all necessary mathematical functions. The controller shall be a microcomputer of modular design. The word size shall be 16 bits or larger, with a memory cycle time of less than 1 microsecond. Level 1 controllers will share information with and from the entire network of Level 1 and Level 2 controllers for full global control. Level 1 controllers shall permit multiuser operation from workstations and laptop computers connected either locally or over the Level 1 network. Level 2 controllers, also referred to as local control units shall provide intelligent, stand-alone control of HVAC, lighting equipment, and access control. Each unit shall have its own internal RAM memory and will continue to operate all local control functions in the event of a failure to any Level 1 controller. In addition, it shall be able to share information with and from the entire network for full global control.

J. Communications Processing

1. The BMCS shall operate as a true token-pass peer-to-peer communication

network. Resident processors in each Multi-purpose controllers shall provide for full exchange of system data between other Multi-purpose controllers on the high performance peer to peer communications network. Systems that limit data exchange to a defined number of system points are not acceptable.

2. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage interpanel communications may be considered only if a similar device is provided as a stand-by. Upon a failure or malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.
3. The failure of any Multi-purpose controller on the network shall not affect the operation of other Multi-purpose controllers. A panel failure shall be annunciated at the specified graphical workstation, alarm printers, or operator terminals.

K. Color Graphic Workstation (located in Custodians Office).
1. The operator workstation will be furnished by the automatic temperature control contractor. The workstation shall consist of the latest generation of PC and shall operate at speed commensurate with the requirements of the ATC graphics and trending requirements. The ATC contractor shall furnish the PC with a dedicated UPS.
2. Network Connection: Graphical workstations shall allow for access to the BMCS network through a pull-down menu approach using only a mouse or similar point device. The keyboard shall be required only when entering text or for programming functions.
   a. The workstation shall be used as an interface to the BMCS network and shall not be required to process any control or energy management algorithms nor manage any BMCS network communications.
3. Graphical Software
   a. Software Description - workstation functions will include monitoring and programming of Level 1 and Level 2 controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments. The workstation software must be able to communicate to all Level 1 and Level 2 controllers, and where necessary integrate information that is common to one or more controllers. It shall be possible to program off-line from any Level 1 or Level 2 controller.
      The software will be oriented towards operators and programmers. In the operator's mode, all information will be available in graphic or text displays. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system.
      All operator functions shall be selectable through a mouse. A "windows" environment shall be used to allow multiple functions to be displayed on the screen simultaneously.
   b. Operating System - The software will utilize the latest generation of Microsoft Windows.
   c. Network Communications - The network consists of a high speed LAN comprised of Level 1 controllers, workstations and

a file server. The file server acts as the central database for the workstations, so that all additions or changes made by one operator are immediately available to other operators on the network.

d. System Database - The workstation database shall consist of all points and programs in each of the controllers that have been assigned to the network. In addition, the database will contain all workstation files including graphic slides, alarm reports, text reports, historical data logs, schedules, and polling records. The software shall conform to the following:
   1) Utilize Microsoft's SQL database server.
   2) Whenever a new controller is added to the system, the software will automatically update that controller with its assigned points and programs. The system will also be able to verify that the point database in each controller is identical to the one at the workstation. If any discrepancy is found, it will automatically modify its database or notify an operator of the error.
   3) The database shall also contain host level points consisting of variables which can be used for host level reports and alarming. These variables can be setpoints or the result of any boolean algebra expression.
   4) Object Tree - It shall possible for an operator view the entire database through a graphical object tree display. This tree will present all controllers and their associated points, programs, graphics, alarms, and reports in an easy to understand structure.

e. System Configuration - Configuration of the database shall be through application modules, each having a unique "icon" for easy visual identification. Each module will provide a windowed menu in which to enter the required data base information. System configuration shall have the following features:
   1) Each site, whether local or remote, shall have a separate record for storing pertinent communication parameters.
   2) Controllers will be associated with a specific site file. The controller record will also contain the controller passwords and communication logon and logoff text strings.
   3) Point records will include as a minimum a 32 character point description, engineering units, logging parameters, point status, and point value.
   4) All database records will be available to the user at all times, regardless of the current tasks being performed by the workstation.

f. Color Graphic Displays - The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These graphics shall contain point information from the database including any attributes associated with the point (engineering units). In addition operators shall be able to command equipment or change set points from a graphic through the use of the mouse. Requirements of the color graphic subsystem include:
   1) SVGA, bit-mapped displays. The user shall have the

ability to import CAD-generated picture files in the OS/2 Metafile format as background displays. Updates to imported CAD drawings will not affect workstation added animation.

2) A library of built in stencils, symbols and display shapes common to the HVAC industry.
3) An online graphics drawing editor that provides for all standard geometric shapes, multiple line thicknesses, shading, up to 16 colors, cutting and pasting of objects, inclusion of text, and zooming.
4) Built-in control panel objects such as buttons, knobs, gauges, and line graphs to enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels.
5) Status changes or alarm conditions can be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
6) Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators will be able to move from one graphic to another by selecting an object with a mouse, no menus will be required.
7) The graphic system shall allow for one touch modification of any analog or digital point in the database regardless of its location in the network.

g. Automatic Monitoring - The software shall allow for the collection of data and reports from any Level 1 or Level 2 controller through either a hardwire or modem communication link. The time schedules and content of the polling shall be user configurable and include any subset of the controller's data base including application programs.

h. Alarm Management - The software shall be capable of both accepting alarms directly from Level 1 controllers, or generating alarms based on polling of data in controllers and comparing to limits or conditional equations configured in the host software. Any alarm (regardless of its origination) will be integrated into the overall alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, reports, or initiating communication to another controller or remote computing device. Alarm management features shall include:

1) A minimum of 255 alarm levels. Each alarm level will establish a unique set of parameters for controlling alarm display, acknowledgment, keyboard annunciation, alarm printout and record keeping.
2) When an alarm occurs the Alarm counter will be incremented by one.
3) Printout of the alarm or alarm report to an alarm printer or report printer.
4) Print the alarm acknowledgment or Return to Normal message.
5) Sound an audible beep on alarm initiation or

acknowledgment.

6) It shall be possible to direct alarm displays to all or any of 16 groups of workstations on the network. Each configured path can be assigned on a unique basis to individual alarm levels.

i. Report Generation - The software will contain a built-in report generator, featuring word processing tools for the creation of custom building reports.

1) Reports can be of any length and contain any points with the database of Level 1 and Level 2 controllers.

2) The report generator will have access to the user programming language in order to perform mathematical calculations inside the body of the report, control the display output of the report, or prompt the user for additional information needed by the report.

3) It shall be possible to run other executable programs whenever a report is initiated.

4) Report Generator activity can be tied to the alarm management system, so that any of the configured reports can be displayed in response to an alarm condition.

j. Scheduling - It shall be possible to configure and download from the workstation schedules for any of the controllers on the network.

1) Time of day schedules shall be in a calendar style configured for either monthly or weekly operation. Scheduling shall be programmable up to one year in advance.

2) Each schedule will appear on the screen as a monthly calendar correctly showing the day, weekday, month and year. It shall be possible to scroll from one month to the next and view or alter any of the schedule times.

3) Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.

4) It shall be possible to configure multiple Holiday schedules in a yearly format. Holiday schedules will override the standard operating schedule for those days that have been defined as holidays. Holidays shall be differentiated on the calendar through color coding of the date. Any changes to a holiday schedule will be automatically updated to the standard schedule to which it has been superimposed.

5) There shall also be a provision for Special Day schedules. Special Day schedules will override both the standard schedule and its associated Holiday schedule. Special Days will be differentiated on the calendar through color - coding of the date. Any changes to a Special Day schedule will be automatically updated to the standard schedule to which it has been superimposed.

6) The use of Holiday or Special Day schedules is strictly optional. Standard schedules do not require either of these two types of schedules.

7) The Scheduling application shall include built-in editing tools to permit users to copy and paste portions of schedules to different days, weeks or months. Users can

select from a particular day, a range of days, or a nonconsecutive group of days over which to edit a schedule.

k. Programmer's Environment - the programmer's environment will include access to a superset of the same programming language supported in the Level 1 controllers. Here the programmer will be able to configure application software off-line (if desired) for custom program development, write global control programs, system reports, wide area networking data collection routines, and custom alarm management software.

l. Security
   1) The software shall employ a two tiered password system. The first tier shall consist of the user's name. The second tier shall be a unique password consisting of up to 8 alphanumeric characters.
   2) Each password shall have a unique access level. At least 8 levels will be defined as follows:
      ◊ No Access - View only graphics as presented in the log-in program.
      ◊ View Only - View all applications, but perform no database modifications.
      ◊ Acknowledge Alarms - View Only privileges plus the ability to acknowledge alarms.
      ◊ Change Values - View and Control point information, Acknowledge Alarms and modify Time Schedules.
      ◊ Enable / Disable - Change Value level plus allow the enabling or disabling of points and alarms.
      ◊ Configure - Minimal program level functions including creating and editing any object.
      ◊ Program - All privileges except password and create users
      ◊ Administrative - All privileges.

m. Saving/Reloading Programs
   1) The workstation software shall have an application to save and restore field controller memory dumps. The site and device record files shall serve as a menu tree to coordinate save/reload records. Each record shall have a minimum 12 character record name and a 32-character description.
   2) The Save/Reload application shall have the capability to set the system clock in a Level 1 controller.
   3) Default values store in the workstation database shall be sent to the controller during a reload operation either automatically or at the user's option.
   4) If during a poll of a controller, the workstation determines that the controller program has been lost, it shall be possible for the workstation to automatically reload the program without operator involvement.
      a) The software shall provide, as a minimum, the following functionality:
         - Graphical viewing and control of environment
         - Scheduling and override of building operations
         - Collection and analysis of historical data
         - Definition and construction of dynamic color

graphics
- Editing, programming, storage and downloading of controller database.

b) The graphical interface shall allow for all system operations and applications to be quickly and easily selected using the mouse in conjunction with groups of drop-down menus, lists, graphics and icons. Provide functionality such that all operations can also be performed using the keyboard as a backup interface device. Provide additional capability that allows at least ten (10) special function keys to perform often-used operations.

c) Software shall provide for a windowed approach which supports concurrent viewing and commanding of system operations. The software shall provide a multi-tasking environment that allows the user to run several applications simultaneously. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished through the use of Microsoft Windows or similar industry standard software that supports concurrent viewing and controlling of systems operations. The software shall be capable of simultaneously displaying and performing a minimum of two of the functions listed below in any workstation:
   (1) Dynamic color graphics and graphic control
   (2) Alarm reporting and acknowledging
   (3) Time-of-day scheduling
   (4) Trend data definition and presentation
   (5) Graphic definition
   (6) Graphic construction

d) Graphic displays shall be high-resolution, multi-colored presentations of actual building data and parameters.
Graphic displays may be quickly and easily viewed via any or all of the following methods as a minimum:
- Graphic links
- Drop down menus
- Special functions keys for points in alarm
   (1) Graphic links shall be standard symbols which can be located on graphic displays as desired by the user. These links shall allow the user to view any graphic display, either in a hierarchical fashion or as otherwise defined. The quantity of possible links shall be limited only by the space available on each display.
   (2) Drop-down menus may be used to view graphic displays by selecting from customized lists which include all graphics

available for viewing. Provide the capability to quickly scroll through all lists.

e) Special function keys shall be used to quickly view graphic alarm displays and user-defined default graphics, such as campus or building site plans. From the alarm display, the user may quickly view the graphic on which the associated point in alarm resides.

f) Provide static and dynamic graphic display capabilities. Static displays such as site plans, building layouts, floor plans and schematics shall provide the user with maps to allow for quick and easy access to any building information. Dynamic graphic displays may represent any real-time system information. Any system point or group of points may reside on a dynamic display. Dynamic displays such as schematics of any mechanical system or piece of equipment shall allow the user to monitor and control actual building operating parameters. Point values such as temperature, humidity and flow, and point status such as on/off, normal and alarm shall automatically and continually update to indicate current operating conditions. As a minimum, symbols, text and colors shall be dynamic in nature.

g) Provide functionality to allow for any analog point value to be displayed as an individual dynamic display window
for use as a convenient control and diagnostic tool. The display window shall include the following information as a minimum:
- Point name
- Point description
- Setpoint
- Current value
- Range of values
- High and low limit setpoints

(1) All values shall be displayed in both text and symbolic form, such as an analog bar, gauge or other standard measurement device. Setpoint values shall be changed by simply moving a pointer to the desired setting on the measurement device. After user verification of the correct setting the system shall control at the new setpoint. Provide the capability to superimpose these displays on their associated schematic graphics or on separate displays in user-defined groups.

h) Provide the capability to control any point from a dynamic graphic display. Relevant point information windows may be accessed by pointing to a symbol or text. Setpoints may be changed by

simply entering the new value. Status may be changed by selecting from predefined lists. The display shall ask the user to verify the change before allowing the system to respond.

i) Provide alarm annunciation capabilities, such that alarm status shall be displayed automatically on the screen regardless of system operation or application modes. The quantity of current alarms shall be displayed via a flashing icon or similar symbol. In addition, provide an audible signal to indicate the occurrence of new alarms. An alarm window may be displayed to view the alarms. From the alarm window the user shall be able to view the graphic and display a customized message of at least 250 characters associated with the point in alarm. When the graphic id displayed, the symbol of the point in alarm shall be flashing and shall have changed color. The user shall also be able to acknowledge, respond to and clear selected alarm conditions as desired.

j) Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide the following spreadsheet graphic types as a minimum:
- Weekly schedules
- Zone schedules
- Monthly calendars

(1) Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Each schedule shall include columns for each day of the week as well as holiday and special day columns for alternate scheduling on -user-defined days. Equipment scheduling shall be accomplished by simply inserting occupancy and vacancy times into appropriate information blocks on the graphic. In addition, temporary overrides and associated times may be inserted into blocks for modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.

(2) Zone schedules shall be provided for each building zone as previously described. Each schedule shall include all commandable points residing within the zone. Each point may have a unique schedule of operation relative to the zone’s occupancy schedule, allowing for sequential starting and control of equipment within the zone. Scheduling

and re-scheduling of points may be accomplished easily via the zone schedule graphic.

(3) Monthly calendars for a 24-month period shall be provided which allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

k) Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point (physical or calculated) may be trended automatically at predetermined time-based intervals or changes of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting. Any point, regardless of physical location in the network, shall be collected and stored in each DDC controller's point group. Each DDC controller panel shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 70,000 samples.

(1) Trend data report graphics shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or pre-defined groups of at least six points. Provide additional functionality to allow any trended data to be transferred easily to an off-the-shelf spreadsheet package such as Lotus 1-2-3 or Microsoft Excel. This shall allow the user to perform custom calculations such as energy usage, equipment efficiency and energy costs and shall allow for generation of these reports on high-quality plots, graphs and charts.

(2) A collection schedule function shall be provided to automatically collect trend data. A menu shall prompt for days of the week and time of day for collection of selected points. Provide a minimum of 12 user-selected time schedules per day.

l) Provide additional functionality that allows the user to view trended data on trend graph displays. Displays shall be actual plots of both static and real-time dynamic point data. Up to four points may be viewed simultaneously on a single graph, with color selection and line type for each point being user-definable. Displays shall include an

"X" axis indicating elapsed time and a "Y" axis indicating a range scale in engineering units for each point. The "Y" axis may be manually or automatically scaled at the user's option. Different ranges for each point may be used with minimum and maximum values listed at the bottom and top of the "Y" axis. All "Y" axis data shall be color-coded to match the line color for the corresponding point.

(1) Static graphics shall represent actual point data that has been trended and stored on disk. Exact point value may be viewed on a data window by pointing or scrolling to the place of interest along the graph. Provide capability to print any graph on the system printer for use as a building management and diagnostics tool.

(2) Dynamic graphs shall represent real-time point data. Any point or group of points may be graphed, regardless of whether they have been predefined for trending. The graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any profit. In addition, the user may pause the graph and take "snapshots" of screens to be stored on the PC disk for future recall and analysis. As with static graphs, exact point values may be viewed and the graphs may be printed.

m) A full screen, forms based point editor and programming function shall allow for point additions, deletions, changes, program modification and creation and point and program storage. This program shall be similar to a word-processing format such that full documentation of program changes may be available. This program shall provide the user with the capability to insert full English narratives to describe the control program. Search, insert, find, cut and paste functions shall allow for quick program modifications.

n) Provide a general purpose graphics package such as PC Paint Plus "In-a-Vision" which shall allow the user to quickly and easily define or construct color graphic displays. In addition, provide a library of standard HVAC equipment and symbols such as Rooftop air handling units, chillers, cooling towers and boilers and standard electrical symbols that shall aid the user in definition of standard or custom graphics. Additional libraries of standard symbols may be easily added to the package or the user can define or construct symbols as desired for additional customization. Graphic displays may be defined or

created to represent any building parameter, mechanical system or group of system points as described to facilitate building operation and analysis.

(1) Provide the user with the capability to easily define all system operating parameters.

(2) Libraries of standard application modules such as temperature, humidity and static pressure control may be used as “building blocks” in defining or creating new control sequences.

(3) The user shall have the capability to easily create and archive new modules and control sequences as desired via a word processing type format.

(4) Provide a library of standard forms to facilitate definition of point characteristics. Forms shall be self-prompting and incorporate a fill-in-the-blank approach for definition of all parameters.

(5) The system shall immediately detect an improper entry and automatically display an error message explaining the nature of the mistake.

o) Provide the capability to backup and store all system databases on the PC hard disk. In addition, all database changes may be performed while the PC is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate multi-purpose control units. Similarly, changes made at the multi-purpose control units shall be automatically uploaded to the PC, ensuring system continuity. The user shall also have the option to selectively download changes as desired.

(1) The workstation shall provide for automatic upload and download of program changes. Any program change made at the workstation shall be downloaded to the respective multi-purpose control unit. Any program change made at the multi-purpose control unit shall be uploaded to the workstation disk.

(2) Should a multi-purpose control unit lose its RAM database, the workstation shall automatically download that control unit’s program from the hard disk.

(3) An auto-boot function shall allow an unattended workstation to automatically re-start from a power failure.

p) Provide context-sensitive help menus to provide instructions appropriate with operations and

applications currently being performed.

q) Multiple user security levels shall be provided to allow for various degrees of system access and control. Provide a minimum of four levels of access, with each increasing level allowing control of additional system operations and applications. A minimum of twelve unique passwords, including user initials, shall be provided. The system shall automatically generate a report of log-on/log-off time and system activity for each user. Provide automatic log-off capability to prevent unauthorized system use. Automatic log-off time shall be user-definable in one-minute increments and may be disabled if desired.

r) The workstation shall be provided with a key element display that **records** logos, log-offs, TOD overrides, alarms and alarm acknowledgments. Provide a 500 element circular buffer for recording purposes. Key element reports may be filtered by operator name and may be run for a user defined time interval.

n. All points mapped to the workstation shall be available in both text and graphic format. All operator functions available on the text side of the workstation must also be available on the graphics side.

L. Multi-Purpose Controllers

1. Provide multi-purpose DDC controllers. Each multi-purpose controller shall be a microprocessor-based direct digital control unit and shall be capable of operating as a standalone controller on a high performance peer to peer network. Provide each multi-purpose controller with sufficient memory to operate in a truly independent manner; that is, each controller shall support its own inputs and outputs, operating system, database and programs necessary to perform control sequences and energy management routines. Additionally, each multi-purpose controller shall have sufficient memory to support the application specific controllers and LAN control panels connected to it over the local area networks.
2. Each multi-purpose controller shall be capable of full operation either as a completely independent unit or as a part of the building-wide control system. All units shall contain the necessary equipment for direct interface to the sensors and actuators connected to it.
3. Control strategies shall be owner definable at each multi-purpose controller, and for all control units in the system from any one operator terminal. Each control unit shall provide the ability to support its own operator terminal if so desired.
4. Each multi-purpose controller shall include its own microcomputer direct digital controller, power supply, input/output modules, and battery. The battery shall be self-charging and be capable of supporting all memory within the control unit if the commercial power to the unit is interrupted or lost for a minimum of 100 hours. Upon a power failure at the remote unit, operator intervention shall not be required to maintain the database.

M. Networking Communications

1. General - the network architecture shall consist of two levels. The top level shall be a high speed Ethernet LAN designed to support network

controllers, central plant controllers, work stations and a file server. The second level shall be a RS485 Token passing bus to support a family of dedicated local controllers for control of HVAC equipment, lighting, and access control. The second level bus shall communicate bidirectionally with the high speed LAN through Level 1 controllers for transmission of global data.

2. High Speed LAN - this Ethernet local area network shall operate at a minimum speed of 10 Mb/sec utilizing a TCP/IP communications architecture. The high speed LAN will provide transfer of point data, alarms and file activity among Level 1 controllers, work stations and the file server. The high speed LAN shall support a minimum of 50 nodes consisting of Level 1 controllers or workstations.
   Any data from a Level 2 controller can also be transmitted onto this bus through a Level 1 controller. The high speed LAN shall support multi-user communications and multi-session activity. That is, all global data sharing shall occur simultaneously with the transmission of alarm data or user activity.
3. Field Bus - the level 2 bus, or field bus, supports local control units of modular size for operation of the building's HVAC, lighting and access control systems. This RS485 bus shall operate at a minimum speed of 19200 baud, with a minimum length
   of 4000 feet or 32 nodes before requiring a network repeater. A minimum of 127 Level 2 controllers shall be configureable on the field bus. Manufacturers with baud rates of less than 19200 shall be limited to 64 Level 2 controllers to insure adequate global data and alarm response times.
   The field bus shall permit peer to peer communications among all Level 2 controllers and allow simultaneous communications with laptop computers that are connected to a Level 2 controller. Failure of the Level 1 controller will not impair the operation of its associated field bus.
4. Network Transparency - all points contained on Level 1 and Level 2 controllers shall be considered global points. Any program in any controller on the network shall be able to reference any point in any controller regardless of its location on the network.
5. Workstation Communications - workstations shall be connected directly to the high speed LAN. Workstations shall be able to communicate to any Level 1 controller, Level 2 controller, to additional workstations or the file server. Work stations shall also be able to communicate via modems to remote controllers via a RS232 connection. Telephone communications shall operate simultaneously with communication to any controllers connected on the high speed LAN.
6. Laptop Communications - the laptop computer shall communicate with either Level 1 or Level 2 controllers. Through the laptop, operators shall be able to view points and change parameters on any Level 1 or Level 2 controller on the network.
7. Dial-up Communications - it shall be possible to access the network remotely through a standard dial-up modem. This modem shall permit direct access to the high speed LAN via a Level 1 controller. It shall be possible to configure multiple modems in Level 1 controllers to enable multi-user communications when more than 1 telephone line is available.

N. DDC Controllers:
   1. A Level 1 controller has its own on-board CPU, clock/calendar, EPROM, RAM, ROM, communication port(s), and network connections to the high

speed LAN and the field bus. The Level 1 controller may either have on-board or remote mounted I/O. Level 1 controllers are capable of complete standalone operation. Level 1 controllers are available with an optional user display.

The firmware shall consist of the operating system, communication software, programming language, and resident control application software. The firmware may optionally contain user interface software to support dumb terminal operation. Where this is not provided the Level 1 controller must be optionally programmable from the laptop computer.

The custom application software shall reside in battery backed RAM or EPROM. RAM will also be used for storing trend data and clock/calendar information.

Level 1 controllers shall provide communication to both the high speed LAN and the field bus. In addition, a minimum of 1 RS232 or RS485 port shall be provided for connection to a workstation or laptop computer. When the port is RS232, it shall optionally support communication to a modem or printer. Where multiple RS232 ports are available, multi-user communications shall be supported.

2. Analog Inputs - the Analog Input (AI) function shall monitor each analog input, perform A/D conversion, and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution 12 bits. Input ranges shall be within the range of 0-10 VDC or 4 - 20 mA.
3. Digital Inputs - the Digital Input (DI) function shall accept dry contact closures and voltage level transitions. A voltage level below 1 volt shall be read as ON (closed), a voltage level above 3 volts shall be read as OFF (open).
4. Pulse Accumulator Inputs - the pulse accumulator input function shall have the same characteristics as the DI, except that, in addition a buffer shall be included to totalize pulses between interrogations. Each input shall accept pulses at a minimum of 2 per second.
5. Temperature Inputs - temperature inputs originating from a thermistor, shall be monitored and buffered as an AI, and provide automatic conversion to degrees F or C without any additional signal conditioning.
6. Input Wiring - all inputs shall be two wire devices and shall not require shielded wire for accurate operation.
7. Outputs - output types shall include digital, universal and tri-state. Outputs shall be available with built-in hand-off-auto switches for local overrides.
8. Digital Output - the Digital Output (DO) function shall provide contact closure for momentary (Pulse Width Modulation) and maintained operation of field devices. Output pulse width shall be selectable between 0.1 and 3200 seconds with a minimum resolution of 0.1 seconds. Isolation and protection against voltage surges up to 180 VAC peak shall be provided. Contact rating shall be a minimum of 1 amps at 24 VAC. Each digital output shall be equipped with an optional ON/OFF/AUTO switch to manually obtain either output state. Manual overrides shall be reported to the controller at each update. An LED shall be provided to indicate the state of each digital output.
9. Universal Output - a Universal Output shall provide 0-20VDC, 0-20 mA control signal (with a maximum resolution of .1 volt and .1 mA), and standard Form C relay operation (1 amps, 24 VAC). It shall be possible to select the mode of output operation for each output by simply wiring to the appropriate terminations on the controller. No circuit boards or output cards shall have to be exchanged to select the desired output mode.

10. A three-position manual override switch shall allow selection of the ON, OFF, or AUTO output state. In addition each UO shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.
11. The Form C output mode shall be capable of standard digital output operation including pulse width modulation.
12. All current outputs shall be fuse protected to 120VAC.
13. Tri-State Outputs - tri-state outputs shall consist of two 24VAC relays for control of bi-directional motors and actuators. Each tri-state output is capable of PWM (pulse width modulation) to a resolution of .1 second.

O. DDC Controller Resident Software Features
1. General:
   a. All necessary software to form a complete operating system as described in this specification shall be provided.
   b. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.
2. Control Software Description:
   a. Software Description - The application software shall be configured for each Level 1 controller either locally through a laptop computer or through a workstation. Level 1 controllers shall contain PROM as the resident operating system. Application software will be RAM resident. Application software will only be limited by the amount of RAM memory. There will be no restrictions placed on the type of application programs in the system.
      Each Level 1 controller shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function by Level 1 controllers shall not be interrupted due to normal user communications including; interrogation, program entry, printout of the program for storage.
   b. Real-Time Operating System - Provide a real time operating system in PROM memory requiring no operator interaction to initiate and commence operations. The program shall include:
      1) Operation and management of all devices.
      2) Error detection and recovery from arithmetic and logical faults
      3) Editing software to allow the user to develop or alter application programs.
      4) System self-testing
      5) Multi-user.
      6) Multi-tasking.
   c. Editor - When programming a controller through either a dumb terminal or laptop computer, editing and word processing features will include as a minimum:
      1) Cut, copy, paste, and undo.
      2) Search and replace.
      3) Comments.
      4) Scrolling.
      5) Character, line, and page cursor control.
      When programming in terminal mode, the system will allow

full screen, character editing for correction or modification of any portion of a program. Syntax errors will be highlighted, and programmers must make corrections prior to the program being compiled. When programming Level 2 controllers, the programming environment will be identical to Level 1 programming with automatic uploading and downloading of the compiled code to the controller.

d. Point Identification - Users must be able to assign unique identifiers for each connected point. Identifiers must have at least twelve alpha/numeric characters. All references to these points in programs, reports, and command messages shall be by these identifiers.
Each point name can have up to a 40 character description, and optionally engineering units (up to 8 characters).

e. User Programming Language - The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be English language and programmable by the user.
The language shall be structured to allow for the easy configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, passwords, and histories.
The language shall allow the creation of timers anywhere in the logic of a program. Each timer shall increment in seconds and increment to a maximum of 365 days.
The language shall be self-documenting. Users shall be able to place comments anywhere in the body of a program. Program listings shall be configurable by the user in logical groupings.

f. Application Software - The system shall contain include ROM based, built-in software modules for the creation of standard application programs. Modules will include as a minimum:
1) PID Algorithm
2) Self-tuning PID
3) Calendar Functions (Seconds, minutes, hour, day of week, day of month, day of year, month and year)
4) Curve fit
5) Optimum Start

g. Mathematical Functions - Each controller shall be capable of performing basic mathematical functions (+,-,X,/), squares, square roots, exponential, logarithms, boolean logic statements, or combinations of both.
The controllers shall be capable of performing complex logical statements including operators such as >,<,=, and/or,exclusive. These must be able to be used in the same equations with the mathematical operators and nested up to five parenthesis deep.

h. Passwords - Level 1 controllers will have up to 8 levels of passwords. The highest level will allow access to all functions within the system. The remaining 4 levels will be definable by the user to include any subset of system commands.

i. History Logging - Each controller shall be capable of logging any system variable over user defined time intervals ranging from 1 second to 1440 minutes. Any system variables (inputs, outputs, math calculations, and flags) can be logged in history. A maximum

of 32767 values can be store in each log. Each log can will record either the instantaneous, average, minimum or maximum value of the point. Logs can be automatic or manual.
If shall be possible to find the average of a log, the standard deviation, the sum, minimum or maximum. It shall also be possible to reference any value within a log for use in a control program.

j. Reporting - The system shall be able to create user definable reports containing any combination of text and system variables. Report templates will be created by users in a word processing environment. Reports can be displayed based on any logical condition or through a user command.
Numerical displays shall be up to 10 digits in length, with up to 4 digits to the right of the decimal point. The format of each numerical display shall be user definable.

k. Alarming - For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested each scan and can result in the display of one or more alarm messages or reports. Messages and reports can be sent to the optional display panel, a local terminal, to the Host Computer, via modem to a remote computing device.

l. Debugging Tools - The language shall have built in program debugging tools for program simulation and error detection.
When a control program is placed in a debug mode, a continuous record shall be kept of the last 128 steps before discarding the oldest data. Up to 4 control programs can be placed in a debug mode concurrently.

m. Overriding Programs - It shall be possible to disable any point in the system and modify it to a user definable value. Any points that have been disabled will be kept in a log and viewable by an operator at any time.

P. Control Valves

1. All automatic valves shall be fully proportioning with packing glands designated for hot service. All valve bodies shall be designated for 125 psig service and shall have bronze trim and throttling plug inner valves for modulating control. Valves shall be normally open or closed as required and each shall be sized for the allowable pressure drop.
2. All two-way valves shall have external spring adjustment with a self-sealing V-ring packing arranged to tighten the seal as the water pressure increases so that no manual adjustment is necessary.
3. All other heating coil valves shall be either normally open or closed as specified. The interiors of all such valves shall be designed for 100% tight shut-off against the operating pressure.
4. All automatic valves and separable sockets shall be furnished by the Temperature Control Contractor and installed in the lines by the Mechanical Contractor.

Q. Dampers

1. All automatic dampers shall be furnished by this Contractor. Automatic control dampers shall be Ruskin CD60 or approved equal. All dampers for modulating control shall be of the proportioning type with adjacent louvers rotating in opposite directions. Damper frames shall be constructed of 16 gauge galvanized sheet metal. Bearings shall be nylon with oil impregnated sintered iron bushings. All linkages shall be fastened to blades within the

damper. Provide double linkages on damper panels over 42" wide.

2. Replaceable rubber seals shall be provided with the dampers. Seals shall be installed along the top, bottom and sides of the frames and along each blade. Seals shall provide a tight closing, low leakage damper. Leakage and floor characteristics charters shall be submitted to the architect prior to approval of dampers.
3. Electronic Actuator
   a. Actuators for damper control shall be direct coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The fastening clamp assembly shall be of a "V" bolt design with associated "V" shaped toothed cradle attaching to the shaft for maximum strength eliminating slippages. Spring return actuators shall have a "V" clamp assembly of sufficient size to be directly mounted to an integral jackshaft of up to 1.05 inches when the damper is constructed in this manner. Single bolt or set screw type fasteners are not acceptable.
   b. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.
   c. For power failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable.
   d. All spring return actuators shall be capable of both clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
   e. Actuators shall be Belimo, or equal.
4. All of the automatic dampers shall be furnished by the Temperature Control Contractor and installed by the Sheetmetal Subcontractor.
5. Combination smoke/fire control dampers amperage draw of motor shall be provided by temperature control contractor. Dampers shall meet UL555S leakage class 2 standards and shall be equipped with wall sleeves and factory mounted electric actuators. Dampers shall be Ruskin S050 or approved equal.

R. Electronic Sensors
1. All mixed air and coil discharge sensors shall utilize industry standard thermistor with averaging elements. Sensing elements shall be a minimum of 25 ft. and temperature sensed shall be averaged over the entire length of the element.
2. Space type sensors shall have an accuracy of +/-.5 degrees over sensed temperature range (20/120F).
3. Well type sensors used for liquid immersion shall have stainless steel removable wells. Sensing element shall have an accuracy of +/- .5 degrees over amperage draw of motor the range (70/220F or 20/120F) of the sensor. Each sensor shall have a suitable electrical box to enclose all wiring connections.
4. Temperature control wells shall be installed by mechanical contractor under supervision of temperature control contractor.

S. Smoke Detectors
1. The Electrical Sub-Contractor shall furnish smoke detectors to be installed in ductwork by the Sheetmetal Subcontractor. The Electrical Sub-

Contractor shall wire from the detectors to the associated HVAC unit control circuit for shutdown of fans. The Electrical Sub-Contractor shall wire the normally closed contacts in series to the fan starter holding coil. All wiring to smoke detectors shall be by the Electrical Sub-Contractor.

2. All units shall utilize smoke detectors, as specified.

T. Safety Low Limit Thermostats

1. All fan systems introducing outdoor air with hot water coils shall be equipped with safety low limit thermostats designed to stop the fan while closing the outdoor air damper any time the discharge temperature falls below 38 degrees. The safety thermostats shall utilize a 20 foot sensing element responsive to the lowest temperature along its entire length. Provide one thermostat for each 16 square foot coil surface as a minimum.

U. Current Sensors

1. Current sensors shall be analog type, sensitivity dated for the application with a 4-20 ma or 0-10 Vdc output. Span and sensitivity shall be adjustable. Sensors shall be used for all fans and pumps.

V. Air Static Pressure Transmitter

1. Transmitter shall have range of 0-1” or 0.5” w.g. and send a 4-20 milliamp output signal. Zero set range and span set range +/- 5% of full range output. A combined static error (non-linearity, non-repeatability, and hysteresis) +/- .5% of full range output. Transmitter ranges shall be selected by ATC contractor as appropriate for intended use.

W. Water Differential Pressure Transmitter

1. Low differential pressure transducer for wet-wet application. 4-20 milliamp output signal. Setra C230 or equal.

X. Building Management and Control System Wiring

1. All input and output control wiring to the control units shall be #18 twisted and shielded cable. All shield to be grounded at the control panel, shields at the sensors or transducers to be folded back and taped.
2. Communication trunk wiring shall be #18 twisted and shielded cable. Trunk isolator/extenders shall be installed on either end of trunk.
3. All cable splices shall have joints soldered and taped including the shield. No mechanical connections will be acceptable.
4. No digital input or output points shall be more than 250 feet from its respective panel.
5. All wiring within the panels must be made with connectors of appropriate size and design for the terminals being applied.
6. All connections within the panels must be made with connectors of appropriate size and design for the terminals being applied.
7. All cables must be labeled and identified on corresponding termination drawings. A copy of the termination drawing will be adequately protected and left in its respective panel.

Y. Control Wiring

1. Electrical work will be in accordance with NFPA 70, ANSI C2 and Division 26 of these specifications. Electrical wiring, terminal blocks and other high voltage contacts will be fully enclosed and marked to prevent accidental injury.
2. All wiring associated with the installation will be the responsibility of the

Contractor. The term “wiring” is construed to include furnishing of wire, conduit, miscellaneous material and labor to install a total working system.

3. It is the responsibility of the Electrical Sub-Contractor to provide adequate connections and extensions from 120-volt power sources to the various items of equipment requiring power under this contract. Branch circuits serving equipment under this contract will be separate and used only for such equipment. All branch circuit conductors 120 volts or greater will be at least 14-gauge copper, type THW, 600 volt insulation, installed in minimum 3/4 inch conduit (EMT).
4. Transient Protection - All electronic equipment including processors, relays, monitoring devices, temperature sensors and other non-computerized solid-state equipment will be adequately protected against power line transients or RFI interference. Equipment that fails to operate properly due to transient or other electrical interference, in the opinion of the Engineer, will be required to be retrofitted with the appropriate protection device(s).

Z. Points List: (the following points list is the minimum required points that will be available to all user interface devices)
1. Boilers:
   a. Boiler enable/disable.
   b. Boiler status.
   c. Boiler sequencing.
   d. Boiler firing rate.
   e. Boiler isolation control valves.
   f. Hot water supply temp.
   g. Hot water return temp.
   h. Boiler failure alarms.
   i. Hot water reset control.
2. Boiler pumps:
   a. Pump status.
   b. Lead/lag control.
   c. Differential pressure sensors.
   d. Variable frequency drives % command.
   e. Pump failure alarms.
3. Rooftop Energy Recovery Units (ERV):
   a. Unit enable/disable.
   b. Supply fan status.
   c. Supply fan VFD % command.
   d. Return fan status.
   e. Return fan VFD % command.
   f. Discharge air temp. set point (winter)
   g. Discharge air temp. set point (summer)
   h. Discharge static pressure.
   i. Discharge air humidity.
   j. Return air temp.
   k. Return air humidity.
   l. Recirculation air damper command.
   m. Filter status.
   n. Occupied set point.
   o. Unoccupied set point.
   p. Freezestat.
   q. Return air CO2 monitoring (where applicable).
   r. Hot water valve command/position.
   t. Outside air entering temperature. (DB/WB)

u. Supply air temp. leaving enthalpy wheel. (DB/WB)
w. Supply air temp. leaving heat pipe. (DB/WB)
x. Exhaust air temp. leaving heat pipe. (DB/WB)
y. Exhaust air temp. leaving enthalpy wheel. (DB/WB)

4. Rooftop air handling units (RTU):
   a. Supply fan status.
   b. Supply fan enable/disable.
   c. Supply fan VFD % command.
   d. Return fan status.
   e. Return fan enable/disable.
   f. Return fan VFD % command.
   g. Discharge air temp.
   h. Discharge static pressure.
   i. Discharge air humidity.
   j. Supply air CFM.
   k. Supply air temperature reset.
   l. Return air temp.
   m. Return air humidity.
   n. Return air CFM.
   o. Mixed air temp.
   p. Mixed air damper command.
   q. Outside air CFM.
   r. Outside air minimum CFM set point.
   s. Filter status.
   t. Return air CO2 monitoring (where applicable).
   u. Room occupancy sensor (where applicable).
   v. Hot water valve command/position.
   w. Compressor staging.
5. Fancoil Units:
   a. Room temperature.
   b. Room temperature set point.
   c. Occupied set point.
   d. Unoccupied set point.
   e. Chilled/hot water valve command/position.
6. Exhaust Fans:
   a. Exhaust fan enable/disable.
   b. Exhaust fan status.
7. Unit heaters/Cabinet unit heaters:
   a. Room temperature.
   b. Room set point.
   c. Heating valve command.
8. Fintube Radiation and Convectors:
   a. Room temp.
   b. Room set point.
   c. Heating valve command.
9. Radiant Panels:
   a. Room temp.
   b. Room set point.
   c. Heating valve command.
10. Hot Water Heater
   a. Setpoint temperature.
   b. Operational status (on/off)
11. IDF/MDF Ductless Split Fancoil Units
   a. High temperature alarm.

b. DFC failure alarm.

12. Ductless Split Fancoil Units
    a. High temperature alarm.
    b. DFC failure alarm.
13. Global Points:
    a. Outdoor air temp. (DB/WB)
    b. Outdoor air humidity. (Rh)
18. Potable Domestic Hot Water Circulator Failure Alarm
19. Non-Potable Hot Water Circulator Failure Alarm
21. Gas Meter (CFH)
22. Boiler Gas Sub-Meter (CFH)
23. Domestic Water Heater Gas Sub-Meter (CFH)
24. Domestic Cold Water Sub-Meter (GPD)
25. Domestic Hot Water Sub-Meter (GPD)
26. Emergency Shower Sub-Meter (GPD)
27. Freezer and Refrigerator alarms.

AA. Hard Wired Alarms

1. The following hard wired alarms shall be provided by the ATC sub-contractor, which shall include a relay output (through a contact closure) and wiring to the MDF room with 30' coiled and labeled at the backer board for connection to the system:
    a. Boiler failure alarm.
    b. Building low temperature alarm.

2.49 SCAFFOLDING AND STAGING

A. General: Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.

B. Scaffolding and staging required for use by this Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Sub-Trade requiring such scaffolding.

C. Each Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).

D. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Subcontractor.

2.50 HOISTING MACHINERY AND EQUIPMENT

A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 – EXECUTION

3.1 MATERIALS AND WORKMANSHIP

A. All materials installed in this work shall be new, unless noted for re-use, without damaged functional or aesthetic components. All equipment finished shall be touched up with matching finishes where slight scratches occur. Equipment or material subject to severe deterioration shall be completely refinished or replaced as directed by the Architect.

B. All labor utilized in the installation of work shall be experienced in the respective trade required. The installation of exposed finished materials shall be neatly done flush, straight and/or plumb, without distortion, meeting the building finished surfaces.

C. All HVAC materials and equipment shall conform to the Standards listed within this Section of the Specifications and wherever such standards have been established, items shall bear its respective label.

D. Where labor to be furnished must meet specific Code requirements, only individuals certified to do such shall be used.

E. All equipment shall be installed in accordance with the manufacturer's instructions and recommendations with adequate clearance for access for maintenance.

3.2 COORDINATION

A. This Contractor shall give full cooperation to other trades and to the General Contractor and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay. If this Contractor installs his work before coordinating with other trades, he shall make the necessary changes in his work to correct the condition, without extra charge. In areas, if due to construction conditions, more than one trade is required to use common openings in beams, or conduits, this Contractor must plan and locate the positions of the items of piping, ducts, and conduits, which are under the scope of his Contract with that of items under the scope of other Contractors, in order that all items are properly located and may be accommodated within the space available. Location and positioning shall be done prior to installation and to the satisfaction of the Architect and/or Engineer.

B. This Contractor shall obtain detailed printed information from the manufacturer of equipment which he is to provide for the proper methods of installation. He shall also obtain all information from the General Contractor and other Contractors which may be necessary to facilitate his work and the completion of the whole project. All equipment shall be installed in strict accordance with manufacturer's recommendations.

C. The work to be accomplished under this Section includes work within existing areas adjacent to the site of new construction. Continuity of services within existing areas shall be maintained. Any interruption of services necessary to accomplish the work shall be made only with the consent of the General Contractor and at such time(s) as the Owner designates.

D. This Contractor shall not unnecessarily disturb or interfere with the Owner's use of

the facilities associated with or adjacent to this Contract. When interference is necessary, permission shall be obtained from the General Contractor before any operation or service line is disturbed or disconnected.

E. This Contractor shall include under coordination work the installation of all systems in conformance with governing codes. This Contractor is advised that no piping, ducts or equipment foreign to the electrical equipment shall be permitted to be installed in, enter or pass through such spaces or rooms provided for switchboards and panelboards in accordance with Article 384 of the National Electrical Code.

E. Diffusers, grilles and registers located in the ceiling shall be located as shown on the Architectural Reflected Ceiling Plan and coordinated with ceiling grid, lights, and speakers. Items shown on the HVAC Drawings, but not located on the Reflected Ceiling Plan shall be coordinated to be located as indicated on the HVAC Drawings.

3.3 COORDINATION DRAWINGS

A. Coordination Drawings shall be initiated under this Section of the Specifications. It is this Contractor's responsibility for preparation of project Coordination Drawings showing the installation of all equipment, piping, ducts and accessories to be provided under this Section of the Specifications. These Drawings shall be prepared at not less than 3/8 inch = 1'0" scale and shall show building room layouts, structural elements, ceiling grid, diffusers, registers, grilles, ductwork and lighting layouts out of function. A reproducible copy of each Drawing prepared shall then be submitted to each Contractor working under the Plumbing, Fire Protection and Electrical Sections of this Specification, who shall be responsible to coordinate their equipment and systems and shall show these on the Drawings submitted. After each Trade Contractor has fulfilled their obligations, they shall return the Drawings to the HVAC sub-contractor. After each Drawing has been coordinated between trades, each trade shall sign each Drawing indicating acceptance of the installation condition. This Contractor shall then print the coordination original, and these prints shall be submitted, through the General Contractor to the Architect, for review and comment, similar to Shop Drawings. Comments made on these Drawings shall result in a correction and resubmittal of the Drawings. A master small scale drawing of the entire building shall be initially prepared showing all areas involved and the Drawing numbers covering each area.

3.4 PROTECTION AND CLEAN UP

A. This Contractor shall be responsible for maintenance and protection of all materials and equipment furnished by him during the construction period from loss, damage or deterioration until final acceptance by the Owner. All materials and equipment on the job site shall be stored and protected from the weather. All piping and equipment openings shall be temporarily closed during construction to prevent obstruction and damage.

B. All equipment with damaged finished surfaces shall be cleaned and repainted with the same paints as were factory applied.

C. Clean-Up: Keep the job site free from the accumulation of waste materials and rubbish daily. At completion of the work, remove all rubbish, construction equipment and surplus materials from the site and leave the premises in a clean condition.

3.5 OPERATING AND MAINTENANCE MANUALS

A. This Contractor shall provide four (4) complete sets of operating and maintenance manuals to the Owner prior to the operating instruction period. Maintenance manuals shall be submitted for approval. The receipt of approved maintenance manuals by the Owner shall be a prerequisite to system acceptance. Each manual shall include the following:
   1. A complete set of Shop Drawings arranged in accordance with their appearance in the Specifications. Drawings shall be folded and included in envelopes and bound into the manual.
   2. A complete set of operational and servicing instructions for each piece of equipment, bound into the manual adjacent to the corresponding Shop Drawing.
   3. A complete listing of all equipment suppliers, together with local agent's names, addresses and telephone numbers.
   4. A complete set of valve listings.
   5. Copies of all service contracts provided for the guarantee period.
   6. Copies of all equipment and system warranties.

3.6 OPERATING INSTRUCTIONS

A. This Contractor shall provide competent representatives of his firm and also qualified representatives for his major equipment to instruct Owner-designated personnel on the start-up, operation, shut-down and servicing of all equipment and systems furnished and installed under this Section. No less than ten (10) days' notice shall be given to the Owner for the beginning of the instruction period to permit scheduling of Owner personnel. The instruction period shall be a prerequisite to system acceptance. This contractor shall coordinate this requirement with the Commissioning Agent. Refer to specification section 01 91 10 for additional requirements.

B. Training of the Tenant's and Building Owner's operation and maintenance personnel is required in cooperation with the Tenant's and Building Owner's representatives. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Tenant's and Building Owner's Representatives after submission and approval of formal training plans. Refer to Commissioning Specifications, Section 01 91 13 for contractor training requirements.

D. At the conclusion of the operating instructions, this Contractor shall have the Owner's personnel sign-off stating they have received the required instruction. Separate statements shall be required for each piece of equipment and system. These statements shall include date, names of Owner's representative, name of instructor, and brief description of equipment or system.

3.7 SYSTEM START-UP AND OPERATION

A This Contractor shall provide all labor and materials and services necessary for the initial start-up and operation of all systems and equipment furnished and installed under this Section of the Specifications.

B This Contractor shall provide the services of qualified factory representatives for all major equipment pre-start set-up, start-up and initial operation. Such periods shall be sufficient to insure proper operation of systems and equipment.

C This Contractor shall check all equipment during the initial start-up to insure correct rotation, proper lubrication, adequate fluid flows, non-overloading electrical characteristics, proper alignment and minimal vibration. Systems shall be checked for air and/or steam and/or water flows throughout without blockages. Rooftop air handling units shall be checked for proper damper connections and positions aligned and adjusted belt drives, proper lubrication, temporary air filters installed, non-excessive electrical characteristics and minimal vibration. Miscellaneous equipment shall be started and operated as described above, as applicable. This Contractor shall prepare and submit monthly start-up and status reports for all equipment and systems as indicated on the schedules. Initial form of this report shall be submitted for review with the initial submittals. Upon closing in of the structure or upon first equipment start-up, the report filing shall be started. One copy of this report shall be submitted to the Testing and Balancing Contractor for his record purposes. Submittal of these reports is a prerequisite for processing and evaluating requisitions.

1. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Commissioning Specifications, Section 01 91 13 for additional requirements.
2. System verification testing is part f the commissioning process. Verification testing shall be performed by the contractor and witnessed and documented by the Commissioning Agent. Refer to Commissioning Specification Section 01 91 13 for system verification tests and commissioning requirements.

D During operation of systems, qualified licensed personnel shall be provided and designated for maintenance of the equipment and systems in good running order. Items such as strainer cleanout, bearing lubrication, packing replacement and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of this Contractor, and continued failures shall be grounds for the Owner to provide such services with back-charges to this Contractor.

E Prior to building flush out, all filters installed within all air handling equipment shall be replaced with filters having minimum rating of MERV 13 unless such equipment was specified with filters having a higher rating. Air handling equipment shall include but not be limited to air handling units, rooftop units, energy recovery units, make-up air units, fancoil units and classroom unit ventilators. Upon completion of building flush out, all filters installed within all air handling equipment shall be replaced with filters having minimum rating of MERV 13 unless such equipment was specified with filters having a higher rating.

F Coordinate all start-up, operation, and testing activities with the Project Manager, General Contractor and the Commissioning Agent per specification section 019110.

3.8 FIRE STOPPING

A. HVAC installations in hollow spaces, vertical shafts and ventilation or air handling ducts shall be so made that the possible spread of fire or products of combustion will not be substantially increased. Openings around mechanical/HVAC penetrations through fire-resistance rated walls, partitions, floors or ceilings shall be fire stopped using approved methods to maintain the fire-resistance rating. Refer to Section 07 84 00 for Firestopping. All fire stopping material and installation will be by the HVAC Subcontractor.

3.9 SYSTEMS IDENTIFICATION

A. General:
1. All equipment, ductwork and piping furnished under this Section shall be marked for ease of identification in accordance with ANSI A13.1-1981 Standard or as indicated below by this Contractor.
2. Marking shall be done using painted stenciling applied to clean, smooth surfaces.
3. Lettering type and size shall be in accordance with paragraph 3.4 and Table 3 of ANSI Standard, with sharply contrasted background for ease of identification. Duct labeling shall not be less than 3 inches in height. Colors shall be in accordance with paragraph 3.2 and Table 2 of the ANSI Standard.

B. Equipment:
1. Equipment markings shall be prominently painted on each normally visible side of equipment. Equipment intended for installation in finished areas shall have markings located behind normally used access panels mounted so as to be readily found.
2. Equipment identification designations shall be taken from equipment schedules as indicated on the Drawings.
3. All rooftop air handling units, energy recovery units and make-up air units shall be numbered on at least two (2) sides in 4” to 6” letters of contrasting color. Number shall be associated with the street or occupancy address preceding the HVAC unit number (example, 23-1, 23-2, ….). LED or keyed remote test switch shall be labeled with device number information corresponding to rooftop designation. Where rooftop units with duct smoke detectors are above a suspended ceiling, the tile grid shall be marked with a red dot if an LED is not present.

C. Piping:
1. Piping marking, except as noted below, shall be prominently painted on all piping concealed and exposed to view, at entries to shafts and at all valving. Marking spacing shall be every 20 feet and at all changes in direction.
2. Piping markings shall indicate direction of flow with piping designation taken from piping legend indicated on Drawings.
3. In lieu of painting pipe marking for outside diameters of no less than 3/4 inches but less than 6 inches labeling shall be on semi-rigid plastic which shall be wrapped entirely around the item being identified and attached to itself to form a non-removable band.
4. In lieu of painting pipe marking for outside diameters of 6 inches or greater, springs or metal bands secured to the corners at each end of the semi-rigid plastic marker so as to hold each end of the marker firmly against the pipe may be utilized.
5. In lieu of painting, for outside diameters less than 3/4 inches, labeling of 1/2 inch high lettering on 1-1/2 inch minimum diameter tags shall be attached so as direction of flow arrows will indicate proper flow direction when tag is being read.

D. Ductwork:
1. Ductwork marking shall be prominently painted on all ductwork concealed and exposed to view. Marking spacing shall be every 20 feet at all dampers and at all changes in direction.
2. Ductwork marking shall indicate direction of air flow with ductwork

designation to consist of the equipment designation to which it is connected and indicate either high or low velocity system.

3. Access doors at service openings for fire dampers, smoke dampers and smoke detectors shall be identified with letters no less than 1/2 inch in height to indicate the location of the fire protection device(s) within.

E. Valve Tags:

1. Valve tags shall be 1-1/2 inch diameter brass with 1/4 inch high lettering for service designation over 1/2 inch high valve number designation and shall be provided for all valving.
2. Two (2) sets of valve lists shall be prepared showing tag numbers, valve locations and valve service. Valve tag numbers shall be marked on Record Drawings. One valve list shall be prepared based on sequenced room numbers of valve locations; one valve list shall be prepared based on valve numbers. One set of lists shall be framed under glass and duplicate list laminated between plastic sheets.
3. One (1) additional copy shall be framed under glass and mounted on the wall in location as designated by the Architect.

3.10 SHEET METAL WORK REQUIREMENTS

A. Furnish and install all sheet metal work as herein specified for all air handling systems shown on drawings and/or described in the specifications.

B. All sheet metal work shall be done in a neat and workmanlike manner with ductwork following building lines and in straight lines with smooth transitions and offsets as required to suit actual installation. Sheet metal work which does not conform to drawings and/or specifications or is poorly done shall be repaired and/or replaced as described by the Architect.

C. Reference shall be made to the paragraph covering Coordination Drawings for the responsibility in the preparation of same.

D. Sheet Metal Contractor shall include in his work furnishing and installing volume dampers in accordance with SMACNA requirements; additional dampers in the duct system for the purpose of balancing by the Balancing Contractor, as well as dampers shown on the drawings.

E. Sheet Metal Contractor include in his work furnishing and installing automatic control, fire, smoke and combination fire/smoke dampers.

F. Air handling systems shall conform to the following:

1. All sheet metal work required for ductwork casing and plenums of all low pressure air handling systems shall be galvanized steel and shall conform to requirements of sheet metal work. Exceptions to this requirement shall be as specifically listed below or as indicated on the drawings.
2. All sheet metal work required for ductwork, casings and plenums of air handling system with scheduled total static pressure equal to or greater than 3 inches shall conform to the requirements for the static pressure scheduled. This construction shall apply from the outside air and return air dampers at the unit inlet and extend to the system terminal boxes.
3. Sheet metal supply and return ductwork for the surgery areas from the terminal boxes to the supply diffuser (including plenum) and from the exhaust registers for 10 feet shall be aluminum.
4. Sheet metal exhaust ductwork for lab exhaust and all other fumehoods shall

be 316 stainless steel. All joints and seams shall be welded to provide a continuous seal.

G. All casings and plenums shall be provided with 54 inch high, 20 inch wide access doors, except where larger door is required for equipment replacement, or when casing or plenum will not accommodate this size door. When alternate door of larger size is required, it shall be sized to meet requirements of equipment being served. For doors smaller than 54" x 20" the largest following door size which can be accommodated shall be provided: 48" x 20"; 36" x 18"; 24" x 18"; 18" x 18"; 18" x 12"; or 12" x 22". In all cases the bottom of the door opening shall be a minimum of 6 inches above the plenum's bottom.

H. Two-piece streamliner shall be furnished and installed at no additional cost to the Owner around each conduit, beam or other obstruction passing through ductwork. Obstructions in ductwork shall be allowed only when offsets around ducts are not possible and shall be indicated on Coordination Drawing.

I. Sealants: All seams in sheet metal work shall be permanently sealed airtight by the use of appropriate mastic compounds. Joints between dissimilar materials shall be provided with lead gaskets. Louver plenums shall be provided with lead gaskets. Louver plenums shall have all bottom seams and side seams up to distance of 12 inches sealed using solder.

J. Duct Liners: Where ducts indicated on drawings or specified are to be lined, such lining shall conform to the requirements specified under Acoustic Liner indicated in Paragraph "Sheet Metal Work". Duct sizes indicated on the drawings are nominal internal dimensions and therefore shall be increased accordingly to accommodate duct lining.

K. The Sheet Metal Contractor shall install all duct mounted smoke detectors, heat detectors and other devices furnished by the Electrical Sub-Contractor for mounting in the ductwork or air handling equipment.

L. Fire dampers shall be installed in accordance with the manufacturer's installation instructions. Fire dampers shall be capable of maintaining the integrity of the required fire-resistance rating and shall be accessible. Where ductwork is rearranged to facilitate coordination or installation, the fire dampers shall be provided at locations where air distribution systems penetrate assemblies required to have a fire-resistance rating.
1. Exception when approved by the Architect and Engineer are as follows:
2. When proper fire tests have shown that fire dampers are not necessary to maintain the integrity of the fire-resistance rated assembly.
3. Sub-ducts extending 22 inches vertically upward may be used in lieu of fire dampers for exhaust ducts penetrating a fire-resistance rated shaft wall.
4. Penetrations of tenant separation and corridor walls in buildings equipped throughout with an approved automatic fire suppression system.
5. When the ducts are constructed of steel and are part of an engineered smoke removal system.
6. Penetrations of corridor walls when the ducts are constructed of steel and do not have openings which communicate the corridor with adjacent spaces or rooms.
7. Penetrations of a roof assembly when ducts are open to the atmosphere.
8. Hazardous exhaust systems as defined in the Mechanical Code.

M. All prefabricated duct sections shall be cleaned prior to storage on the site and be provided with protective covering on all openings to maintain the interior of the ductwork clean and free of dust and other materials prior to installation. Field assembled duct sections shall be cleaned during assembly and similarly protected until installation.

N. Blank off all portions of louvered openings not required for ventilation systems.

O. Access doors shall be provided adjacent to each fire damper, smoke damper, combination fire/smoke damper, and smoke detector. The access opening shall be large enough to permit inspection, maintenance and resetting of the device. Where the size of the duct permits, the minimum size door should be 18 inches x 16 inches.

P. Testing for ductwork shall be performed for all duct systems specified to be constructed to a static pressure class of 4" w.g. or greater and to all stainless steel exhaust systems serving laboratory hoods or other systems designed to convey hazardous fumes or materials. The leakage class shall be in accordance with Table 4-1 of SMACNA HVAC Air Duct Leakage Test Manual, First Edition 1985.

Q. The Sheet Metal Contractor shall install automatic control dampers furnished by the Automatic Temperature Control System manufacturer and shall include all safing and/or duct transitions to complete damper installation.

3.11 PIPING SYSTEM INSTALLATION

A. Installation of Pipe, Fittings and Valves:
1. Furnish and install piping approximately as indicated; straight, plumb and as direct as possible; form right angles on parallel lines with building walls.
2. Keep pipes close to walls, partitions and ceilings; offset only where necessary to follow walls, as indicated.
3. Locate groups of pipes parallel to each other; space them at distances to permit applying full insulation and to permit access for servicing valves.
4. Piping shall be accurately cut to measurements established in the field and worked into place without springing or forcing. All piping shall be assembled using standard manufacturer's screwed or welded fittings. Where standard fittings are not available for branch connections, use "Threadolets" or "Weldolets" as appropriate to suit pipe sizes, neatly cut and welded into the line.
5. All piping shall be reamed to be free of burrs.
6. Keep pipe free from scale and dirt; protect open pipe ends whenever work is suspended during construction to prevent foreign bodies entering and lodging there. Use temporary plug or other approved material for protection.
7. Use all long radius ells on welded piping.
8. Provide bypass line with globe valve with isolation valves to provide bypass around all control valves which serve air handler coils and other central system equipment. Bypass valves are not required for terminal units, radiation, fancoils, cabinet heaters, unit heaters and similar equipment served from a central system. Bypass valve size shall be a minimum of one-half the supply line size.
9. Prior to installation of any piping, submit shop drawings indicating location of all pipes larger than 2 inches in diameter. Piping may be shown on Coordination Drawings in lieu of shop drawings.
10. Provide cap and chain for 3/4 inch hose connection for all drain valves.

B. Installation for Hot Water Systems:
1. Pitch all piping in direction of flow.
2. Automatic vent valves shall be installed in the piping systems, where indicated on the drawings at all high points of any piping system.
3. Drain valves shall be located at the base of all low points in the piping systems and at all water connections to associated equipment and pumps. Drain valves shall be 3/4 inch gate valves with 3/4 inch drain hose threaded adapters.
4. Provide blow-down line with ball valve on each strainer with cap and chain.
5. Provide pressure relief valve and piping to allow bypass of discharge from each pump back to pump inlet where pump shut off head exceeds the maximum rated working pressure of any pipe segment, fitting, valve, or other device. Relief valve shall be sized to recirculate adequate flow to maintain system pressure below the rated working pressure. When provided, the bypass piping shall be connected between the pump and isolation valves.

C. DX Systems:
1. Charging of refrigerant piping shall be done subsequent to pressure testing.
2. Evacuate system to 2.5 mm of mercury and hold vacuum for eight (8) hours and then break vacuum with dry nitrogen. Re-evacuate piping to 2.5 mm and break vacuum with refrigerant charge.
3. Pipe sizing, where indicated on drawings, are the sizes estimated for specific manufacturer's equipment and anticipated piping installation.
   a. The Contractor shall provide piping sized for actual piping installation requirements for the field installation conditions in accordance with the system equipment manufacturer's recommendations.
4. All refrigerant systems which require field piping shall include a filter-dryer, moisture indicator, liquid line sightglass, refrigerant charging connections and solenoid valves. Devices not furnished with the refrigeration equipment shall be provided by this Contractor.

D. Installation of Unions:
1. Provide unions, screwed or flanged, in the following locations:
   a. In long runs of piping to permit convenient disassembly for alterations or repairs. Provide unions in all trench piping located every 20 feet and at all connections in branch and mains leaving the trench.
   b. In bypass around equipment.
   c. In connections to traps, tanks, pumps, and other equipment.

E. Installation of Valves:
1. Provide shut-off valves where indicated and in the following locations:
   a. Risers and main branches at points of take-off from their supply or return mains. Valves shall be arranged so that piping mains for the building and for each floor can remain in service while branch line piping is out of service. Balancing valves suitable for shut-off service shall be used in returned piping.
   b. Individual equipment, control valves, strainers, traps and other piping systems devices at inlet and outlet to permit unit removal for repairs without interfering with remainder of system.
2. Locate valves for easy access and operation.

3. Do not locate valves with stems below horizontal.
4. Provide balancing valve at outlet of each equipment connection. In water piping systems, locate balancing valve as shown on drawings where piping details are provided.

F. Pipe Welding: Welding backing rings shall be used at each pipe weld. All pipe welders shall be tested and qualified under the National Certified Pipe Welders Bureau. Welders for high pressure steam shall be certified for ASME Code welding.

G. Expansion:
1. Provide for taking up expansion in hot water by means of loops, offsets, guides and anchors, where indicated and/or required.
2. Use swing or swivel joints for connections from mains to risers and from risers to radiators, unit heaters and other heating units; use at least five (5) fittings from main to riser, including tee in main; use at least four (4) fittings from riser to radiator or unit heater, including tee in riser.
3. When installing expansion loops, they may be cold sprung. Cold springing shall compensate for approximately half of the total expansion.

H. Drains: All coiling coils shall have drip pans, trapped and condensation discharge piped to nearest suitable receptor except as noted otherwise. All traps shall be located inside to prevent freezing. Trap seals shall be appropriate for respective units scheduled pressure differential plus 50 percent on coils downstream of fans, and a minimum 3 inches for coils upstream of fans.

I. Intake and exhaust plenums not detailed to have through-louver drainage shall have a 1 inch drain connection with a serviceable 3 inch deep trap provided within a heated space to prevent freezing and piped to the nearest floor drain or janitor sink. Bottom of plenum shall pitch toward drainage opening. Drain lines indicated on the drawings to terminate through the wall to outdoors shall not be required to include a trap.

3.12 PIPING SYSTEM FLUSHING AND CLEANING

A. This Contractor shall make temporary connections and required adjustments to the piping system for the purpose of cleaning and flushing.

B. Steam and return piping shall be blown out by operating steam with all returns run to waste until the system is thoroughly cleaned out. During the above period, all strainer and thermostatic trap interiors shall be removed and strainers and traps cleaned, together with dirt pockets. The system shall be left free from oil, scale and dirt. The strainer and trap interiors shall be replaced after the system has been cleaned.

C. Hot water lines shall be chemically cleaned by circulating water solution for not less than four (4) hours, flushed out and cleaned with water run to waste. All strainers shall be removed, cleaned and replaced. All equipment such as pumps, coils and heat exchangers shall be checked to insure all foreign material has been eliminated. This Contractor shall submit chemical cleaning treatment and method to the Architect for approval.

D. Compressed air lines shall be blown out using compressed air. All filters and instruments shall be removed from system during this flushing and then replaced.

E. Chemical treatment required for cleaning shall be provided a specified under

"Chemical Treatment".

3.13 PIPING SYSTEM PRESSURE TESTS

A. All piping systems furnished and installed under this section shall be pressure and/or vacuum tested prior to being buried, concealed, and/or insulated. This Contractor shall make all necessary temporary connections and gauges required and shall isolate all equipment which may be damaged by testing procedures. This Contractor shall notify Architect in writing of his testing schedule to permit observation of procedures. Tests shall be initiated only after testing medium has reached ambient temperatures. Systems which fail testing shall be repaired in a manner approved by the Architect and testing repeated. Testing of sections of extensive systems are permitted. Written summary of all testing shall be submitted upon completion of testing indicating system, date of test, testing medium, initial and final pressures and temperatures, repair procedures and supervisor's name.

B. The following systems shall be tested as indicated:

SYSTEM	TEST MEDIUM	TEST PRESSURE PSIG	TIME PERIOD HOURS	ALLOWED DEVIATION PERCENT	NOTES
Hot Water S&R (All)	Water	100	4	0	1
Make-Up Water	Water	90	4	0	1
Chemical Feed	Air	350	4	-5	1
Refrigerant	Nitrogen	250	4	-5	3
Refrigerant	Vacuum	29.5" Hg	4	-5	3

Note 1: Water shall be clean, clear liquid.
Note 2: Compressed air shall be oil-free.
Note 3: Dry nitrogen shall be used for pressure test followed by vacuum test. Introduce refrigerant into piping to break vacuum.
Note 4: Water shall be plant demineralized water.

C. For testing of piping systems exposed to low ambient conditions, this Contractor shall assume responsibility of taking suitable precautions to prevent freezing within piping systems.

3.14 INSULATION APPLICATION REQUIREMENTS

A. Insulation materials shall be installed in accordance with the applicable insulation classes for piping, ductwork and equipment.

B. Insulation shall be applied in a workmanlike manner so as to provide a neat and smooth surface, suitable for painting. Work and/or material that is poorly done or done in a manner not conforming to the specifications and/or drawings shall be repaired or replaced as directed by the Architect.

C. Insulation shall not be applied to piping and related equipment until the completion of pressure testing. Insulation shall not be applied to ductwork and related equipment until air systems have been sealed and/or pressure tested.

D. Sections of piping and equipment may be covered as the work progresses, provided

the above requirements have been met for pressure testing and tightness.

E. All piping and equipment to be covered shall be clean and dry prior to the application of insulation.

F. Insulation shall not be applied when ambient temperatures within the space are below 40 degrees F.

G. Piping and duct insulation shall be carried full thickness through all floor and wall openings, except when installed through sleeves through fire-rated construction, insulation shall be discontinued at the penetration and replaced with caulking material specified for sleeves.

H. All insulation shall be applied with edges tightly butted.

I. All voids and/or seams in insulation shall be filled with insulating cement plaster or insulating cement.

J. All insulation ends shall be finished to a 45 degree level with insulation cement troweled to a neat and smooth finish.

K. Equipment nameplates, pressure vessel code labels and equipment access doors shall be left exposed with insulation edges finished as described in Paragraph J. above.

L. Piping installed outdoors with the exception of underground conduit and condenser water piping shall be furnished with layers of insulation of equal thicknesses with the total thickness twice that specified in insulation thickness schedule. The double layer insulation shall be installed so that all seams are staggered. Apply 45 pound roofing felt with 2 inch overlap at joints. All joints to be sealed with asphalt. Wire jacket in place with 16 gauge copper annealed wire on 9 inch centers.

M. Under no circumstances shall pneumatic control tubing be covered with insulation.

N. When installation thickness specified exceeds that provided as manufacturer's standard, then multiple layered material shall be used to achieve specified thickness.

O. Any piping, ductwork or equipment which may convey a fluid gas or air below 75 degrees F. at any time in its normal operation shall be provided with insulation with an external vapor barrier except where explicitly indicated otherwise.

P. Where specified under Pipe Hangers, Supports and Hangers, insulated cold make-up water or refrigerant suction lines shall have calcium silicate used at all points of support. Calcium silicate sections shall be of the same thickness as the adjacent insulation with vapor barriers continued unbroken through the support section. Support sections shall be three times the pipe diameter in length or not less than 12 inches nor more than 24 inches. 14 gauge galvanized sheet metal saddles the same length and diameter as the calcium silicate section and covering not less than 120 degrees of arc shall be provided at support points.

Q. Insulated hot water lines shall be provided with welded pipe saddles at all support points. Saddles shall fit the insulation outside diameter with insulation filling the void between pipe and saddle.

R. All cold make-up water or other piping insulation with vapor barriers shall not be stapled. Sections of insulation which are stapled shall be removed and replaced with new material as specified.

S. Insulation for piping and equipment shall be provided with wire or band supports to prevent sagging and cracking of finished surface or vapor barrier. Supports shall be applied in accordance with insulation manufacturer's recommendations. Supports shall generally be located beneath finish jacketing.

T. Valves which are specified to be insulated shall be covered to top of bonnets.

U. Insulation for piping systems shall be provided up to coil connections and the exterior casing, including tube returns or manifolds external to casing shall also be insulated except where noted otherwise.

V. Engine exhaust pipes, fittings, and silencers shall be covered with 4 inch calcium silicate insulation. Insulation shall be applied in two (2) layers with staggered joints. Secure insulation in place with heavy gauge stainless steel bands. Seal all seams and joints in each layer with high temperature cement. Cover insulation with reinforced glass fiber cloth.

W. All unlined supply and return ductwork located outdoors shall have a minimum thickness of 3 inches of rigid board insulation and an aluminum weatherproof cover applied over the vapor barrier.

3.15 SYSTEM BALANCING

A. This Contractor, as part of his contract, shall obtain the services of a testing and balancing agency that specializes in this type of work, to perform the work required under this section.
   1. The testing and balancing agency selected shall not have installed, fabricated or engineered any part of the system that the testing and balancing work shall be performed on, so as to prevent any conflict of interest. This shall include but not be limited to drilling and patching holes, taking apart and re-assembling equipment, removing and replacing fan guards, removing and replacing control box covers, and changing belts and sheaves.
   2. In addition, the selected company shall not be a subsidiary of or be associated with persons having financial interests in the accessories, ductwork, and controls undergoing these tests so that the Owner will receive a completely unbiased test and balance report upon completion of the work.
   3. Additionally, the testing and balancing agency shall complete no work on the HVAC systems, where such work involves the installation or modification to the HVAC systems. Such work is solely assigned to the HVAC sub-contractor and their employees. Note that it is the intention of the paragraphs herein to assign full responsibility for labor, tools, corrections, installation of balancing dampers, installation or test openings, pullet changes, belt changes, and all other "work", which involves modifications or corrections to the HVAC system to HVAC sub-contractor. Where the testing and balancing agent is assigned "work" herein, such work shall be limited to testing, reporting, and providing sufficient information to the HVAC sub-contractor such that they can make necessary modifications or corrections for proper system operation.

B. The selected testing and balancing agency shall be a certified member of the AABC or the NEBB. Minimum criteria for this project shall be the General Membership Standards of the Associated Air Balance Council, as published nationally in AABC NSFMI Volume One, #81266 or as otherwise noted herein.

C. All work performed by the approved agency shall be done in full accordance with minimum standards as set forth in AABC National Standards, Fourth Edition (1982) and ASHRAE Systems Manual (1984). In addition, vibration readings shall be taken on all rotating equipment in this section and recorded in mills of deflection.

D. Submittals:
1. The TAB Agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency's Test and Balance Engineer (TBE) certificate.
2. The TAB agency shall submit the TAB procedures and agenda proposed to be used.
3. The TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards.

E. This Contractor shall cooperate with the test and balance agency in the following manner:
1. Provide sufficient time before final acceptance data so that tests and balancing can be accomplished and reviewed.
2. Provide immediate labor and tools to make corrections when required without undue delay. Install balancing dampers as required by test and balance agency.
3. Put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.
4. The testing and balancing agency shall be kept informed of any major changes made to the system during construction, and shall be provided with four (4) complete sets of Construction and Coordination drawings, one (1) set of which shall be turned over to the Owner with ductwork systems differentiated by coloring each system's ductwork in a distinguishing color and diffusers, registers and grilles identified with a number corresponding with the respective item on the balancing report.
5. Include the costs of test openings, dampers, pulley and belt changes in his contract.

F. The test and balance agency shall test and balance all air handling systems and equipment and shall also test and balance all hot water and make-up water systems. All systems shall be adjusted so that they achieve within 10 percent of design quantities, except over-all pressure relationship shall be maintained.
1. Where provided, air flow measuring devices shall be utilized to balance air system. Accuracy also shall be verified by the balancing agency.
2. Final adjustments to each variable volume and constant volume box shall be provided by the balancing agency.
3. Where combination balancing valve and flow measuring devices, or flow devices, are indicated, the balancing agency shall utilize them for balancing the water system.

G. The items requiring testing, adjusting and balancing include the following:
1. Air Systems:
a. Supply Fans (including those in ERU's, RTU's, AHU's and FCU's)

b. Return Fans (including those in RTU's)
c. Exhaust Fans (including those in ERU's)
d. Zone Branch and Main Ducts
e. VAV Systems
f. Diffusers, Registers and Grilles
g. Coils (Air Temperature)
h. Chilled beams

2. Hydronic Systems:
a. Pumps
b. System Mains and Branches
c. Boilers
d. Coils
e. Chiller
f. Radiant panels
g. Fintube radiation.
h. Chilled beams

H. TAB Preparation and Coordination:
1. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided to the TAB agency no later than 30 days prior to start of TAB work.
2. System installation and equipment start-up shall be complete prior to the TAB agency's being notified to begin.
3. The building control system shall be complete and operational. The Building Control System Contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided for reprogramming, coordination, and problem resolution.
4. All test points, balancing devices, and identification tags shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
5. Qualified installation or start-up personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided for coordination and problem resolution.

I. Reports:
1. The TAB agency shall submit the final TAB report for review by the Engineer. All outlets, devices, and HVAC equipment shall be identified, along with a numbering system corresponding to report unit identification. The TAB agency shall submit an AABC "National Project Performance Guaranty" assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and AABC National Standards.
2. Submit four (4) copies of the final TAB Report.

J. Deficiencies:
1. Any deficiencies in the installation or performance of a system or component observed by the TAB agency shall be brought to the attention of the appropriate responsible person.
2. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB agency returns to retest. Unresolved deficiencies shall be noted in the final report.
3. System balance reports which, upon field inspection of the systems, are found to be erroneous, shall have the questioned systems corrected by the

test and balance agency until a proper balance is achieved. Such correction work shall be done at no cost to the Owner. Balancing Contractor shall field verify balancing settings and measurements as randomly selected by the Architect

K. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards.

L. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC National Standards. Adjustment tolerances shall be + or – 10% unless otherwise stated.
1. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.
2. All information necessary to complete a proper TAB project and report shall be per AABC Standards unless otherwise noted. The descriptions for work required, as listed in this section, are a guide to the minimum information needed.

M. Air Systems:
1. The TAB agency shall verify that all ductwork, dampers, grilles, registers and diffusers have been installed per design and set in the full open position. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards.
2. For Supply Fans:
   a. Test and adjust fan RPM to achieve maximum or design CFM.
   b. Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
   c. Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM.
   d. Test and adjust the outside air on applicable equipment using a pitot-tube traverse. If a traverse is not practical use the mixed air temperature method if the inside and outside temperature difference is at least 20 degrees F. or use the difference between pitot-tube traverses of the supply and return air ducts.
   e. Test and record system static profile of each supply fan.
3. For Return Fans:
   a. Test and adjust fan RPM to achieve maximum or design CFM.
   b. Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
   c. Perform a pitot-tube traverse of the main return ducts to obtain total CFM.
   d. Test and record system static profile of each return fan.
4. For Exhaust Fans:
   a. Test and adjust fan RPM to achieve maximum or design CFM.
   b. Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
   c. Perform a pitot-tube traverse of main exhaust ducts to obtain total

CFM.

d. Test and record system static profile of each exhaust fan.

5. The Balancing Contractor shall make all necessary tests and measurements and provide information to provide for replacement of adjustable sheaves utilized for initial balancing with optimum sized fixed sheave and select optimum replacement sheave sizes for existing equipment fan drives for systems indicated to be modified. All adjustable sheaves replaced shall be tagged to indicate which unit it was on and turned over to the Owner.
6. For Zone, Branch and Main Ducts:
   a. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
7. For VAV Systems:
   a. Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
   b. Identify the type, location, and size of each terminal box. This information shall be recorded on terminal box data sheets.
8. For Diffusers, Registers and Grilles:
   a. Test, adjust and balance each diffuser, grille and register to within 10% of design requirements. Minimize drafts.
   b. Identify the type, location, and size of each grille, diffuser and register. This information shall be recorded on air outlet data sheets.
9. For Coils:
   a. Once air flows are set to acceptable limits, take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry bulb temperature shall be taken on the entering and leaving side of each coil.
10. Where air balancing cannot be completed due to lack of air flow and the reason for the lack of air flow cannot be identified, a static profile shall be performed to identify the reason for loss of adequate air flow.

N. Hydronic Systems:
1. The TAB agency shall, as applicable, confirm that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards.
2. For Pumps:
   a. Test and adjust hot water pumps to achieve maximum or design GPM. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead Head calculations.
   b. Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.
3. For System Mains and Branches:
   a. Adjust water flow in pipes to achieve maximum or design GPM.
4. For Boilers:
   a. Verify that boilers have been filled and started, and are in operation.
   b. As applicable, test and record motor voltage and amperage, and

compare data with the nameplate and limits to ensure motor is not in or above the service factor.

c. Test and adjust water flow through water boilers.

d. Test and record temperature and pressure profiles of water boilers.

5. For Coils:

a. Test, adjust and balance all hot water coils within 10% of design requirements.

b. Verify the type, location, final pressure drop and GPM of each coil. This information shall be recorded on coil data sheets.

O. The TAB agency shall conduct sound testing in the following areas per AABC National Standards and to the criteria listed, using sound meter with octave band analyzer:

1.

Test Area	Number of Locations	NC Level Acceptable
General Office	16	30-35
Computer/Equipment Rooms	4	40-45
Schools/Classrooms	16	25-30

P. The TAB agency shall conduct vibration testing on the following equipment per AABC National Standards. Test deflection in mils and velocity in inches per second shall be measured and the results compared to requirements in equipment specification sections.

1. EQUIPMENT
Fans over 3.0 Horsepower
Pumps over 3.0 Horsepower

Q. Indoor Air Quality Verification:

1. The TAB agency shall take measurements at design outside air. It shall measure temperature and humidity uniformity throughout the space, check filter installation for proper fit, seal, and operation and verify condensate drain operation. The TAB agency shall note any water damage or obvious contamination sources from inside or outside.

2. The TAB agency shall conduct the following air sampling tests for every 2,500 square feet of space:

a. Carbon Dioxide

b. Carbon Monoxide

c. Ozone

d. Nitrogen Oxides

e. Formaldehyde

3. The TAB agency shall prepare a report showing the results, location, time and date of each test. A summary of the HVAC operating conditions, and a listing of any discrepancies shall be provided.

4. All IAQ readings are applicable only to the date and time noted on report.

R. The TAB agency shall review the project documents and Contractor submittals for their effect on the TAB process and overall performance of the HVAC system. It shall submit recommendations for enhancements or changes to the system within 30 days of document review.

S. During construction, the TAB agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of two times. (Typically, these are performed when 60% of the total system is installed and again when 90% of the total system is installed, prior to insulation of the duct and piping.) The TAB agency

shall submit a written report of each inspection.

T. The Installing Contractor shall isolate and seal sections of ductwork for testing. The test pressures required and the amount of duct to be tested shall be described by the Engineer in the appropriate duct classification section. All testing shall be based on one test per section only unless otherwise noted.

U. The TAB agency shall be assisted by the Building Control Systems Contractor in verifying the operation and calibration of all HVAC and temperature control systems.
1. Automatic Temperature Control Contractor shall have all automatic valves adjusted and calibrated prior to balancing.
2. The Balancing Contractor shall make all necessary tests and measurements and provide information as required by the Automatic Temperature Control Contractor to select the optimum range of sensing and control devices.
3. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, fire and freezestats, and other safety devices.
4. Verify that all controlling instruments are calibrated and set for design operating conditions.

V. To verify system control and operation, a series of three temperature tests shall be taken at approximately two hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than two degrees F. from the thermostat or control setpoint during the tests. Outside temperature and humidity shall also be recorded during the testing periods.

W. At the time of final inspection, the TAB agency may be required to recheck, in the presence of the Owner's representative, specific or random selections of data recorded in the certified report. Points and areas for recheck shall be selected by the Owner's representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, will not exceed 10% of the total number tabulated in the report.

X. The TAB agency shall test and adjust fume hood total air flow by duct pitot-tube traverse. If a pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Test and record face velocities under design operating conditions using a maximum of a one square foot grid pattern across the entire open face. The TAB agency shall set sash height on hoods to obtain face velocities within 20% of 100 feet per minute unless specified otherwise. It shall test and adjust VAV controllers to obtain design exhaust air flows and make-up air flows to maintain design hood pressures and face velocities, and design room pressurization. The TAB agency shall test for turbulence and proper air flow patterns at the face and inside the hoods using a hand-held smoke puffer or other approved smoke-emitting device.

Y. The TAB agency shall test and adjust building/zone pressurization by setting the design flows to meet the required flow direction and pressure differential. For positive pressure areas, it shall set the supply air to design flow, and gradually reduce the exhaust air rate to obtain the required flow or pressure difference. For negative pressure areas, it shall set the supply air to design flow, and gradually increase the exhaust air rate to obtain the required flow or pressure difference.

Z. The TAB agency shall test and record life safety control operation on the HVAC equipment. It shall verify the installation of required smoke detectors in air handling equipment (AHE), and shall verify operation of the smoke detector by activating the smoke detector and observing air handler shut-down. With the controls and alarm contractors, the TAB agency shall verify the operation of interconnected systems such as the AHE smoke detector's activation of the fire alarm system and the alarm system's activation of the life safety control sequences.

END OF SECTION

SECTION 23 08 00 – COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section presents specific commissioning requirements for the Central Falls High School project to be met in addition to other commissioning requirements, including but not limited to Section 01 91 13 “General Commissioning Requirements.”

1.2 RELATED COMMISSIONING SECTIONS

A. Section 01 91 13 General Commissioning Requirements

B. Section 22 08 00 Commissioning of Plumbing

C. Section 26 08 00 Commissioning of Electrical

1.3 ABBREVIATIONS

A. See Section 01 91 13 for abbreviations and definitions.

1.4 CONTRACTOR REQUIREMENTS

A. Meet all the requirements of Section 01 91 13 “General Commissioning Requirements.”

B. Provide factory start-up and required technical personnel for participation in Owner’s Commissioning.

C. Construction and Acceptance Phase

1. Provide submittal data, commissioning documentation, O&M data and training related to Commissioning, including information from equipment suppliers.
2. Attend meetings necessary to facilitate the Commissioning process (refer to Section 01 91 13 and PART 3 of this specification for more information on meetings).
3. Review the commissioning Issues Log for items related to contracted work and assist the commissioning team in addressing and resolving these issues.
4. Complete commissioning checklists provided by Stephen Turner Inc. and return completed checklists to the Commissioning Team. Startup checklists may require specific input from the Equipment Supplier such as a copy of the Manufacturer’s Startup Checklist.
5. Address any available Owner and Design Professional punch list items before final commissioning testing. Discrepancies and problems shall be remedied before commissioning testing of the respective systems.
6. Install a P/T plug at each water sensor that is an input point to the control system.
7. Complete water and air TAB with discrepancies and problems remedied before commissioning testing of the respective air or water-related systems.
8. Execute commissioning tests, which will be developed and led by Stephen Turner Inc. Testing will start at the components level, will proceed to the system level, and will end with inter-system testing.
9. Correct issues (differences between required and observed performance) as interpreted by Stephen Turner Inc., the Owner, and the Design Professional and retest the equipment.

10. Provide training of the Owner's operating staff, as required in PART 3 of this specification and elsewhere in the Contract Documents.
11. Assist and cooperate with Stephen Turner Inc. Provide skilled technicians familiar with this building to assist with commissioning testing.

D. Warranty Period

1. Execute seasonal or deferred commissioning testing, as applicable, witnessed by Stephen Turner Inc. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.5 INCLUDED SYSTEMS

A. For the following systems and components, Stephen Turner Inc. will develop pre-functional checklists (PFCs) that are completed by the Trade Contractors (TC) and Functional Performance Tests (FPTs) that are executed by the Trades with Stephen Turner Inc., as indicated.

Building Systems to be Commissioned	Pre-Functional Checklists	Functional Performance Testing
HVAC Systems and Associated Controls		
ERUs	Yes	100%
VRF Indoor Units	Yes	Sampling
VRF Outdoor Units	Yes	100%
ERV	Yes	100%
Kitchen Hood Exhaust Fan	Yes	100%
Exhaust Fans	Yes	100%
Building Automation System	Yes	100%

B. The work provided under this Division that is listed above is included in the scope of the Commissioning activities to meet the Owner's goals.

C. In addition to component and systems level commissioning of the work listed, participation in inter-system testing and integrated commissioning of interrelated work is required. For list of all commissioned work see Section 01 91 13 "General Commissioning Requirements."

PART 2 – PRODUCTS

2.1 BAS INTERFACE

A. If any special software or hardware is required to access BAS at controllers, integrators, and field panels, it shall be made available to Stephen Turner Inc. for use during testing, and during the first year of operation of the building if authorized by the Owner.

B. BAS access with log-ins having full override access shall be made available to Stephen Turner Inc. prior to turnover of the building to the Owner.

2.2 P/T PLUGS

A. 1/4" & 1/2" NPT Pressure/Temperature Test Plugs & Caps:

1. P/T plugs shall have a self-sealing pierce-able rubber core that is rated at 1000 PSI and 275°F.
2. Pressure/Temperature test plugs shall be provided at each pressure or temperature sensor on chilled and hot water systems where other means do not exist for temporary pressure and temperature measurement access in hydronic systems without disturbing the process.

PART 3 - EXECUTION

3.1 COMMISSIONING TEAM PARTICIPATION

A. Each trade including all Sub-contractors, Tier Contractors, manufacturers' start-up personnel, as well as direct Equipment Suppliers shall designate personnel to be responsible for coordinating commissioning activities with the Commissioning Authority as required in Section 01 91 13 "General Commissioning Requirements."

3.2 CONTRACTOR RESPONSIBILITIES

A. Execution requirements for the following are in Section 01 91 13 "General Commissioning Requirements" with additional specific requirements for this Division stated below.

3.3 COMMISSIONING MEETINGS

A. Additional requirements for this Division:

1. Attendance of regularly scheduled commissioning meetings is required by at least one (1) representative from the Contractor(s) for the systems being commissioned during delivery, installation, and start-up, and when checklists and tests are being performed.
2. As specific issues arise, a representative from each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor will be required to attend the meeting to assist in resolutions.

3.4 SUBMITTALS

A. Additional requirements for this Division:

1. The BAS/Controls Contractor's Submittals of the Sequences of Operations shall demonstrate that the control design and application incorporates the requirements provided by the Design Professional within the contract documents into a fully functional building automation system. The controls submittals shall document Step-by-Step Control sequences for each controlled device, for each mode of operation, and for each possible transition from one mode to another. The BAS/Controls Contractor's submittals of control drawings shall include complete, functional, and detailed Sequences of Operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. Sequences documented in the submittals of control drawings shall include all custom and standard sequence elements including but not limited to:
   a. Start-up sequences
   b. Warm-up mode sequences
   c. Normal occupied operating mode sequences
   d. Unoccupied mode sequences

e. Shutdown sequences

f. Capacity control and staging sequences

g. Temperature and pressure control sequences including setbacks, resets, and step or mode changes

h. Detailed sequences for implementing required economizer, optimum start/stop, demand limiting and other modes

i. Sequences for maintaining required outside air ventilation criteria in all occupied modes, including sequences for any CO_2-based demand controlled ventilation airflow rates with minimum and maximum airflow rates at normal and high CO_2 levels

j. Sequences for any unoccupied setbacks from maximum required ventilation rate (based on both number of occupants and square feet per ASHRAE Standard 62.1, for example) to minimum required ventilation rate (based on square feet only per ASHRAE Standard 62.1)

k. Emergency or stand-by power sequences where applicable, including effects of power or equipment failure and all stand-by functions

l. Effects of equipment failure

m. Sequences for all alarms and emergency shut-downs including annunciation and notification sequences

n. Seasonal operation variations and recommendations including all change-over sequences and requirements

o. Initial and recommended values for all adjustable settings, setpoints, and parameters that are typically set or adjusted by operating staff

p. Initial and recommended values for all adjustable settings, setpoints, and parameters, as well as control settings, delays, or fixed values that will be implemented or used during BAS/Controls Contractor's start-up and testing

q. Schedules, if known

r. All interlocks, interfaces, and interactions with other systems including controls systems provided by others.

s. Detailed delineation of control interface between any packaged equipment controls and the BAS, listing all controllable or adjustable points and all monitoring points.

t. Written sequences of control for packaged controlled equipment, including additional clarifying narrative for equipment manufacturers' stock sequences.

u. Description of graphics to be developed and programmed during construction.

2. The BAS submittal shall include all engineering drawings and product data.

   a. Product data sheets submitted prior to engineering drawings will be deemed not suitable for further review until complete engineering drawings are provided.

3. If the engineer's specified sequences are not clear or do not contain enough detail for Stephen Turner Inc. to develop detailed functional test procedures for evaluation in the field, the BAS vendor shall elaborate on or expand on them in the BAS Submittal, or shall submit RFIs in advance of the BAS Submittal requiring the Design Professional to provide such elaboration or clarification. The Design Professional shall coordinate such clarifications and ensure that they are contained in the BAS Submittal prior to circulating it for review.

4. The BAS Submittal shall include a list of proposed alarms with the priority code for alarm annunciation and alarm clear for each alarm listed.

5. HVAC product data submittals for any packaged or skid-mounted equipment that includes factory OEM controls shall include detailed sequences including setpoints, inputs, outputs, and logic in sufficient detail for Stephen Turner Inc. to develop specific functional testing procedures to verify controls functionality. Points lists, communication protocol (BACnet or other), and lists of preprogrammed alarms shall be included.
6. HVAC coordination drawing submittals shall include complete thermal metering plans, if applicable, demonstrating compliance with the Owner's metering standard and interface to the building metering system.
7. The TAB Contractor shall submit a project-specific TAB Submittal six (6) weeks prior to starting TAB work. This plan will be developed after the TAB Contractor has some familiarity with the systems and associated control systems. The Submittal shall address each system and component, and shall include but not be limited to:
    a. TAB Contractor's certifications and credentials to perform the contracted work.
    b. Certification that the TAB has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.
    c. The identification and types of measurement instruments to be used and their most recent calibration date.
    d. An explanation of the intended use of the building control system for review and comment on feasibility by the BAS contractor and Stephen Turner Inc.
    e. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted, and balanced with the data to be gathered for each.
    f. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    g. Final test report forms to be used.
    h. Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / sub-main proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.
    i. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    j. Details of how total flow will be determined.
        1) Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
        2) Water: pump curves, circuit setter, flow station, ultrasonic, etc.
    k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.
    l. Confirmation that TAB contractor understands the outside air ventilation criteria under all conditions.
        1) Details of whether and how minimum outside air cfm will be verified and set, and for what level (total building, zone, etc.).
        2) Details of how any CO_2-based demand controlled ventilation airflow rates will be verified at various CO_2 levels.

3) Details of verification for any unoccupied setbacks from maximum required ventilation rate (based on both number of occupants and square feet per ASHRAE Standard 62.1, for example) to minimum required ventilation rate (based on square feet only per ASHRAE Standard 62.1)

m. Details of how building static and exhaust fan / relief damper capacity will be checked. Proposed selection points for sound measurements and sound measurement methods.

n. Details of methods for making any specified coil or other system plant capacity measurements. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.

o. Phasing plan for performing TAB work by floor or area, and details regarding specified deferred or seasonal TAB work.

p. Details of any specified false loading of systems to complete TAB work.

q. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.

r. Procedures for verifying required room pressure differentials.

s. Details of any required interstitial cavity differential pressure measurements and calculations.

t. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

u. Plan for formal progress reports (scope, frequency, and distribution list).

v. Plan for formal deficiency reports (scope, frequency, and distribution list).

w. Procedures for addressing partial build-out, diversity, and part load issues including false loading or other approaches where allowed.

x. Methods to make all specified coil and system capacity measurements.

y. Specific procedures to ensure both water and air distribution systems operate at the lowest possible pressures and the methods to verify and document this.

z. Proposed points for sound measurements including proposed measurement methods.

8. The HVAC Submittals shall:

a. Include ranges for all thermometers, pressure gauges, flow meters, and other measuring devices.

b. Provide performance data including range, accuracy, data storage, local read-out, and data connections for each meter type submitted.

c. Include service designation for each individual system, including each duct system and piping system, fittings and joining materials, each insulation system, all valves, all piping specialties, and all accessories. These shall be presented in table format, to clearly indicate where each type of material will be used for each system. Generic cut sheets that do not indicate the specific application are not acceptable. Copies of the project specifications are not acceptable.

d. Provide detailed product data for each piece of equipment including capacities, electrical components and requirements, including all specified product attributes.

e. Provide performance curves (full and part-load as applicable) for each pump, fan, and piece of unitary equipment submitted.

f. Provide Manufacturers' detailed installation requirements clearly marked (arrow, underline, circled, etc.) to indicate only the intended item.

g. Provide Manufacturers' detailed start-up requirements and procedures clearly marked (arrow, underline, circled, etc.) to indicate only the intended item.

h. Provide Manufacturers' operation instructions clearly marked (arrow, underline, circled, etc.) to indicate only the intended item.

i. Provide Manufacturers' recommended maintenance and troubleshooting procedures clearly marked (arrow, underline, circled, etc.) to indicate only the intended item.

j. Provide Warranty and clear statement of Owner's obligations to maintain equipment to preserve warranty.

3.5 PRE-FUNCTIONAL CHECKLISTS

A. No additional requirements for this Division.

3.6 O&M MANUALS

A. Additional requirements for this Division:

1. Within 4 weeks of completing the submittal review ("Approved" Product or Shop Drawing Submittal), provide final, or if that is not yet available, draft electronic format O&M Manual to Stephen Turner Inc. for use in developing Functional Performance Tests.
2. Final BAS/Controls O&M Manuals shall include:
   a. Component installation, operation, and maintenance instructions for each building level, floor level, and equipment level controller, integrator, or field panel.
   b. Calibration requirements and intervals by sensor and positioned or actuator type.
   c. Specific instructions on how to perform all functions, access all features, and switch to each mode in the workstations and controllers.
   d. Software version and security update requirements.

3.7 EQUIPMENT START-UP

A. Additional requirements for this Division:

1. For all commissioned systems and equipment, one copy of the equipment manufacturer's or Contractor's start-up report shall be provided to Stephen Turner Inc. for review and to document that the equipment is installed, operational, and ready for commissioning testing.
2. Copies of additional testing performed including but not limited to vibration analysis required elsewhere in the specifications shall be provided to Stephen Turner Inc.
3. For all third party testing required elsewhere in this specification or by code, provide test reports to Stephen Turner Inc. for review and to document that the testing has been performed. Coordinate dates for third party testing in advance with Stephen Turner Inc. to allow commissioning personnel to witness selected tests.
4. The BAS/Controls Contractor shall prepare a written plan indicating the step-by-step procedures that will be followed to ring out, check out, and adjust the BAS prior to functional performance testing. The plan shall indicate, for each type of equipment controlled by the BAS: the system name; the devices list; controller testing procedures; field check-out, calibration, and log sheets; test instruments required; and the tests to be completed prior to TAB to support TAB work using the BAS.

5. The Contractor shall ensure that the actual room numbers as posted in the building are used in the controls programming and point names.

3.8 COMMISSIONING TESTING

A. Additional requirements for this Division:

1. Each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor shall assist the installing contractor in commissioning testing.
2. The BAS/Controls Contractor shall provide signed and dated certifications for the completion of the programming, point to point ring outs, and check out of each controlled device, equipment, and system prior to functional performance testing. Any programming to be completed during functional performance or inter-system testing shall be clearly indicated.
3. The BAS/Controls Contractor shall assist and cooperate with Stephen Turner Inc. Skilled technicians familiar with this project shall execute the functional performance testing of the controls system and shall assist in the functional performance testing of controlled systems and equipment, including systems with interlocks, interfaces, or other interaction with the BAS.
4. The BAS/Controls Contractor shall implement control system trend logs at the direction of Stephen Turner Inc. prior to the start of on-site functional performance testing. The BAS/Controls Contractor shall provide Stephen Turner Inc. with access to the BAS system, at a minimum on-site and, if Owner network security permits, remote access and monitoring capability. If this access requires proprietary software, this shall be supplied to Stephen Turner Inc. for use during testing and first year of operation.
5. Additional Requirements for Testing Specified Elsewhere
    a. This includes the following tests:
        1) HVAC Piping Pressure Testing.
        2) HVAC Duct Pressure Testing.
    b. Additional requirements for each of these tests:
        1) The General Contractor (GC) shall provide a copy of the proposed test procedure to Stephen Turner Inc. for review.
        2) The GC shall notify Stephen Turner Inc. at least two days in advance of the date and time the test is scheduled.
        3) The GC shall provide copies of field and final test results to Stephen Turner Inc. for review for consistency with the Owner’s Project Requirements.
6. Initial Testing
    a. The emphasis of the initial commissioning testing is on the building automation system performance, since many of the building functions have the control system as a common component.
    b. Included in this work will be sample-based verification of instrument and sensor calibration, access to components, labeling of devices, clear sequences and shop drawings.
    c. The verification of the control system will be accomplished as an on-going task during construction to identify and resolve systemic issues early in the project.
    d. The building automation system operation shall be sufficiently operational prior to the TAB of the system. It is understood that a portion of the final building automation system startup occurs in conjunction with the TAB work. The intent of

this requirement is for the TAB work to be productive and not be hampered by a control system that is not sufficiently functional.

e. The commissioning testing of the control system will utilize the controls system instrumentation for testing. Therefore, the first portion of the control system testing will be verification of the sensors, inputs and outputs.

f. Point-to-Point Verification: All wiring shall be checked out by the controls contractor from end to end, point to point, from field to computer screen to ensure correct connection and a system free from wiring deficiencies. The BAS/Controls Contractor shall document this verification and provide to Stephen Turner Inc. prior to start of Functional Performance Testing.

g. Commissioning verification of sensors will be made using the sampling method; an exhaustive re-test of all control system inputs and outputs will not be conducted by Stephen Turner Inc. Prior to Stephen Turner Inc. verification, the control contractor shall be responsible for complete input/output checkout quality assurance.

1) Sensor and Actuator Calibration, General:

a) This section is included to emphasize the importance of the control contractor calibrating the instrumentation, and to make clear the requirement for same; and that “factory calibration” or “calibration by exception” is not acceptable.

b) All field-installed temperature, relative humidity, CO_2, and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner in advance. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided to Stephen Turner Inc. need not be field calibrated.

c) All procedures used shall be fully documented, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

2) Sensor Calibration Methods

a) All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end.

b) Sensors without Transmitters. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor is within the specified tolerances. If not, install offset in BAS, calibrate or replace sensor.

c) Sensors with Transmitters. Connect a signal generator. Adjust transmitter zero and span to match the signal generator until the ammeter reads 4 mA. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading is within the specified tolerances. If not, replace sensor and repeat.

3) Valve and Damper Stroke Setup and Check

a) For all valve and damper actuator positions checked, verify the actual position against the BAS readout.

b) Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or

damper position doesn't reasonably correspond, repair or replace actuator.

c) Closure for normally closed valves and dampers. Disconnect power to the actuator motor and verify the valve or damper moves to full closed position. Restore to normal.

d) Normally open valves and dampers: disconnect power to the actuator motor and verify the valve or damper moves to full open position. Restore to normal.

7. The systems in the building will be operated in different modes of operation to verify the control system responds properly. This testing provides both the Owner and Contractor with documentation that the control system was operating properly at Project Acceptance. The tests include but are not limited to:
   a. Sequence of control for:
      1) Central Air Distribution Systems
      2) Local Air Distribution System
      3) Exhaust Air System
      4) Hot Water Systems
   b. Operator's Workstation graphics display
   c. Trend logs
   d. Status review screens, out of bounds checks, and alarming
8. Stephen Turner Inc. will witness the Initial tests. Each contractor will be responsible, as required, to put the system in various modes of operation, to fix minor problems found during the test (i.e. problems that can be fixed without delaying the completion of the test), and to witness the testing. Where Stephen Turner Inc. develops a procedure for the test, the contractor shall implement the test to the satisfaction of Stephen Turner Inc.
9. Stephen Turner Inc. will provide all commissioning team members (General Contractor, contractors, Design Professional, Owner, etc.) the commissioning test procedures prior to scheduled testing. If no comments are received from a particular commissioning team member, that shall constitute acceptance of the commissioning test procedures as is.
10. Stephen Turner Inc. shall schedule and witness the testing once all commissioning checklists (with exception of the TAB Checklists) have been completed by the contractors and accepted by Stephen Turner Inc.
11. Intermediate Testing
    a. The TAB contractor shall, upon request by Stephen Turner Inc. if necessary during system troubleshooting, provide Stephen Turner Inc. with the technician(s) who accomplished the TAB, along with the specific equipment used for the TAB, to verify and re-test between 10% and 20% of the TAB final report.
       1) Included in this work will be:
          a) Sample-based verification of measured quantities
          b) Review of firm qualifications
          c) Review of instrument calibration records
          d) Review of basic procedures. Particular emphasis will be placed on the use of iterative methods (repeat measurements) acknowledging the fact that changes in branch flows have an overall system effect.

b. The TAB Contractor shall provide the field reports or draft TAB reports to Stephen Turner Inc. within one week of completion for each system or area, before functional performance testing.

c. The TAB Contractor shall make skilled technicians and instruments used during TAB available to address functional performance test results that are at variance with TAB reports.

12. System Level Testing

a. Additional commissioning testing will be conducted after testing of the control system and TAB work, but prior to occupancy of the building. This testing will provide both the Owner and Contractor with documentation that the system operated correctly according to the Owner's Project Requirements. These tests are typically performed at the room level, where a sample of rooms is selected for review.

b. Stephen Turner Inc. will lead this portion of commissioning testing. Each Contractor will be responsible, as required, to put the system in various modes of operation, to fix minor problems found during the test (i.e. problems that can be fixed without delaying the completion of the test), and to witness the testing. Where Stephen Turner Inc. develops a procedure for the test the Contractor shall implement the test to the satisfaction of Stephen Turner Inc.

c. Contractors shall attend and operate equipment during commissioning testing as required by the specific test being performed.

d. Stephen Turner Inc. shall schedule and administer the testing once all commissioning checklists have been completed by the Contractors and accepted by the Commissioning Authority.

13. Inter-System Testing

a. Additional inter-system testing is required under the Owner's Commissioning process to ensure that work in this Division is properly interoperable with other work. Contractors shall participate in system level and inter-system testing. Testing will include operation under both normal power and emergency power where applicable; change-over and transition between different operating modes; and complete exercising of systems through all modes and sequences.

1) HVAC and hot water systems

2) BAS system

3) Metering system

4) Plumbing systems including but not limited to Domestic Hot Water and pumps

5) Lighting controls, indoor and outdoor

6) Power systems

7) Emergency power systems, including recovery from utility power loss

3.9 SITE OBSERVATIONS AND VERIFICATION

A. No additional requirements for this Division.

3.10 DOCUMENTATION OF COMMISSIONING ISSUES

A. Additional requirements for this Division:

1. Each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor shall assist the installing contractor in resolving commissioning issues.

3.11 TRAINING

A. No additional requirements for this Division.

3.12 AS-BUILT DRAWINGS

A. Additional requirements for this Division:

1. Sequences of operations for each piece of equipment.
2. Final points list including cross-references to final room numbers and equipment designations provided by the Owner during Construction.
3. Full as-built file of all schedules and setpoints in electronic format as specified in the contract documents.
4. Full as-built file of all software programs in electronic format on DVD-ROM of the complete programs for this project in format compatible with BAS per the Owner's requirements.
5. Actual room numbers as posted in the building shown on controls drawings.

END OF SECTION 23 08 00

SECTION 26 00 00

ELECTRICAL

INDEX

SECTION 26 00 00

ELECTRICAL

PART 1 - GENERAL

1.1 GENERAL REFERENCES

A. Bidding Requirements, Contract Forms, General Conditions Contract for Construction Services and Division 1, General Requirements are hereby made a part of this Section.

1.2 SCOPE OF WORK

A. The scope of work consists of the installation of all materials to be furnished under this Section, and without limiting the generality thereof, consists of furnishing all labor, materials, equipment, plant, transportation, rigging, staging, scaffolding, appurtenances, programming, software, vendor inspections, component energization, startup testing, training, scheduling, documentation, and services necessary and/or incidental to properly complete all electrical work as shown on the Drawings, as described in the Specifications, or as reasonably inferred from either, in the opinion of the Architect as being required.

B. The work of this Section includes:
1. Access Panels.
2. Building Preparation for Communications Systems.
3. Building Preparation for Electronic Safety and Security Systems.
4. Building Preparation for Theater and Stage Equipment.
5. Cable Tray.
6. Collection and Presentation Equipment.
7. Conduit.
8. Cord Reels.
9. Disconnect Switches.
10. Distributed Digital Lighting Control System.
11. Dry-type K-Rated Transformers.
12. Dry-type Transformers.
13. Electrical Supporting Devices.
14. Electrical Switchboard.
15. Electric Service.
16. Emergency Standby System.
17. External Telephone Service.
18. External Cable TV Service.
19. Fire Alarm System.
20. Fire Stopping.
21. Floor Boxes.
22. Fuses.
23. Grounding.
24. Lighting Fixtures.
25. Mineral Insulated Metal Sheathed Cable (MI Cable).
26. Nameplates.
27. Outlet Boxes and Accessories.
28. Panelboards.
29. Poke-Thrus.
30. Public Safety Booster System.
31. Pull Boxes, Junction Boxes and Wireways.
32. Scoreboards.
33. Short Circuit Coordination Selective Coordination Study.

34. Sleeves, Inserts and Supports.
35. Starters.
36. Surge Protection Devices (SPD's).
37. Telephone, Data, Video Outlet and Conduit System.
38. Thermal Switches.
39. Time Clocks.
40. Wire and Cable.
41. Wiring Device Plates.
42. Wiring Devices.
43. Zero Sequence Harmonic Filters.
44. Alternates.
45. Furnish, erect and maintain staging and scaffolding, including electrical hoisting and rigging equipment required for the performance of the electrical work.
46. Existing Work and Demolition.

C. The Electrical Subcontractor shall be responsible for all cutting related to the work of this Section except in finished surfaces. Patching is the responsibility of the trade effected.
1. For coordination of cutting and patching refer to Section 01 31 00, Project Management and Coordination.
2. For cutting and patching Specifications, refer to Section 01 73 00, Execution.

1.3 CODES, REGULATIONS AND PERMITS

A. All work done under this Section shall conform to the Codes and regulations governing such work as follows:
1. ANSI American National Standards Institution.
2. ASTM American Society for Testing Materials.
3. CS Commercial Standards.
4. FS Federal Specifications.
5. IEEE Institute of Electrical and Electronic Engineers.
6. IES Illuminating Engineering Society.
7. NECA National Electrical Subcontractors Association.
8. NEMA National Electrical Manufacturer's Association.
9. NFPA National Fire Protection Association.
10. UL Underwriters Laboratory.
11. NESC National Electrical Safety Code.
12. IPCEA Insulated Power Cable Engineers Association.
13. EEI Edison Electrical Institute.
14. EIA Electronic Industry Association.
15. All Local Governing Codes.
16. NETA, National Electrical Testing Association.
17. 2015 NFPA 1 Uniform Fire Code.
18. 2012 Rhode Island Energy Conservation Code.
19. 2015 NFPA 101 Life Safety Code.
20. 2013 Rhode Island State Building Code.
21. 2013 Rhode Island Electrical Code.

B. Give notices, file plans, obtain and pay for permits and licenses and obtain necessary approvals from authorities having jurisdiction. Permits shall be secured through the City. Deliver certificates of inspection to Architect. No work shall be covered before examination and approval by Architect, inspectors and authorities having jurisdiction. Imperfect or condemned work shall be replaced with work conforming to requirements, without extra cost to Owner, subject to the approval of the Architect. If work is covered before due inspection and approval, the Electrical Subcontractor shall pay costs of uncovering the installed work, whether it meets contract requirements or not. Refer to

Section 00 21 13 Instruction to Bidders and General Conditions Contract for Construction Services for payment of fees.

1.4 COMMISSIONING REQUIREMENTS

A. An independent Commissioning Agent (CA) will be retained for this project. The commissioning process will be implemented in accordance with the NE-CHPS.

B. The Electrical Subcontractor shall assist and support the CA as necessary in accordance with the requirements of Specification Section 01 91 13 – Commissioning Requirements/Plan.

1. Commissioning of a system or systems specified in this Section is part of the construction process. Documentation and testing of these systems, as well as training of the Tenant's and Building Owner's operation and maintenance personnel, is required in cooperation with Tenant's and Building Owner's Representatives and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation and issue closure. Refer to Commissioning Requirements/Plan, Section 01 91 13, for detailed commissioning requirements.

1.5 DEBRIS REMOVAL AND CLEAN-UP

A. The Electrical Subcontractor shall, at the end of each day's work, remove waste materials and debris resulting from the installation of the electrical system. The Electrical Subcontractor shall deposit such waste and debris in a dumpster on site. Dumpster shall be provided by the General Contractor. The General Contractor shall be responsible for the emptying of dumpster when required.

B. The Electrical Subcontractor shall, at the completion of his work, remove from the property all tools, equipment and surplus materials resulting from the installation of the electrical system.

1.6 DEFINITIONS

A. "E.C." or "Contractor" as used herein after in this Section shall mean the "Electrical Subcontractor," i.e., the filed bid Subcontractor under this Section 26 00 00.

B. "Concealed" shall be defined as areas where conduit and wiring is located in chases, walls, partitions, shafts, and above finished ceilings.

C. "Underground" shall mean conduit and wiring exterior to or within the Building that is buried. All other conduit and wiring shall be considered "exposed."

D. "Exposed" shall mean conduit and wiring run on the surface of the Building construction.

E. "Conduit" shall mean in addition to conduit, all fittings, hangers and other accessories relating to such conduit systems.

F. "Provide" shall mean "provided complete in place," that is, "furnished and installed."

1.7 DRAWINGS AND SPECIFICATIONS

A. The Drawings and Specifications are complementary each to the other, and any labor or material called for by either, whether or not by both, or necessary for the successful operation of any components shall be furnished and installed.

B. Before installing any work, verify that it does not interfere with the clearances required for other work. Installed work which interferes with existing necessary services shall be modified as directed by the Architect, at no additional cost to the Owner.

C. Be familiar with the Drawings and Specifications of all other trades to prevent interferences and assure complete coordination.

1.8 ELECTRICAL CHARACTERISTICS

A. In general, and unless specifically indicated otherwise in the Specifications or noted on the Drawings, all new Building service, heating, ventilating, air conditioning and plumbing equipment shall be of the following characteristics:
1. Motors up to and including 1/3 HP shall be suitable for 120 volt, single phase operation.
2. Motors larger than 1/3 HP shall be suitable for 480 volt, three phase operation.

1.9 EXAMINATION OF SITE AND CONTRACT DOCUMENTS

A. Bidders are advised to visit the site and inform themselves as to conditions under which this work will be performed. Failure to do so will, in no way, relieve the successful bidder from the responsibility of furnishing any materials or performing any work in accordance with the true intent and meaning of the Drawings and Specifications.

B. No claim for extra compensation will be recognized if difficulties are encountered which an examination of the site conditions and contract documents prior to executing the contract would have revealed.

C. The Electrical Subcontractor shall be responsible for ordering and furnishing the correct quantity of material required. Routing and equipment arrangements shown on the Drawings are approximate only and are not warranted to be accurate.

D. Arrangements shall be made with the Owner prior to the visit for inspection of the existing Buildings.

E. The Electrical Subcontractor and the General Contractor shall be responsible to coordinate with the work of other trades and vendors. The Electrical requirements involved with HVAC, Plumbing, and Fire Suppression, shall be considered part of the Electrical Subcontractors scope of work.

1.10 GIVING INFORMATION

A. Keep fully informed as to the shape, size and position of all openings and foundations required for all apparatus furnished under this Section and give full information to the General Contractor sufficiently in advance of the work, so that all such openings and foundations may be built in advance. Furnish all sleeves and supports herein specified, so the General Contractor may install same in place.

B. In the case of failure to give proper information as noted above, assume the cost of having necessary changes to the work made by the General Contractor.

1.11 GUARANTEE AND SERVICE

A. The Electrical Subcontractor shall guarantee the performance of the installation and all equipment included in this Section in writing for one year from the date of final acceptance

of same. Should any defects in materials or workmanship appear during this period, they shall be corrected or replaced by the Electrical Subcontractor to the satisfaction of the Architect, and at no additional expense to the Owner.

1.12 INTENT

A. It is not intended that the Drawings show every conduit, fitting and appurtenance. All such parts necessary for the complete execution of the work, in accordance with the best practices of the trade and to the satisfaction of the Architect shall be provided whether these parts may have been specifically mentioned or not, or indicated on the Drawings.

B. Electrical Subcontractor is responsible to provide equipment, components, and systems that are complete and fully working, with all necessary tests and documents.

1.13 MATERIALS AND EQUIPMENT

A. All materials and equipment furnished under this Section shall be new and of the best grade for the service intended. The manufacturers mentioned in the Specifications are intended to indicate the quality desired. Any substitutions shall be approved by the Architect as herein provided by the “or equal” clause, in addition to meeting the limitations of space and capacity shown or specified. Re-built materials and equipment will not be accepted.

1.14 MOCK-UPS

A. General: Refer to Division 1, General Requirements, Section 01 43 29, Mock-Ups for requirements.

B. The Electrical Subcontractor will be required to Mock-up (1) typical Classroom and (1) typical Science Classroom as described in Section 01 43 29.

1.15 OBTAINING INFORMATION

A. Obtain detailed information from the manufacturers of apparatus which is to be provided, for the proper methods of installation. Obtain all information from the General Contractor and other Subcontractors which may be necessary to facilitate the work and the completion of the whole project.

B. Electrical Subcontractor shall inspect the site associated with this project prior to submitting his bid and shall investigate all conditions under which this work will be performed. This shall include determination of exact locations of items indicated as existing on the Drawings. Such existing locations are diagrammatic and shall not be construed as exact enough to use for equipment and labor estimating purposes. Failure to inspect existing conditions or to fully understand the work which is required shall not excuse the Electrical Subcontractor from his obligation to supply and install work in accordance with the Specifications and Drawings and under all existing site conditions. It shall be the responsibility of the Electrical Subcontractor to investigate and locate all existing underground utilities which may conflict with the installation of this electrical work. Coordinate elevations of conduits required to be installed under this Contract to avoid interference with any existing underground utilities.

1.16 OPERATIONS AND MAINTENANCE MANUALS

A. At least two (2) months prior to the time of turning over this contract to the Owner for use and occupancy or substantial completion, secure and deliver to the Architect three (3) complete indexed files containing approved operating and maintenance manuals, Shop

Drawings and other data as follows:

1. Operation description of all systems.
2. Complete Shop Drawings of all equipment.
3. Preventive maintenance instructions for all systems.
4. Spare parts lists of all system components.
5. Names, addresses and telephone numbers of all suppliers of the systems.

B. Non-availability of operating and maintenance manuals or inaccuracies therein may be grounds for cancellation and postponement of any scheduled final inspection by the Owner until such time as the discrepancy has been corrected and/or retainage of sufficient monies to prepare same.

C. Provide qualified trained personnel to insure proper operation of the systems and to train the Owner's operating and maintenance personnel in the proper operation and maintenance of the systems. Instruction period shall be five (5) eight-hour days.

1. Training of the Tenant's and Building Owner's operation and maintenance personnel is required in cooperation with the Tenant's and Building Owner's Representatives. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Tenant's and Building Owner's Representative after submission and approval of formal training plans. Refer to Commissioning Specification, Section 01 91 13, for Electrical Subcontractor training requirements.

D. Sequence of Operation details and/or drafts of the Operations and Maintenance Manual shall be submitted in accordance with requirements for the preparation of Commissioning prefunctional and functional test protocols. Submittals to be scheduled in advance of final equipment/system installation and prior to performance of startup tests.

1.17 RECORD DRAWINGS

A. General: Refer to Division 1, General Requirements, Section 01 78 00, Closeout Submittals for Requirements.

B. The Record Drawings required to be furnished under this Section are of the "E" and "T" Series Drawings.

1.18 RELATED WORK SPECIFIED ELSEWHERE

A. The following related work or material shall be provided under the designated Divisions:

1. Excavation, backfill, pumping, and shoring: Division 31, "Earthwork."
2. Concrete work: Division 03, "Concrete."
3. Flashing and counterflashing for all roof openings: Division 07, "Thermal and Moisture Protection."
4. Field Painting: Division 09, "Finishes."
5. Specialty Equipment: Division 11, "Equipment."
6. Elevator: Division 14, "Conveying Systems."
7. Sprinkler System: Section 21 00 00, "Fire Suppression."
8. Plumbing Equipment: Section 22 00 00, "Plumbing."
9. HVAC Equipment: Section 23 00 00, "HVAC."
10. Door Hardware: Section 08 71 10.
11. For restrictions concerning the hanging of materials, piping, mounts, brackets, hangers, hooks and other items from metal decking. Steel Decking, Section 05 31 00.
12. Commissioning.

1.19 SHOP DRAWINGS

A. General: Refer to Division 1, General Requirements, Section 01 33 00, Submittal Procedures, for submittal provisions and procedures.

B. In accordance with Division 1, General Requirements, submit to the Architect for approval complete sets of detailed information consisting of manufacturer's' bulletins, capacities, Shop Drawings, and parts lists of all material to be provided for this project.

C. Any manufacturer's names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary Specification unless otherwise noted and it should be noted that or approved equal applies to all products denoted herein. It is understood that all manufactures will have minor variations in configuration, appearance, and product Specifications and such minor variations shall not eliminate such manufacturers as an approved equal. It is the intent of this Specification to encourage open and competitive involvement from multiple manufacturers' that are able to supply similar products.

D. In accordance with the requirements of the Commissioning Specification, Section 01 91 13, and NE-CHPS, provide a copy of submittals to the Commissioning Agent to obtain comments during the design review cycle.

1.20 TEMPORARY LIGHT AND POWER

A. Provide capacity from the local utility company power lines, make arrangements with the local utility company for temporary service and pay all expenses related thereto.

B. Refer to Division 1, Section 01 50 00 for requirements.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

A. Provide access panels for access to concealed junction boxes and to other concealed parts of system that require accessibility for operation and maintenance. In general, electrical work shall be laid out so access panels are not required.

B. Access panels shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that junction can be easily reached and size shall be sufficient for purpose (minimum size 12" x 16"). When access panels are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.

C. Access panels shall be as specified under Section 08 31 00, Access Panels and Doors.

2.2 BUILDING PREPARATION FOR COMMUNICATIONS SYSTEMS

A. The Electrical Subcontractor shall be responsible for properly preparing the project for installation by the Communications Integrator, Section 27 10 00, 27 40 00, and 27 50 00 as specified.

B. Responsibilities of the Electrical Subcontractor shall include: The Electrical Subcontractor shall be responsible for providing and installing all related Building preparation including, but not limited to: outlet boxes with plaster rings, floor boxes, poke through devices, pathways, power, cableways, J hooks, cable tray including cable tray over each rack and cabinet to facilitate a neat and orderly installation of cables, cable protection, wiremold,

surface raceways, cable supports, conduits with bushings, conduit stubs with bushings. Sleeves with bushings (all conduits, stubs, and sleeves, shall be brought to an accessible hallway ceiling or accessible area below floor), backboxes, plaster rings, pull strings, bonding, grounding, core drilling, cutting, patching, fireproofing of penetrations and openings, environmental seals, smoke and fire stopping seals including all conduits, raceways, sleeves, and slots, where cables pass from one location to another, removal and re-installation of ceiling tiles to install concealed cabling, seismic supports, supplementary steel and channels, for a completely operational system as specified. The Electrical Subcontractor shall also accept delivery and properly store and secure all equipment and materials required by the systems integrator. The Electrical Subcontractor shall install all specialized backboxes (clock, speaker, and amplifier) and any exterior antennas provided by the Systems Integrator.

1. The Electrical Subcontractor shall be responsible for providing and installing: conduits from each IDF location back to the MDF location to comply with Code for applicable sound, voice, data and video cabling: conduits from the Point of Demarcation to the MDF location to comply with Code for applicable sound, voice, data and video cabling: conduits from the Video Headend location back to the MDF location to comply with Code for applicable video cabling.

C. Responsibilities of the Communications Integrator for this Section: The Communications Integrator shall be responsible for providing, installing, programming, troubleshooting, training and warranty service of all cabling, terminal equipment, headend equipment specified in this Section for a completely operational system. The Communications Integrator shall furnish all specialized backboxes (clock, speaker, and amplifier) and all exterior antennas to the Electrical Subcontractor for their installation.

2.3 BUILDING PREPARATION FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

A. The Electrical Subcontractor shall be responsible for properly preparing the project for installation by the Electronic Safety and Security, Section 28 00 00 as specified.

B. Responsibilities of the Electrical Subcontractor shall include: The Electrical Subcontractor shall be responsible for providing and installing all related Building preparation including, but not limited to: outlet boxes, pathways, power, cableways and J hooks to facilitate a neat and orderly installation of cables, cable protection, surface raceways, cable supports, conduits with bushings, conduit stubs with bushings. Sleeves with bushings (all conduits, stubs, and sleeves shall be brought to an accessible hallway ceiling or accessible area below floor), backboxes, pull strings, bonding, grounding, core drilling, cutting, patching, fireproofing of penetrations and openings, environmental seals, smoke and fire stopping seals including all conduits, raceways, sleeves, and slots where cables pass from one location to another, removal and re-installation of ceiling tiles to install concealed cabling, seismic supports, supplementary steel and channels, for a completely operational system as specified. The Electrical Subcontractor shall also accept delivery and properly store and secure all equipment and materials required by the Systems Integrator. The Electrical Subcontractor shall install all specialized backboxes.

C. Responsibilities of the Electronic Safety and Security Integrator for this Section: The Electronic Safety and Security Integrator shall be responsible for providing, installing, programming, troubleshooting, training and warranty service of all cabling and equipment specified in this Section for a completely operational system. The Electronic Safety and Security Integrator shall furnish all specialized backboxes to the Electrical Subcontractor for their installation.

2.4 BUILDING PREPARATION FOR THEATER AND STAGE EQUIPMENT

A. The Electrical Subcontractor shall be responsible for the following:

1. Install theatrical lighting equipment as furnished by Section 11 61 00.
2. Provide all wiring and conduit to connect all theatrical lighting equipment as furnished by Section 11 61 00.

B. The Electrical Subcontractor shall be responsible for properly preparing the project for installation by the Theater and Stage Equipment Integrator, Section 11 61 00 as specified.
1. Responsibilities of the Electrical Subcontractor shall include: The Electrical Subcontractor shall be responsible for providing and installing all related Building preparation including, but not limited to: outlet boxes, pathways, power, cableways and J hooks to facilitate a neat and orderly installation of cables, cable protection, surface raceways, cable supports, conduits with bushings, conduit stubs with bushings. Sleeves with bushings (all conduits, stubs, and sleeves, shall be brought to an accessible hallway ceiling or accessible area below floor), back boxes, pull strings, bonding, grounding, core drilling, cutting, patching, fireproofing of penetrations and openings, environmental seals, smoke and fire stopping seals including all conduits, raceways, sleeves, and slots, where cables pass from one location to another, removal and re-installation of ceiling tiles to install concealed cabling, seismic supports, supplementary steel and channels, for a completely operational system as specified. The Electrical Subcontractor shall also accept delivery and properly store and secure all equipment and materials required by the Theater and Stage Equipment Integrator. The Electrical Subcontractor shall install all specialized back boxes.

2.5 CABLE TRAY

A. Conform to NEMA VE1.

B. Ladder Type Cable Trays:
1. Material: Aluminum 6036-T6 alloy.
2. Width: 20 inches overall.
3. Inside depth: 6 inches.
4. Cross rung spacing: 9 inches.
5. Minimum fitting radius: 24 inches.
6. Design Load: Provide tray capable of supporting 50 pounds per linear foot, when supported on 12 foot centers.
7. Hangers: 1/2 inch diameter threaded steel rods; furnish with pair of 1/2 inch nut and washers for each rod. Rods shall be supported from the structural floor above, independent of furred or suspended ceilings, unless otherwise noted.

C. Cable Tray Accessories
1. Fittings: Furnish tees, crosses, risers, elbows, and other fittings as indicated, manufactured with the same materials and finishes as the cable trays.
2. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.6 COLLECTION AND PRESENTATION EQUIPMENT

A. Furnish and install an OpenBlue or equal data collection unit with power supply. In MDF provide 4 post rack shelf for unit and include monitor (17”-19”) keyboard and mouse. Furnish and install network cable and Bacnet switch. Connect switch to BACnet network. Bacnet network must have internet connectivity. Coordinate with owner. The Johnson Controls Enterprise Management Data Collector is an industrial PC that provides connectivity to meters and building automation systems to extract data for the JEM application.

B. This gateway uses Internet of Things (IoT) capabilities to collect and push data to the cloud. An Internet of Things (IoT) gateway is a physical device or software program that serves as the connection point between the cloud and controllers, sensors, and intelligent devices. The IoT gateway also provides additional security for the IoT network and the data it transports.

D. The JEM Data Collector is protected by Microsoft Security Essentials (Windows Defender).

E. The Data Collector shall be a standard unmodified digital computer of modular design, currently manufactured. Data collector shall be BACnet-IP capable to collect BACnet-IP meter data.

E. Hardware shall meet the following minimum requirements:
1. Processor: Intel® Core (TM) i7-6700TE CPU @ 2.40GHz (14mm).
2. System JEMory: 16 GB DDR4 RAM.
3. I/O Chipset: Q170.
4. Display Interface: VGA x 1, HDMI x 2.
5. Chipset Integrated Graphics: Intel® HD Graphics 530.
6. HDMI: DP, VGA up to 3840 x 2160 @ 60Hz.
7. Storage Devices: CFast™, SATA SSD (500GB min).
8. OS support: Windows 10 Enterprise N2016 LTSB.
9. Ethernet: Intel® I210, 10/100/1000Base-TX x 3 I/O.
10. USB 3.0 ports x 4, USB 2.0 port x 2.
11. Audio Line-out x 1, Mic-in x 1.
12. LAN port connector x 3.
13. LAN RJ-45 connector.
14. Power Reset Switch x 1, DC Power x 1.
15. LED Indicator: Power LED x 1, HDD Active LED x 1.
16. Expansion Slot: Full-size Mini-Card x2, SIM slot x1.
17. Power Supply:
    a. DC Input: 9 – 36V with 3-pin terminal block.
18. Mechanical:
    a. Construction: Rugged aluminum extrusion and heavy-duty steel.
    b. Mounting: 4 post rack mount.
    c. Dimension (W x H x D): 264.2 x 66.5 x 156.2 mm (10.4 x 2.6 x 6.1).
    d. Gross Weight: 3.5 kg (7.7 lb).
    e. Net Weight: 3.0 kg (6.6 lb).
19. Environmental:
    a. Operating Temperature: Ambient with Airflow (-20°C - 55°C).
    b. Anti-Vibration: 2 Grms/ 5~500Hz/ operation – CFast.
    c. Storage Temp.: -45°C - 80°C (-49°F - 185°F).
    d. EMC: CE/FCC Class A.

F. Software:
1. Johnson Controls application and Data server (ADS or ADX) release 5.2 or higher.
2. Johnson Controls Enterprise management software.
3. Include standard license and Kiosk license.
4. Microsoft SQL license and software if data collection requires it.

G. The 55” wall mounted Touch Display, with wall mount, is furnished and installed by Section 27 40 00 in the location shown on the technology drawings. It shall be referred to as the Kiosk hereafter. In coordination with the owner, program the software of the cloud based system to present the following details.

1. The Kiosk shall connect to cloud based Energy Management or third party building automation systems, to monitor energy data.
2. The Kiosk shall be touch screen capable, fully customizable, maintainable, and interactive, and/or a slideshow that can display several kinds of content - energy data being the main focus.
3. The Kiosk display shall show live data including current energy, natural gas, and water usage, reductions in CO2 emissions, outdoor air conditions (temperature, humidity, wind direction/speed) and more.
4. Users and visitors shall be able to view information about the organization, its history, programs, goals and objectives. This information serves to increase understanding about the environmental impact and builds awareness of NE-CHPS certification requirements, ENERGY STAR® criteria, and sustainability goals.
5. The Kiosk shall also be able to support playing YouTube videos, as chosen by the user.
6. The Kiosk shall provide historical data for energy consumption. In addition, the software is easily configured, allowing changes to content, color scheme, and logos as required, to keep information current and relevant.
7. The Kiosk shall include a library of predefined Green Tips that are customer-selectable using the Kiosk Editor:
    a. Renewable Energy.
    b. Recycle.
    c. Reuse.
    d. Reduce.
    e. Energy Efficiency.
    f. Refuse.
    g. Conserve Water.
8. The user shall be able to display their green tips in a random order, and also easily add/configure their own green tips to display on the Kiosk, if desired.
9. The Kiosk Maps feature shall provide flexibility to select any of the user's locations from a map.
10. The map shall display color coded pin icons on each location to depict that particular location's level of consumption.
    a. Green pin icon shall indicate that current consumption has decreased at that location compared to previous consumption.
    b. Yellow pin icon shall indicate that current consumption has nominally increased (by 0-5%) at that location compared to previous consumption.
    c. Red pin icon shall indicate that current consumption has increased by >5% at that location compared to previous consumption.
11. The Kiosk shall contain a library of predefined Equivalency categories that are user-selectable, and provide equivalencies of commodities for comparison display. The conversion factor for these equivalencies shall be user-configurable from the Kiosk Editor.
12. The Kiosk shall be able to display Building and Floor Comparisons, helping the user to compare performance of buildings for a selected location.
    a. The Comparison shall be applicable for all of the commodities selected at the location space.
    b. Users shall be able to configure all the buildings, floors, and commodities in the Kiosk Editor, which need to be displayed.
    c. Users shall be able to compare up to 5 buildings/floors for a selected time stamp.
    d. Floor space comparison shall be available at the building level.
13. Provide Shielded Cat 6A patch cable from all sub-meters listed below to data outlets in the room. Refer to Drawings for locations of Sub-meters:
    a. Natural Gas Sub-meters

b. Water Sub-meters
c. Switchboard Sub-meters
d. Panelboard Sub-meters
e. Equipment Sub-meters where indicated on Drawings

2.7 CONDUIT

A. Electric metallic tubing shall be electrogalvanized or sherardized steel and the rigid steel conduit shall be hot-dipped galvanized or sherardized, inside and outside, manufactured by one of the following: Pittsburgh Standard, Republic Steel Corp., Allied Tube and Conduit Corp. or equal.

B. Flexible metal conduit shall be galvanized steel and shall contain a separate copper grounding conductor. Liquid-tight flexible metal conduit shall be similar, but shall also have an extruded moisture and oil proof outer jacket of polyvinyl chloride plastic.

C. Non-Metallic Conduit (NMC): Rigid polyvinyl chloride (PVC) shall be Schedule 40, rated for use with 90 degree conductors, UL rated or approved equal, conforming to industry standards and NEMA TC-2, NEMA TC-3, Fed. Spec. W-C-1094, and UL 651.

D. Rigid steel conduit fittings, couplings and connectors shall be threaded and shall be galvanized or cadmium plated. Conduit fittings and outlet boxes shall be held in place by fittings of a type approved by the Architect. Steel supports or racks shall be galvanized steel channel and fittings, Unistrut, Kindorf or Husky Products Company, or equal.

E. Couplings and connectors for electric metallic tubing shall be galvanized steel of the compression type other than the identer type and with insulated throat or set-screw type.

F. Steel support rods or support bolts for conduits shall be 1/8” diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than 1/4” in diameter.

G. Conduit shall be supported from the Building structure, and shall be independent of ducts, pipes, ceilings and their supporting members.

2.8 CORD REELS

A. References:
1. American National Standards Institute (ANSI)/ Underwriters Laboratories Inc. (UL), ANSI/UL 355-2016.
2. CSA Group (CSA), CSA C22.2 No 21-2018 – Cord Sets and Power Supply Cords.

B. Basis of design for the Cord Reels is based on products manufactured by Hubbell Wiring Device Kellems, or equal.

C. Cord Reels shall be listed and labeled by a qualified agency and marked for intended location and application.

D. Industrial Cord Reels:
1. Industrial Cord Reels shall be provided with minimum 45 foot cable rated for 20 amperes 600V with required phase conductors, neutral, and equipment grounding conductor. Reels shall be constructed of powder coated cast aluminum.
2. Cord Reels shall have a movable guide arm that can be mounted in two positions, positive latch mechanism automatically maintains desired cord lengths, ratchet

lock that can be disengaged in field for constant tension applications.
3. Cord Reels conductor size shall be 12 AWG, unless otherwise indicated.
4. Cord Reels shall be Hubbell HBLI45123R220M1, or equal.

E. Accessories:
1. Manufacturer shall provide a full line of accessories to include and not be limited to cord sets, receptacles, and housings. Provide double duplex receptacles on ends of cord reels.
2. Manufacturer shall provide cable strain relief connectors that accommodate the cable range for the Cord Reels.
3. Mounting brackets shall be available that will attach to the structural supports and allow quick and easy installation. The support shall be equal to Hubbell wiring device inREACH mounting bracket.

F. Examine conditions in which the Cord Reels are to be installed. Notify the respected managing construction parties in writing of any conditions that will be detrimental in the proper installation of the Cord Reels.

G. Color of Cord Reels shall be white, unless otherwise indicated.

2.9 DISCONNECT SWITCHES

A. The Electrical Subcontractor shall furnish and install disconnecting means to comply with the National Electrical Code for all motors. Disconnect switches shall be fused or unfused as shown on the Drawings, NEMA Type HD safety switches for heavy duty, with interlocking cover, side operated with provisions for padlocking the switch handle in the off position.

B. All motor isolating switches indicated on the Drawings shall be rated in horsepower, and shall be rated for the voltage of the motor and shall be furnished and installed at the motor location whether or not the motor is within sight of the motor feeder disconnecting means.

C. Disconnect switch enclosures shall be of the proper NEMA type for the intended location as defined by NEMA and shall be phosphate coated or equivalent code gauge galvanized sheet steel with USAFI No. 24 dark gray baked enamel finish.

D. Disconnect switches shall bear the Underwriters' Laboratories label and be manufactured by Square D Company, Eaton/Cutler-Hammer, Siemens, or equal.

2.10 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. Part 1 – General
1. Summary
a. Section Includes:
1) Digital Lighting and Plug Load Controls
2) Relay Panels
3) Emergency Lighting Control
b. Related Sections:
1) Wiring Devices
2) Lighting Fixtures
3) Building integrator shall provide integration of the lighting control system with Building Automation Systems.
4) Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section

5) Electrical Sections, including wiring devices, apply to the work of this Section.

c. Control Intent – Control Intent includes, but is not limited to:
1) Defaults and initial calibration settings for such items as time delay, sensitivity, and fade rates.
2) Initial sensor and switching zones
3) Initial time switch settings
4) Emergency Lighting Control

2. References
a. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
b. International Electrotechnical Commission (IEC)
c. International Organization for Standardization (ISO)
d. National Electrical Manufacturers Association (NEMA)
e. WD1 (R2005) - General Color Requirements for Wiring Devices.
f. Underwriters Laboratories, Inc. (UL)
1) 20 – Plug Load Controls
2) 508– Industrial Controls
3) 916 – Energy Management Equipment.
4) 924 – Emergency Lighting

3. System Description and Operation
a. The Lighting Control and Automation system as defined under this section covers the following equipment:
1) Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
2) Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
3) Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.
4) Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.
5) Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
6) Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
7) Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings.
8) Digital Lighting Management (DLM) local network – Free topology,

plug-in wiring system (Cat 5e) for power and data to room devices.

9) Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control
10) Network Bridge – Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
11) Segment Manager – Provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
12) Programming and Configuration Software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
13) LMCP Digital Lighting Management Relay Panel – Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).
14) Emergency Lighting Control Unit (ELCU) – Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

4. Lighting Control Applications
   a. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
      1) Space Control Requirements – Provide occupancy/vacancy sensors with Manual-ON functionality in all spaces except where indicated.
      2) Bi-Level Lighting – Provide multi-level controls where indicated.
      3) Task Lighting / Plug Loads – Provide automatic shut off of non essential plug loads and task lighting where indicated. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
      4) Daylit Areas – Provide daylight-responsive automatic control where indicated.
         a) All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
         b) Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
         c) Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
         d) Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system

may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

5) Where indicated controls that allow for independent control of each local control zone shall be provided. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

5. Submittals
   a. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
   b. Shop Drawings:
      1) Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
      2) Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans. (Provide AutoCAD format reflected ceiling plans.)
      3) Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
      4) Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
   c. Product Data: Catalog sheets, specifications and installation instructions.
   d. Include data for each device which:
      1) Indicates where sensor is proposed to be installed.
      2) Prove that the sensor is suitable for the proposed application.
6. Quality Assurance
   a. Manufacturer: Minimum [10] years experience in manufacture of lighting controls.
7. Project Conditions
   a. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
      1) Ambient temperature: 0° to 40° C (32° to 104° F).
      2) Relative humidity: Maximum 90 percent, non-condensing.
8. Warranty
   a. Provide a five year limited manufacturer’s warranty on all room control devices and panels.

B. Part 2 – Products
1. Manufacturer
   a. Acceptable Manufacturer:
      1) WattStopper
         a) System: Digital Lighting Management (DLM)
      2) Basis of design product: WattStopper Digital Lighting Management (DLM) or subject to compliance and prior approval with specified requirements of this section, one of the following:
         a) Lutron, Crestron, or Equal.
      3) Substitutions:

a) Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
b) By using substitutions, the Electrical Subcontractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The Electrical Subcontractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted for review and approval prior to rough-in.

2. Digital Lighting Controls
   a. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.
3. Digital Wall Switch Occupancy Sensors
   a. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.
   b. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
      1) Digital calibration and pushbutton configuration for the following variables:
         a) Sensitivity – 0-100% in 10% increments
         b) Time delay – 1-30 minutes in 1 minute increments
         c) Test mode – Five second time delay
         d) Detection technology – PIR, Dual Technology activation and/or re-activation.
         e) Walk-through mode
         f) Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
      2) Programmable control functionality including:
         a) Each sensor may be programmed to control specific loads within a local network.
         b) Sensor shall be capable of activating one of 16 user-definable lighting scenes.
         c) Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
         d) On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
            i. Ultrasonic and Passive Infrared
            ii. Ultrasonic or Passive Infrared
            iii. Ultrasonic only
            iv. Passive Infrared only
      3) Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
      4) Two RJ-45 ports for connection to DLM local network.
      5) Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote

personal controls.

6) Device Status LEDs including:
   a) PIR detection
   b) Ultrasonic detection
   c) Configuration mode
   d) Load binding
7) Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
8) Assignment of local buttons to specific loads within the room without wiring or special tools.
9) Manual override of controlled loads.
10) All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

c. BACnet object information shall be available for the following objects:
   1) Detection state
   2) Occupancy sensor time delay
   3) Occupancy sensor sensitivity, PIR and Ultrasonic
   4) Button state
   5) Switch lock control
   6) Switch lock status

d. Units shall not have any dip switches or potentiometers for field settings.

e. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

f. Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:
   1) Left button
      a) Press and release - Turn load on
      b) Press and hold - Raise dimming load
   2) Right button
      a) Press and release - Turn load off
      b) Press and hold - Lower dimming load

g. Low voltage momentary pushbuttons shall include the following features:
   1) Load/Scene Status LED on each switch button with the following characteristics:
      a) Bi-level LED
      b) Dim locator level indicates power to switch
      c) Bright status level indicates that load or scene is active

h. The following button attributes may be changed or selected using a wireless configuration tool:
   1) Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
   2) Individual button function may be configured to Toggle, On only or Off only.
   3) Individual scenes may be locked to prevent unauthorized change.
   4) Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   5) Ramp rate may be adjusted for each dimmer switch.
   6) Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

i. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

4. Digital Wall or Ceiling Mounted Occupancy Sensor
   a. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.
   b. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
      1) Digital calibration and pushbutton configuration for the following variables:
         a) Sensitivity – 0-100% in 10% increments
         b) Time delay – 1-30 minutes in 1 minute increments
         c) Test mode – Five second time delay
         d) Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
         e) Walk-through mode
      2) Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
      3) Programmable control functionality including:
         a) Each sensor may be programmed to control specific loads within a local network.
         b) Sensor shall be capable of activating one of 16 user-definable lighting scenes.
         c) Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
         d) On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
            i. Ultrasonic and Passive Infrared
            ii. Ultrasonic or Passive Infrared
            iii. Ultrasonic only
            iv. Passive Infrared only
            v. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
      4) One or two RJ-45 port(s) for connection to DLM local network.
      5) Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
      6) Device Status LEDs, which may be disabled for selected applications, including:
         a) PIR detection
         b) Ultrasonic detection
         c) Configuration mode
         d) Load binding
      7) Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
      8) Manual override of controlled loads.

9) All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

c. BACnet object information shall be available for the following objects:
1) Detection state
2) Occupancy sensor time delay
3) Occupancy sensor sensitivity, PIR and Ultrasonic

d. Units shall not have any dip switches or potentiometers for field settings.

e. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

f. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

5. Digital Wall Switches

a. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
1) Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2) Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3) Configuration LED on each switch that blinks to indicate data transmission.
4) Load/Scene Status LED on each switch button with the following characteristics:
a) Bi-level LED
b) Dim locator level indicates power to switch
c) Bright status level indicates that load or scene is active
d) Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
5) Programmable control functionality including:
a) Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
b) Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
6) All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

b. BACnet object information shall be available for the following objects:
1) Button state
2) Switch lock control
3) Switch lock status

c. Two RJ-45 ports for connection to DLM local network.

d. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

e. The following switch attributes may be changed or selected using a wireless configuration tool:
1) Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2) Individual button function may be configured to Toggle, On only or Off only.

3) Individual scenes may be locked to prevent unauthorized change.
4) Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5) Ramp rate may be adjusted for each dimmer switch.
6) Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
7) WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

6. DLM Handheld User Interface Remotes
   a. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
      1) Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.
      2) LED on each button confirms button press.
      3) Load buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
      4) Inactivity timeout to save battery life.
   b. A wall mount holster and mounting hardware shall be included with each remote control
   c. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.
7. Digital Partition Controls
   a. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.
   b. Four-button low voltage pushbutton switch for manual control.
      1) Two-way infrared (IR) transceiver for use with configuration remote control.
      2) Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
      3) Configuration LED on each switch that blinks to indicate data transmission.
      4) Each button represents one wall; Green button LED indicates status.
      5) Two RJ-45 ports for connection to DLM local network.
      6) WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.
   c. Contact closure interface for automatic control via input from limit switches on movable walls (by others).
      1) Operates on Class 2 power supplied by DLM local network.
      2) Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
      3) Input max. sink/source current: 1-5mA
         a) Logic input signal voltage High: >18VDC
         b) Logic input signal voltage Low: <2VDC
      4) Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
      5) Two RJ-45 ports for connection to DLM local network.
      6) WattStopper part number: LMIO-102

8. Digital Daylighting Sensors
   a. Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring.
      1) Closed loop sensors measure the ambient light in the space and control a single lighting zone.
      2) Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
      3) Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.
   b. Digital daylighting sensors shall include the following features:
      1) The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
      2) Sensor light level range shall be from 1-6,553 footcandles (fc).
      3) The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
      4) For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
      5) For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
      6) Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
      7) Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
      8) Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
      9) Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
      10) Configuration LED status light on device that blinks to indicate data transmission.
      11) Status LED indicates test mode, override mode and load binding.
      12) Recessed switch on device to turn controlled load(s) ON and OFF.
      13) BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
         a) Light level
         b) Day and night setpoints

c) Off time delay
d) On and off setpoints
e) Up to three zone setpoints
f) Operating mode – on/off, bi-level, tri-level or dimming

14) One RJ-45 port for connection to DLM local network.
15) A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
16) Any load or group of loads in the room can be assigned to a daylighting zone
17) Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18) All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

c. Closed loop digital photosensors shall include the following additional features:
1) An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2) Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3) Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
4) WattStopper Product Number: LMLS-400, LMLS-400-L.

d. Open loop digital photosensors shall include the following additional features:
1) An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
2) Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
3) Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4) WattStopper Product Number: LMLS-500, LMLS-500-L.

e. Dual loop digital photosensors shall include the following additional features:
1) Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con

2) Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
3) Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
4) Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
5) Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6) Device must include extendable mounting arm to properly position sensor within a skylight well.
7) WattStopper product number LMLS-600

9. Digital Load Controllers (Room, Plug Load and Fixture Controllers)
   a. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:
      1) Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
      2) Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
      3) Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest.
      4) Device Status LEDs to indicate:
         a) Data transmission
         b) Device has power
         c) Status for each load
         d) Configuration status
      5) Quick installation features including:
         a) Standard junction box mounting
         b) Quick low voltage connections using standard RJ-45 patch cable
      6) Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
         a) Turn on to 100%
         b) Remain off
         c) Turn on to last level
      7) Each load shall be configurable to operate in the following

sequences based on occupancy:
a) Auto-on/Auto-off (Follow on and off)
b) Manual-on/Auto-off (Follow off only)

8) The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9) BACnet object information shall be available for the following objects:
a) Load status
b) Electrical current
c) Total watts per controller
d) Schedule state – normal or after-hours
e) Demand response control and cap level
f) Room occupancy status
g) Total room lighting and plug loads watts
h) Total room watts/sq ft
i) Force on/off all loads
10) UL 2043 plenum rated
11) Manual override and LED indication for each load
12) Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
13) Zero cross circuitry for each load
14) All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

b. On/Off Room Controllers shall include:
1) One or two relay configuration
2) Efficient 150 mA switching power supply
3) Three RJ-45 DLM local network ports with integral strain relief and dust cover
4) WattStopper product numbers: LMRC-101, LMRC-102

c. On/Off/Dimming enhanced Room Controllers shall include:
1) Real time current monitoring
2) Multiple relay configurations
a) One, two or three relays (LMRC-21x series)
b) One or two relays (LMRC-22x series)
3) Efficient 250 mA switching power supply
4) Four RJ-45 DLM local network ports with integral strain relief and dust cover
5) One dimming output per relay
a) 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
b) Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and

incandescent loads. (LMRC-22x series)

c) Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.

d) The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

e) Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.

f) Calibration and trim levels must be set per output channel.

g) Devices that set calibration or trim levels per controller are not acceptable.

h) All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

6) Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.

7) Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.

8) The following dimming attributes may be changed or selected using a wireless configuration tool:
   a) Establish preset level for each load from 0-100%
   b) Set high and low trim for each load
   c) Set lamp burn in time for each load up to 100 hours

9) Override button for each load provides the following functions:
   a) Press and release for on/off control
   b) Press and hold for dimming control

10) WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC-221, LMRC-222

d. Plug Load Room Controllers shall include:

1) One relay configuration with additional connection for unswitched load

2) Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).

3) Factory default operation is Auto-on/Auto-off, based on occupancy

4) Real time current monitoring of both switched and un-switched load (LMPL-201 only)

5) Efficient switching power supply
   a) 150mA (LMPL-101)
   b) 250mA (LMPL-201)

6) RJ-45 DLM local network ports
   a) Three RJ-45 ports (LMPL-101)
   b) Four RJ-45 ports (LMPL-201)

7) WattStopper product numbers: LMPL-101, LMPL-201.

e. Fixture Controllers shall include:
1) A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
2) One 3A 120/277V rated mechanically held relay.
3) Programmable behavior on power up following the loss of normal power:
a) Turn on to 100%
b) Turn off
c) Turn on to last level
4) Requirement for 7 mA of 24VDC operating power from the DLM local network.
a) The Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.
b) Power to drive the LMFC Fixture Controller electronics can come from any Room or Plug Load Controller, LMPB-100 Power Booster and/or LMZC-301 Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).
5) 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.
6) Terminals to connect an RJ-45 adaptor with 24” leads, mountable in a ½” KO, for connection to the DLM local network.
a) The adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
7) A complete set of dimming features described above in the section detailing On/Off/Dimming Enhanced Room Controllers.
8) WattStopper product numbers: Fixture Controller: LMFC-011, DLM Cable Connector: LMFC-RJ-50-24, Power Booster: LMPB-100

10. DLM Local Network (Room Network)
a. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
b. Features of the DLM local network include:
1) Plug n’ Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2) Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
3) Push n’ Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
4) Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line

of sight of up to 30 feet from a sensor, wall switch or IR receiver.

c. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

d. If manufacturer's pre-terminated Cat 5e cables are not used for the installation, the Electrical Subcontractor is responsible for testing each cable following installation and supplying manufacturer with test results.

e. WattStopper Product Number: LMRJ-Series

11. DLM Segment Network (Room to Room Network)

a. The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.

1) Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.

2) Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.

3) The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.

4) Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.

5) Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.

6) Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERs, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

b. WattStopper Product Number: LM-MSTP, LM-MSTP-DB

12. Hand Held and Computer Configuration Tools

a. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

b. Features and functionality of the wireless configuration tool shall include but not be limited to:

1) Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

2) High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

3) Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.

4) Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.

5) Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6) Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7) Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8) Verify status of building level network devices.

c. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

13. Network Bridge

a. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
1) The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
2) Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
3) The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
a) Read/write the normal or after hours schedule state for the room
b) Read the detection state of each occupancy sensor
c) Read the aggregate occupancy state of the room
d) Read/write the On/Off state of loads
e) Read/write the dimmed light level of loads
f) Read the button states of switches
g) Read total current in amps, and total power in watts through the room controller
h) Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
i) Activate a preset scene for the room
j) Read/write daylight sensor fade time and day and night setpoints
k) Read the current light level, in footcandles, from interior and exterior photosensors and photocells

l) Set daylight sensor operating mode
m) Read/write wall switch lock status
n) Read watts per square foot for the entire controlled room
o) Write maximum light level per load for demand response mode
p) Read/write activation of demand response mode for the room
q) Activate/restore demand response mode for the room

b. WattStopper product numbers: LMBC-300

14. Segment Manager

a. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

b. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans.

c. Operational features of the Segment Manager shall include the following:

1) Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
2) Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC.
3) Log in security capable of restricting some users to view-only or other limited operations.
4) Segment Manager shall provide two main sets of interface screens – those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system, and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:

a) Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
b) Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the WattStopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager.
c) After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and

operational parameters to be viewed and changed by the user.

d) Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.

e) Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an “Export Table” that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator’s request for info and the overall system performance.

5) Capabilities using the Segment Manager’s Dashboard Screens shall include:

a) A dynamic “tile” based interface that allows easy viewing of each individual room’s lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x).Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles shall be color coded based on three energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. The tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.

b) Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules.

c) Ability to provide a simple time vs. power graph based

on information stored in each Segment Manager's memory (typically two to three days' data).

d) Ability to group rooms and loads for common control by schedules, switches or network commands.

e) Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.

f) Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control.

6) If shown in the contract drawings, Segment Managers shall be integrated into a larger control network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Segment Manager interface software with dedicated communication and networking capability, able to pull information automatically from each individual Segment Manager in the network. By using a Supervisor, information for individual Segment Managers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten after a few days because of Segment Manager memory limits.

7) The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

d. Segment Manager shall support multiple DLM rooms as follows:

1) Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).

2) Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).

e. WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

15. Programming, Configuration and Documentation Software

a. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

b. Additional parameters exposed through this method include but are not limited to:

1) Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.

2) Six occupancy sensor action behaviors for each controlled load,

separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.

3) Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4) Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5) Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6) Load control polarity reversal so that on events turn loads off and vice versa.
7) Per-load DR (demand response) shed level in units of percent.
8) Load output pulse mode in increments of 1second.
9) Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

c. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1) Device list report: All devices in a project listed by type.
2) Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3) BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4) Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5) Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6) Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).

d. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.
Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
1) Set, copy/paste an entire project site of sensor time delays.
2) Set, copy/paste an entire project site of sensor sensitivity settings.
3) Search based on room name and text labels.
4) Filter by product type (i.e. LMRC-212) to allow parameter set by product.
5) Filter by parameter value to search for product with specific configurations.

e. Network-wide firmware upgrading remotely via the BACnet/IP network.
1) Mass firmware update of entire rooms.
2) Mass firmware update of specifically selected rooms or areas.
3) Mass firmware upgrade of specific products.

f. WattStopper Product Number: LMCS-100, LMCI-100

16. LMCP Lighting Control Panels and LMZC Zone Controller
a. Provide lighting control panels in the locations and capacities as

indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

1) Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
2) Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3) Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
    a) Removable, plug-in terminal blocks with connections for all low voltage terminations.
    b) Individual terminal block, override pushbutton, and LED status light for each relay.
    c) Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
    d) Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
    e) True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
    f) Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
    g) Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
    h) Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
4) Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
    a) Electrical:
        i. 30 amp ballast at 277V

ii. 20 amp ballast at 347V
iii. 20amp tungsten at 120V
iv. 30 amp resistive at 347V
v. HP motor at 120V
vi. 14,000 amp short circuit current rating (SCCR) at 347V
vii. Relays shall be specifically UL 20 listed for control of plug-loads

b) Mechanical:
i. Replaceable, ½" KO mounting with removable Class 2 wire harness.
ii. Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
iii. Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
iv. Tested to 300,000 mechanical on/off cycles.

5) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6) Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7) Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8) Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
a) Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
b) The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
c) The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
d) The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:

i. Scheduled ON / OFF
ii. Manual ON / Scheduled OFF
iii. Astro ON / OFF (or Photo ON / OFF)
iv. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

e) The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)

f) The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.

g) Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

9) The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.

10) The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol.

a) The panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.

b) The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.

c) Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property.

d) Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64.

e) The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.

f) Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet

objects for panel setup and control as follows:

i. Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays.

ii. Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control.

iii. Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays.

iv. Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

g) The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

h) The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object.

i) Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.

j) Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11) In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:

a) The LMZC shall use the same intelligence board as the LMCP relay panel.

b) The LMZC shall not include relay driver boards or relays.

c) The LMZC shall have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.

d) The LMZC tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.

e) All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.

12) To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50% output when any digital occupancy sensor detects motion.
13) WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

b. User Interface
1) Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum:
a) Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
b) Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
c) Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
d) Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
e) Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
f) Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
g) An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as determined by the end user's representative.
h) WattStopper Product Number: LMCT-100

17. Emergency Lighting Control Devices

a. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
   1) 120/277 volts, 50/60 Hz, 20 amp ballast rating
   2) Push to test button
   3) Auxiliary contact for remote test or fire alarm system interface
b. WattStopper Product Numbers: ELCU-100, ELCU-200.

C. Part 3 – Execution
1. Pre-Installation Meeting
   a. A factory authorized manufacturer's representative shall provide the Electrical Subcontractor a functional overview of the lighting control system prior to installation. The Electrical Subcontractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
      1) Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
      2) Review the specifications for low voltage control wiring and termination.
      3) Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
      4) Discuss requirements for integration with other trades.
2. Electrical Subcontractor Installation Services
   a. Electrical Subcontractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.
   b. Electrical Subcontractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the Electrical Subcontractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturer with test results. Electrical Subcontractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer's specifications. Electrical Subcontractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.
   c. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, Electrical Subcontractor shall test all devices to ensure proper communication.
   d. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
      1) Adjust time delay so that controlled area remains lighted while occupied.
   e. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
      1) Sensor parameters, time delays, sensitivities, and daylighting setpoints.

2) Sequence of operation, (e.g. manual ON, and Auto OFF)
3) Load Parameters (e.g. blink warning)

f. Post start-up tuning – After 30 days from occupancy Electrical Subcontractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3. Factory Services
   a. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.
      1) Lighting vendor shall provide a copy of its start-up protocol to the Electrical Subcontractor and the Commissioning Agent no later than three weeks prior to the start-up date.
   b. The electrical Electrical Subcontractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.
      1) Lighting vendor shall conduct a field inspection of all lighting devices and verify their operation during start-up.
      2) Lighting vendor shall submit a written start-up report no later than one week after start-up completion and prior to system training.
   c. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.
4. Commissioning Support Services
   a. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent perform the sample checkout of the devices and system as required for the commissioning agent's functional test scope. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or Electrical Subcontractor may offer spreadsheets and/or printouts to assist the agent with this task.
   b. The commissioning agent shall work with the Electrical Subcontractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the Electrical Subcontractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

2.11 DRY TYPE K-RATED TRANSFORMERS

A. Description
1. This Specification describes the design of a copper wound, multi-shielded, three phase, K-factor rated, high efficiency, power conditioning isolation transformer. The power conditioning transformer specified must be a continuous duty rated, 600 volt class, convection cooled, dry type, isolation transformer to support harmonic rich non-linear loads while maintaining safe operating temperatures and shall include superior transverse and common mode noise attenuation. The power

conditioning transformer shall meet NEMA TP 1-2002 dry type transformer efficiency standards. In addition, the transformer shall be designed to achieve NEMA TP 1-2002 Table 1-1 efficiencies under K-13 non-linear load at or between 35% to 50% of its rating, as outlined in Section G, 10, of this Specification Section.

B. Standards
1. The power conditioning system shall be designed in accordance with applicable portions of the following standards:
   a. NEMA TP 1-2002 Dry Type Distribution Transformer Efficiency Standards.
   b. American National Standards Institute (ANSI C57.110 and C62.41-1991).
   c. Institute of Electrical and Electronic Engineers (IEEE 519-1992).
   d. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC).
   e. Federal Information Processing Standards Publication 94 (FIPS Pub 94).
   f. UL Listed to Standard 1561.
   g. C-UL listed to CSA Standard C22.2, No. 47-M90.

C. Submittals
1. Manufacturer Requirements:
   a. The manufacturer shall be ISO 9001:2008 “Quality Assurance Certified” and shall upon request furnish certification documents.
   b. The manufacturer shall be a United States based manufacturer with at least 15 years’ experience in design and fabrication K-rated, shielded, power conditioning isolation transformers.
2. Product Data:
   a. The manufacturer shall supply documentation for the installation of the system, including wiring diagrams and cabinet outlines showing dimensions, weights, BTUs, input/output connection locations and required clearances.
   b. Factory test results and design data shall be provided to show compliance with the requirements.

D. Manufacturer’s
1. The equipment specified is the Ultra-K, Series 600K, manufactured by Controlled Power Company. Equipment shall be as manufactured by Controlled Power Company, Acme, Siemens, or equal.

E. Input Specifications
1. The nominal AC input voltage rating of the power conditioner shall be 480 VAC 3 phase with sufficient margin to sustain a constant input of +10% without saturation.
2. The nominal operating frequency shall be 60 hertz $\pm$ 3 hertz.
3. The power conditioning transformer primary shall be configured in a three phase delta. Transformers below 500kVA shall include full capacity taps at 2½ % increments, two (2) above and four (4) below the nominal voltage tap.
4. When energized, the current inrush shall not exceed a maximum of 10 times the full load input current for a 1/2 cycle.

F. Output Specifications
1. The nominal AC output voltage rating of the power conditioning transformer shall be 208 VAC wye derived, 60 hertz.
2. The output impedance of the power conditioning transformer shall be 3% - 4% typical.
3. The power conditioning transformer shall be K-13 rated in accordance with: $K = \sum Ih(pu)^2 h^2$

4. The power conditioning transformer shall provide a continuous duty, full load output power as indicated on Drawings.

G. Performance Specifications
1. The output voltage of the power conditioning transformer shall be maintained within ±2.5% or less of nominal, from no load to full load.
2. The overload rating of the power conditioning transformer shall be 500% for 10 seconds, and 1,000% for one cycle.
3. The power conditioning transformer shall add no more than 1% total harmonic distortion to the output waveform under a linear load.
4. Output voltage shall remain sinusoidal with no flat topping when high crest factor (3.0:1), non-linear loads are present at the output.
5. The audible noise of the power conditioning transformer shall be no greater than measurements indicated below:
   a. 50 dB for 15 KVA to 112.5 KVA units measured at 1 meter.
   b. 55 dB for 150 KVA to 225 KVA units measured at 1 meter.
   c. 60 dB for 300 KVA to 500 KVA units measured at 1 meter.
6. The power conditioning transformer shall incorporate a solid copper foil, triple electrostatic shield to minimize inner winding capacitance, transient and noise coupling between primary and secondary windings.
7. Transformer shall be triple-shielded and capable of 146dB common mode noise attenuation.
8. Transformer shall be capable of transverse mode noise attenuation of 3 dB down at 10kHz, decaying 20 dB per decade.
9. The power conditioning transformer shall have an efficiency of 98% typical and shall meet NEMA TP 1-2002 dry type transformer efficiency standards on models 15kVA and above.
10. The power conditioning transformer shall be designed to achieve NEMA TP 1-2002 Table 1-1 efficiencies listed below under a K-13 non-linear load at or between 35% to 50% load and at an operating temperature of 75 degrees C.

kVA	Efficiency
15*	97.00%
30	97.50%
45	97.70%
75	98.00%
112.5	98.20%
150	98.30%
225	98.50%
300	98.60%
500	98.70%

*15kVA model efficiency applicable to K4 and K7 loading only.

11. The power conditioning transformer shall incorporate a fused (with front panel mounted, blown fuse lamp indicator) 3 phase, secondary connected, 6 mode spike suppression network. The suppressor shall be comprised of high energy metal oxide varistors with less than a 5 nanosecond response time and a maximum peak current handling capability of 40,000 amps (8x20μsec) per mode. The suppression network system shall remain functional when subjected to ANSI/IEEE C62.41 Category B-3 waveforms. The spike suppression network will increase the transverse mode noise attenuation to 3 dB down at 10kHz, decaying 40 dB per decade.

H. Main Transformer Construction

1. The transformer windings shall be all copper conductor construction, with separate primary and secondary, isolated windings. The transformer shall conform to National Electrical Code that specifies a separately derived power source. The neutral conductor shall be provided at 2 times the ampacity of the phase conductor.
2. Terminals shall be provided for isolated three phase output conductors, neutral conductor and ground.
3. Output neutral shall be bonded to ground via a removable jumper wire or bus bar.
4. All leads, wires and terminals shall be labeled to correspond with the circuit wiring diagram.
5. Basic Impulse level shall be no less than 10,000 Volts.
6. Mean Time Between Failure (MTBF) shall be no less than 200,000 hours.
7. Grain oriented, M6 grade, silicon transformer steel shall be utilized to provide maximum efficiency. Flux density shall not exceed 15k gauss. Core losses shall be limited to 0.6% or less of the KVA rating.
8. Class N, 200°C insulation system shall be utilized throughout with a maximum temperature rise above ambient of 115°C under a linear load, not to exceed 130°C under non-linear loading per UL 1561.
9. The transformer shall be designed for natural convection cooling.

I. Cabinet Construction
1. The cabinet shall be a NEMA type 2 general purpose, floor mounted, indoor enclosure. Dimensions shall not exceed TABLE 1-2 dimensions below.
2. Cabinets shall be manufactured from 14 gauge steel with base sub-structure suitable for fork lifting.
3. The cabinet shall have a baked on powder coat paint finish with proper pre-treatment.
4. Input and output power connections shall be hardwired to copper stand off bus located behind the front panel of the transformer cabinet. Input and output locations shall be available on either side of transformer cabinet.

J. Environment
1. Temperature: The power conditioning system shall be required to operate without overheating in an ambient temperature range of -20°C to +40°C.
2. Humidity: The power conditioning system shall operate in a relative humidity of 0 to 95% non-condensing.
3. Altitude: The power conditioning system shall operate up to 5000 feet above sea level without de-rating.

K. Warranty
1. Manufacturer shall guarantee the power conditioning transformer to be free from defects in material and workmanship for a period of two years following shipment from the factory.

2.12 DRY TYPE TRANSFORMERS

A. Transformers shall have separate primary and secondary windings. Transformers shall be UL listed insulation systems of 220 degrees C., with 150 degrees C. temperature rise above 40 degrees C. ambient, except sizes less than 10 KVA may be 185 degrees C., UL listed insulation system with 150 degrees C. temperature rise above an ambient of 40 degrees C. Transformers larger than 10 KVA shall be of ventilated type.

B. Core and coil assembly shall be supported from the enclosure base and shall have sound insulation pads between core and coil assembly and the enclosure base. KVA and voltage ratings shall be as indicated on Drawings.

C. Transformers shall be designed for natural draft cooling conforming to applicable ANSI and IEEE Standards. Six 2-1/2% full capacity taps shall be provided, two above and four below rated voltage. Noise level shall not exceed 45DB on 15 to 50 KVA, 50DB on 51 to 150 KVA transformers and 55 DB on transformers over 150 KVA.

D. Connection to transformers shall be made with liquid- tight flexible conduit with grounding conductor. Transformers shall be installed in association with Korfund vibration isolation pads to reduce noise level to a minimum. Refer to schedule on Drawings for mounting arrangement. Transformers shall be manufactured by Square D, Cutler-Hammer, Siemens, or equal.

2.13 ELECTRICAL SUPPORTING DEVICES

A. All conduit and fittings on all work are to be secured by one or more of the following:
1. Masonry - metal clips secured by toggle bolts or lead expansion sleeves.
2. Woodwork - metal clips secured by wood screws.
3. Bar joists - wedge hangers.
4. Flanged beams - flange clips.

B. All pipe hangers and equipment supports shall be constructed and installed in accordance with Seismic Zone requirements as outlined in the State Building Code. The Electrical Subcontractor shall submit one (1) copy of Shop Drawings and calculations detailing seismic hanger restraints to the local Building Authority and Architect, along with a letter of compliance signed by a registered structural engineer confirming that the piping hangers meet State Seismic Code requirements. Cable provided for seismic systems shall be color-coded and pre-stressed.

2.14 ELECTRICAL SWITCHBOARD

A. Furnish and install a NEMA One, Class One Switchboard. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the International Building Code (IBC) Site Classification as based on installed location zip code. The manufacturer shall provide the tested baseline mounting location information to the Electrical Subcontractor. The installing Electrical Subcontractor shall complete all required installation calculations and mount the unit based on the engineered to site plans.

B. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

C. All sections of the switchboard shall be a minimum of 90 inches high and group distribution sections shall be no more than 30 inches deep. All vertical sections shall rear align.

D. All switchboard components shall be either front or side accessible. Where space for future is called for, all necessary bus extensions except devices connecting straps shall be provided.

E. The switchboard assembly and all circuit breakers shall be rated for short-circuited stresses as indicated on Drawings.

F. Fully Rated equipment shall be provided; Series Rated equipment is not acceptable.

G. All main bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted

with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure). No portion of the horizontal bus shall extend within 8 inches of the bottom or within 8 inches of the front inside any vertical panel section of the switchboard structure.

H. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and finished with gray enamel over a rust-inhibiting phosphatized coating.

I. The switchboard shall have an UL service entrance equipment label.

J. The switchboard layout and rating shall be as indicated on the plans and shall have the following features:
1. Service entrance shall be by means of conduit entering from the bottom.
2. Provide a main molded case circuit breaker for ratings 1600 amperes and below. Provide main insulated case circuit breaker for all ratings 2000 amperes and above. Circuit breakers which are rated at 1200 amps or more shall have Arc Energy Reduction complying with National Electrical Code 240.87.
3. Provide Digitrip or equal electronic trip unit with integral GF protection on all main breakers. Provide thermal magnetic or ETU for feeders as shown on Drawings.
4. Provide National Electrical Code compliant arc reduction maintenance protection with separate maintenance settings, activation switch and light for all main breakers.
5. Main section shall be equipped with a line side digital power quality meter, Eaton IQ 35M Series or equal. Unit shall monitor voltage, amperes, power usage, and harmonic content displayed on the board and available for interface to the BMS via **BACnet** communications. Mount the unit in a separate compartment with system rated AIC disconnect device and shorting block for Line mounted CT's.
6. Each switchboard section shall have full ampere bussing with full neutral capacity. A ground bus bonded to each cubicle shall run throughout the switchboard and all buses shall be copper.
7. Internal busing and circuiting shall conform to the power riser diagram shown on the plans.
8. Distribution sections shall consist of circuit breakers group mounted with bolted connectors to bus all front accessible. See schedule on Drawings for frame size and trip unit types.
9. Where shown on drawings provide Electric Utility Company metering section that meets all local electric utility company requirements. Provide CT and PT units if required by the electric utility company. Provide all required documentation for electric utility company compliance review prior to construction of the switchboard.
10. For 480Y/277 volt service disconnect switch or main circuit breaker, 1000 amps and larger, provide ground fault protection.

K. The switchboard shall be a Pow-R-Line C as manufactured by Eaton, Square D, Siemens, or equal.

2.15 EMERGENCY STANDBY SYSTEM (DIESEL)

A. Furnish and install a complete and operating emergency power system as specified herein and as indicated on the Drawings.

B. The system shall be arranged to provide automatic and instantaneous power upon loss of normal power. This system shall meet all Code requirements for emergency lighting and power.

C. Furnish complete, install and leave in good running condition a 700 KW diesel fueled engine driven generating set continuously rated for standby service. The KW rating shall be continuously available during any power outage. The unit shall be as hereinafter described and as shown on the Drawings, complete with all controls, attachments, accessories, fuel and exhaust systems.

D. The unit shall be the product of a manufacturer regularly engaged in the production of this type of equipment as manufactured by Kohler Company, Caterpillar Corporation, Onan Corporation, Generac, or equal.

E. The unit shall be capable of accepting the incoming loads of the Automatic Transfer Switches.

F. Operation:
1. The operation of this unit shall be automatic and upon the closing of a remote starting contact in Automatic Transfer Switch, the engine shall start and attain rated voltage and frequency within ten (10) seconds.
2. All necessary accessories shall be provided to assure starting within the time described above under the ambient conditions described herein.
3. Furnish and install all electrical work and equipment required for the proper operation of this system. The General Contractor will provide the necessary structured supports for the emergency generator. The Electrical Subcontractor shall provide weight information, as well as dimensional information of the generator to the General Contractor, prior to installing the supports, if necessary.

G. Emissions:
1. The proposed generator set shall be factory EPA certified for Stationary Emergency use and be in compliance with the Rhode Island Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with EPA Tier 2 emissions standard per ISO 8178 – D2 Emissions Cycle at specified ekW/bHP rating. Utilization of the “Transition Program for Equipment Manufacturer’s” also known as “Flex Credits” to achieve Tier 3 certification is not in compliance with MA Regulations “310 CMR 7.02 U Plan Approval and Emission Limitations” and will not be accepted.

H. Engine:
1. The engine shall be unit-mounted radiator cooled, 4 cycle, industrial type, heavy duty, diesel fueled, and a maximum RPM of 1800. Ratings shall be for standard conditions of 29.92 barometer and 60 degrees air temperature.
2. Lubrication shall be a full pressure system using an engine driven gear-type lube oil pump with replacement element full flow lube oil filter. Oil cooler shall be required.
3. Base Mounted Fuel Tank:
There shall be a double wall diesel fuel storage tank and rupture alarm supplied as an integral part of the base of the unit. The tank shall be furnished and constructed in accordance with Rhode Island and City requirements for fuel storage. The fuel tank shall be installed in the generator manufacturer's factory and all fuel connections, vents, returns and fills shall be installed and tested prior to shipment. Field or dealer installed tank installations are not acceptable. Tank shall be sized to provide 48 hours of usable run time, at 100% load.

The fuel tank shall meet all CMR 527 and Board of Fire Preventions Regulations and be accompanied with approval seal.

This installation shall include but shall not be limited to the following:
-Double wall steel fuel tank of the rated capacity
-Enlarged steel skid base
-Fuel lines including supply, return and vent lines
-Fuel fill
-Fuel level gauge
-Low fuel warning float switch
-Rupture basin and alarm
-Low fuel level alarm relay

All required appurtenances recommended or required by the manufacturer for a complete and correct installation shall be supplied and the entire assembly shall be factory primed and painted in the manufacturer's standard color to protect against corrosion.

4. Diesel Fuel System
   a. The engine fuel system shall include all equipment normally supplied and recommended by the generator set manufacturer for standby generator service. The fuel engine system equipment shall include (but not be limited to) the following:
      -fuel injection system
      -fuel line solenoid valve
      -flexible fuel connections
5. Governor:
   a. The engine shall be equipped with a isochronous governor capable of +/- 0.25% steady-state frequency regulation.
6. Starting System:
   a. The engine shall have a 24 V.D.C. starting system with 24 volt positive engagement solenoid shift starting motor and 35-ampere minimum automatic battery charging alternator with solid state regulation.
   b. Batteries - One set of starting batteries with cables and steel battery rack, shall be included, capable of delivering the manufacturer's recommended minimum cold-cranking amps required at 0°F, per SAE Standard J-537.
   c. Float type battery charger shall be supplied to maintain the starting batteries at full charge. The charger shall be a 10-ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/- 10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Alarm circuit board to meet the requirements of NFPA 110 for low battery voltage, high battery voltage, and battery charger malfunction shall be provided.
   d. There shall be a belt driven battery charging alternator with regulator and charge rate ammeter for charging the batteries while the engine is running or the float type battery charger may be arranged to charge the batteries from the normal source when the engine is shut down and from the generator output when the generator is operating. This shall be accomplished by a relay energized from the generator output.
7. Jacket Water Heater:
   a. An engine jacket water heater shall be provided to maintain the engine jacket at a temperature high enough to assure starting the engine and attaining rated voltage and frequency within ten (10) seconds. The jacket water heater shall be of the capacity recommended by the generator set manufacturer to meet the above conditions. Input to the voltage heater shall be 208 volt, single phase.
8. Safety Shutdown:

a. The engine shall be equipped with safety contacts for:
-Low lube oil pressure
-High jacket water temperature
-Overspeed
-Overcrank

9. Engine Instruments:
a. The following engine instruments shall be connected either in an engine instrument panel or in the generator control panel:
-Lube oil pressure
-Water temperature
-D.C. ammeter
Any other instruments considered necessary by the manufacturer shall be included.

10. Exhaust System:
a. A critical grade exhaust silencer suitable for residential type silencing complete with condensate drains shall be supplied of the size recommended by the generator set manufacturer, but in no case less than 4 inches. Silencer shall be as manufactured by Kettell, Maxim or Burgess Manning. An octave band center frequently in Hertz data sheet shall accompany all muffler shop Drawings. A section of seamless, flexible stainless steel exhaust connection of the size and type recommended by the generator set manufacturer, but in no case less than 4-inch diameter and eighteen (18) inches long shall be supplied. If the engine is Vee type, a single exhaust outlet header shall be supplied. The generator stack shall comply with 310 CMR 7.26 (42). Stack height shall be a minimum of 10'-0" above the emergency generator weather housing for generators rated equal to or greater than 300KW but less than 1MW. For emergency generators rated 1MW and above, the stack shall be 1.5 times the height of the height to the top of the generator enclosure. Manufacturer to verify required height to meet 310 CMR 7.26 (42).

11. Mounting:
a. The engine and generator shall be close coupled and mounted on a structural steel base designed to maintain proper alignment of the unit.
b. The unit shall be certified by the manufacturer to be free from any critical torsional vibrations within a range of plus or minus 10% of synchronous speed.
c. Vibration isolators of the type shall be supplied with the unit. The number of isolators shall be as recommended by the generator set manufacturer.

I. Generator:
1. Rating - 700 KW, 875 KVA, 0.8 P.F., 3 phase, 60 cycle, 480/277 volts.
2. Type - Revolving field, 4 pole, single bearing, drip-proof.
3. Exciter - Brushless, direct connected, fully tropicalized, SCR rectifiers, static voltage regulator, rheostat, excellent motor starting capability.
4. Voltage Regulation - Plus or minus 1% of any preset value over the three (3) phase load range. Instantaneous voltage dip or rise, when measured with an oscilloscope, will not exceed 20% upon full load applications or rejection, and will return to preset value within 0.5 seconds.
5. Waveform - Deviation factor of output voltage will not exceed 5% and the value of any individual harmonic will not exceed 2% of the fundamental when operating with an unbalanced load.
6. Temperature Rise - Temperature rise of any component will not exceed the rise permitted by NEMA standards.
7. Rotor - One (1) piece laminations welded and secured to shaft by a key and press fit. Armortisseur windings installed and connected between poles as an aid to

parallel operation and improved waveform during unbalanced loads. Field coils machine would on insulated pole body and securely braced. Rotor statically and dynamically balanced.

8. Stator - One (1) piece laminations welded together. Stator coils random wound and placed in insulation slots. Stator pressed and welded in a rigid steel frame.
9. Bearing - Double sealed ball bearing, lubricated for life.
10. Insulation - NEMA Class F insulation.
11. Varnish - Three (3) coats modified polyester type, will not support fungus growth.
12. Cooling - Cast aluminum fan mounted on generator shaft.
13. Radio Suppression - Radiated or conducted radio interference will not affect normal commercial apparatus.
14. Controls:
    a. Unit Mounted - The engine generator set shall include a combination engine generator control panel shock mounted at the generator end of the unit. This unit mounted panel shall include (but not be limited to) the following:
    -Water temperature gauge
    -Oil pressure gauge
    -D.C. battery charge rate ammeter
    -A.C. voltage regulator
    -Voltage adjusting rheostat
    -Start-stop switch
    -A.C. voltmeter
    -A.C. ammeter with current transformers
    -Combination VM-AM phase selector switch
    -Frequency meter
    -Elapsed time meter
    -Automatic start stop control with:
    overcrank protection (manual reset)
    high water temperature
    overspeed
    overcrank
    selector switch - “off, auto, manual”
    -Common failure relay (wire to fire alarm control panel as trouble alarm)
    - Manual reset line circuit breakers shall be provided with electronic trip and LSI settings, sized as indicated on Drawings, as furnished with generator, 480/277 volts. Mounted in NEMA 1 enclosures with interrupting capacity of 65,000 amps symmetrical. Circuit breakers which are rated at 1200 amps or more shall have Arc Energy Reduction complying with National Electrical Code 240.87. Fully Rated equipment shall be provided; Series Rated equipment is not acceptable. The NEC Article 700 Emergency circuit breaker(s) shall be installed barrier separated from all other generator circuit breakers.
    b. The control shall be designed to start the engine upon a closure of a remote contact, arm all safeties, and shutdown the engine when the remote contact is reopened.
    c. The control must be manually reset following any fault condition.
    d. Control power shall be from the engine start battery.
    e. The engine generator control panel shall monitor the integrity of the automatic transfer switch(es) and fire pump controller (if applicable) “engine start” contact wiring, by independently monitoring both a normally open (NO) contact and a normally closed (NC) contact. The NO contacts shall be wired in parallel with one another and the NC contacts shall be wired in series with one another. Should the controller fail to see a change in state to both of the monitored ATS inputs, the engine shall be started

and an "ATS wiring failure" alarm and indicator shall be activated on both the local and remote annunciators.

J. Annunciator Panel:
1. A remote mounted engine generator annunciator panel shall be built, tested and supplied by the generator supplier. The annunciator panel shall monitor, visually and audibly, the following:
-Alarm Silence
-Generator Test
-Line Power
-Generator Power
-System Ready
-Alarm Switch off
-Generator Switch off
-Overcrank
-Low Battery Voltage
-High Battery Voltage
-Overspeed
-Emergency Stop
-Low Oil Pressure
-High Water Temperature
-Low Fuel
-Low Water Temperature
-Approach Low Oil Pressure
-Approach High Water Temperature
-Main Tank Rupture

K. Automatic Load Transfer Switches:
1. Automatic transfer switches shall be furnished with full load current rating as indicated on Drawings, 480/277 volts, 3 phase, 4 wire, 4 pole, 60 Hertz, A.C. normal and emergency. Minimum AIC rating shall be 65,000. The transfer switches shall be capable of switching all classes of load, and shall be rated for continuous duty when installed in a non-ventilated enclosure that is constructed in accordance with Underwriters' Laboratories, Inc., standard UL-1008. Emergency loads (ATS-2) shall be Step 1, while Optional Standby loads (ATS-1) shall be Step 2.
2. The transfer switches shall be double throw, actuated by a single electrical operator momentarily energized; and connected to the transfer mechanism by a simple overcenter type linkage with a total transfer time not-to-exceed one-half (1/2) second. The transfer switches shall be capable of transferring successfully in either direction with 70% of rated voltage applied to the switch terminals.
3. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in position without the use of hooks, latches, magnets, or springs; and shall be silver-tungsten alloy protected by arcing contacts, with magnetic blowouts on each pole.
4. The transfer switches shall be equipped with a manual operator that is designed to prevent injury to the operating personnel, if the electrical operator should suddenly become energized during manual transfer. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flash-over from switching the main contacts slowly.
5. The transfer switches shall be equipped with an elevator pre-signal contact.
6. Engine starting contacts shall be provided to start the generating plant, if any phase of the normal source drops below 70% of rated voltage, after an adjustable time delay period of three (3) to thirty (30) seconds, to allow for momentary dips.

The transfer switches shall transfer to emergency, as soon as the voltage and frequency have reached 90% of rated voltage. After restoration of normal power on all phase to 90% of rated voltage, an adjustable time delay period of 0-30 minutes shall delay re-transfer to normal power, until it has had time to stabilize. If the emergency power source should fail during the time period, the time delay shall be by-passed, and the switches shall return immediately to the normal source. After the switches have retransferred to normal, the engine generator shall be allowed to operate at no load for an adjustable period of time (0-5 minutes) to allow it to cool before shutdown. The transfer switches shall include a test switch to simulate normal power failure pilot lights on the cabinet door to indicate the switch closed on normal or emergency and four (4) auxiliary contacts on the main shaft; two (2) closed on normal, the other two (2) closed on emergency. Included engine exerciser with 0-168 hours' timer.

7. Load transfer switches shall be as manufactured by Russelectric, ASCO, Westinghouse, or equal.
8. *Provide two hour rated stop/start circuits from the generator control panel to all automatic transfer switches as per Drawings.*
9. *Upon loss of normal power as sensed by the ATS controller and the expiration of the engine start time delay, a normally open and normally close engine starting contact shall change state simultaneously to initiate starting of the generator.*
10. *Upon restoration of normal power as sensed by the ATS controller, the expiration of the return to normal time delay, and a transfer back to normal power, the engine starting contacts shall simultaneously return to their normal state.*

L. Test:

1. The supplier of the equipment shall provide at no additional charge, any information or supervision required for the proper installation of the equipment. Upon completion of the installation of this unit, a test run of four hours shall be conducted by the equipment manufacturer's factory trained serviceman in the presence of the City Electrical Inspector and in full compliance with the latest edition of NFPA-110. Using load banks to test full generator KW, at this time adjustments shall be made for correct operation of the equipment and the following readings taken at 15-minute intervals.
   -Engine jacket water temperature
   -Generator temperature
   -Oil pressure
   -Battery charge rate
   -A.C. volts
   -A.C. amps (all legs)
   -Engine air exhaust temperature
   -Engine oil temperature
2. The unit test shall also be made by utilizing available connected load. The supplier of this equipment shall also furnish and install lube oil in the engine and also drain and refill the engine with new lube oil after the engine-generator test has been completed. If the engine-generator unit should fail this initial test run, as determined by the representative of the Owner, after proper corrective measures have been implemented, replace engine lube oil again after the second test. If any additional tests are required to prove the performance of the engine-generator unit, lube oil shall be replaced after each test run.
3. Prior to shipment of generator to the job site, conduct a 3-hour full load shop test utilizing inductive load to attain full rated load. A written report of this test shall be forwarded to the Engineer for approval prior to shipment. All expense for these tests shall be carried by the Electrical Subcontractor.
4. A power outage test will be conducted by the Electrical Subcontractor, witnessed by the Commissioning Agent, using the Building load when all systems are

completed. Electrical Subcontractor shall demonstrate proper operation of the emergency system to supply power to all emergency equipment during the simulated power outage and return back to normal utility service.

5. The Electrical Subcontractor shall pay for all fuel required for testing and shall leave the fuel tank full of fuel and the radiator full of antifreeze at the completion of testing and acceptance of the emergency generator.

M. Weather Housing

1. Weather housing shall be constructed of a minimum 16 gauge steel material. Fixed louvers shall be installed front and back to prevent blowing snow or rain from entering the housing. Roof shall have a crease down the length to prevent water from standing. Roof shall be braced, if necessary, to support the weight of silencer. Side panels and rear panels shall be lockable and removable for access to junction box. Locks must be heavy duty. Housing shall be free of any manufacturer's stickers and logos.
2. The enclosure shall be fabricated and mounted by the generator set manufacturer so as to insure compatibility of all systems. Seller-installed enclosures and enclosures provided by other than the manufacturer of the generator will not be acceptable. The complete assembly shall be factory finished and painted inside and out in the standard color of the manufacturer to help prevent against weathering and corrosion and to maintain an aesthetically pleasing appearance.
3. The enclosure shall be completed lined with a sound insulation barrier. This barrier must be not less than 1" thick and have a minimum density of 2 lbs. /3 cu. ft. In addition, material must meet UL-94 classification HF-1. This material is intended to absorb airborne noise within the enclosure.
4. The enclosure shall be sized such that all accessories specified herein including but not limited to:
   -Engine/Generator
   -Jacket heaters
   -Batteries
   -Battery charger
   -Base fuel tank
   -Exhaust
   -Line circuit breakers shall be housed within the enclosure.
5. Provide an exterior mounted vandal proof EPO station pre-wired into the generator control panel.

N. Provide a cantilevered catwalk and railing assembly with a single stair that will attach to the base mounted diesel fuel tank that provides access to all enclosure doors and maintenance compartments. The catwalk, railing and stair assembly shall be manufactured of a non-rusting metal material and shall have grating on all walking surfaces. Stairs and railings shall conform to all federal and local building/safety codes. The entire assembly shall be epoxy painted. The assembly shall be shipped loose for installation on site.

O. Provide generator relay output to annunciate generator failure. The Electrical Subcontractor shall provide wiring from the generator relay output to the MDF Room. Provide 30 feet of extra wiring coiled in the MDF Room. The coil will need to be clearly labeled. The Communications Contractor will take the coiled wire, attach it and program it into the system as directed by the Owner.

P. Communications between BMS system and generator shall be via Bacnet.

2.17 FIRE ALARM SYSTEM

A. Furnish and install an addressable fire alarm system as indicated on the Drawings and as herein described. The equipment and installation shall comply with the current applicable

provisions of the following standards:

1. NFPA 70 National Electrical Code
2. NFPA 71 Central Station Signaling Systems-Protected Premises Unit.
3. NFPA 72 National Fire Alarm Code
4. State Building Codes.
5. All requirements of the Local Authority Having Jurisdiction, including RIUFC.
6. Underwriters Laboratories, Inc.
7. NFPA 101 Life Safety Code
8. Americans with Disabilities Act

B. The system and all components shall be listed by Underwriters Laboratories, Inc. for use in Fire Protective Signaling Systems under the following standards as applicable:

1. UL864 Control Units for Fire Protective Signaling Systems.
2. UL268 Smoke Detectors for Fire Protective Signaling Systems.
3. UL 268A Smoke Detectors for Duct Applications.
4. UL 217 Smoke Detectors, Single and Multiple Station.
5. UL 521 Heat Detectors for Fire Protective Signaling Systems.
6. UL 228 Door Closers-Holders for Fire Protective Signaling Systems.
7. UL 464 Audible Signaling Appliances.
8. UL 1638 Visual Signaling Appliances.
9. UL 38 Manually Actuated Signaling Boxes.
10. UL 1481 Power supplies for Fire Protective Signaling Systems.
11. City Fire Alarm Regulations.

C. General Requirements

1. Submittals
   a. Submit complete documentation for the Fire Alarm/Life Safety System showing the Model Number, type, rating, size, style, Manufacturer's Names, and Manufacturer's Catalog Data Sheets for all items to ensure compliance with these Specifications. Submittals shall be prepared by a NICET level III and reviewed signed and dated by a NICET IV.
   b. Upon Contract Bid approval, and prior to start of system installation, submit Shop Drawings to and obtain written approval from the Fire Department, prior to ordering fire alarm equipment. General requirements are as follows:
      1) Submittal of fire rated sealant for penetrations.
      2) A complete point to point riser diagram of the fire alarm system. (Typical riser diagrams are not acceptable).
      3) A complete point to point installation diagram. (Typical installation diagrams are not acceptable).
      4) A complete list of current drain requirements during normal supervisory, trouble, and alarm condition.
      5) Battery standby calculations showing total standby power required to meet the specified system requirements (60 Hours/15 Minutes).
      6) Supplier’s qualifications indicating years in business, service policies, warranty definitions, and list of similar installations.
      7) Electrical Subcontractor qualifications, indicating years in business, prior experience with installations that include the type of equipment that is to be supplied, and installers license number and type of license.
      8) Circuit calculations for all Notification Appliance Circuits. Calculations shall conform to UL864 10th edition and shall be performed using 19vdc starting voltage with a drop allowance to minimum nameplate voltage for the devices on each circuit.

Amplifiers shall be calculated based on the following tap settings".

a) Unless otherwise indicated, set to .5 watt.
b) Gymnasium, Cafeteria/Student Dining, Auditorium, rooms greater than 1,000 square feet and Mechanical rooms shall be set at 2 watts.
c) Corridors shall be set at .5 watt.
d) Classrooms shall be set at 1 watt.
e) Offices shall be set at .25 watt.
f) Provide one back up amplifier for each 50 watts provided to support the system. Provide 25% spare capacity.

c. All substitute equipment proposed as equal to the equipment specified herein, shall meet or exceed the fire alarm equipment standards. For equipment other than that specified, the Electrical Subcontractor shall supply proof that such substitute equipment does in fact equal or exceed the features, functions, performance, and quality of the specified equipment. Submit this information for approval by the engineer at least ten (10) days prior to bid.

2. Equipment Manufacturer's
   a. All references to manufacturer's or supplier's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment (compatible UL Listed) from other manufacturers may be substituted for the specified equipment.
3. General Equipment and Material Requirements
   a. All equipment and components shall be supplied by a factory authorized Autocall affiliate. All equipment and material shall be new and unused and listed by Underwriter's Laboratories for the specific intended purpose. All control panel components and field peripherals shall be designed for continuous duty without degradation of function or performance. All equipment covered by this Specification or noted on Installation Drawings shall be the best equipment suited for the application and shall be provided by a single manufacturer or be recognized and U.L. listed as compatible by both manufacturers.
   b. Furnish and install a fully Microprocessor Based, Fire Alarm System according to the following Specifications and as shown on the Drawings.
   c. The system will permit maximum system expansion and owner flexibility with a minimum of additional field wiring. The system shall be wired, connected, tested, and left in first class operating condition.
   d. The system shall be totally solid state, microprocessor based, to ensure reliable operation, low maintenance costs, and long life.
   e. The equipment and completed installation shall meet the approval of the Fire Department, the Authorities having jurisdiction, and in accordance with applicable Sections of NFPA 72 for Auxiliary Fire Alarm Systems, and National Fire Codes.
   f. All fire alarm control panels shall be predominately red in color and have a white label with the words <u>FIRE ALARM CONTROL PANEL</u> on the front of the panel with a minimum four (4) inch letter size. No other functions shall be allowed in the panel (e.g. security system).
   g. All fire alarm control panels shall provide 30% excess power supply capacity for future expansion.
   h. All equipment shall be listed by Underwriters Laboratories.
   i. Approved Equipment Suppliers
      1) Equipment and materials shall be as manufactured by Autocall or approved equal as manufactured by Edwards or Notifier. Equipment designations and model numbers herein specified are

those of Autocall. It will be the responsibility of the Engineered System Distributor to ensure proper Specification adherence for system operation, final connection, test, turnover, warranty compliance, and after-market service. The distributor of the equipment specified shall be factory trained and certified.

j. All equipment shall be provided by one manufacturer, Autocall, Edwards, or Notifier. Manufacturers listed shall insure compliance with the functional operating requirements specified herein.

D. System Operation

1. The system shall provide means to detect fire conditions within a protected property, transmit the alarm to the Fire Department via a Digital Alarm Communicating Transmitter to a UL listed Central Station, alert Building occupants in which the alarm occurred, supervise the entire system for conditions which would impair proper system operation and to annunciate such abnormal conditions in accordance with applicable codes.
2. Except as alternately required by the Fire Marshal, the operation of any alarm-initiating device shall cause the evacuation alarm to sound and be displayed on all evacuation signaling devices in all areas of the Building.
3. Systems designed to sound/display evacuation signals only in designated areas shall be provided with means to sound/display the evacuation signal on any individual signaling device, group of devices or all connected devices. This means shall be field programmable any operated via selection switches provided at the control panel. There shall be no limit to the quantity of signaling zones and circuit wiring shall not dictate signaling zones.
4. Audible/Visual devices shall be speaker/strobes listed for fire alarm service except as otherwise permitted. Addressable signal modules shall be utilized to accomplish field programmable signaling zones.
5. Visual signaling devices shall be approved for the purpose and shall operate only in those areas where the evacuation signaling is required to be sounded and shall have the word "FIRE" permanently inscribed on their surfaces. Visual signaling zones shall also be field programmable as required.
6. The system shall be electrically/electronically supervised against component failure of the entire audio path including wiring, switches and electrical contacts and shall detect opens, shorts, grounds or loss of signal, which might impair the function of the system.

E. Main Fire Alarm Control Panel:

1. The FACP shall be an Autocall 4100ES, Edwards EST, or Notifier NFS640 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: addressable detectors, addressable notification devices, addressable modules, printer, annunciators, and other system controlled devices.
   a. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".
   b. Network Communications shall be fiber optic interconnection of panels for data, voice and two-way communications via Modular Network Communications Cards
   c. Alphanumeric Display and System Controls: Panel shall include an 854 character, expanded content multi-line QVGA LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
   d. Nodes shall be interconnected via fiber-optic cable in minimum of 2” conduit.
   e. Network node communication shall be through a token ring, hub, or star

topology configuration, or combination thereof

f. A single open, ground or short on the network communication loop shall not degrade network communications. Token shall be passed in opposite direction to maintain communications throughout all network nodes. At the same time the status of the communication link shall be reported

g. If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications

h. The communication method shall be NFPA 72 style 7

2. Network Synchronization of Notification Appliances

a. The fire alarm and emergency communications network shall be capable of providing UL Listed synchronization across all the notification appliance circuits for all panels on a network loop in accordance with the requirements of UL 1971

b. Systems that require all notification appliances to be connected to a single panel for synchronization thus creating a potential single point of failure shall not be acceptable

c. Up to 99 panels on a network loop shall be capable of UL Listed synchronization of all notification appliance circuits across the network loop in accordance with the requirements of UL 1971

d. Should network communications be disrupted, re-synchronization shall occur across all nodes that continue to communicate together after network re-initialization is completed and restored to affected nodes

3. System Capacity and General Operation

a. The control panel shall provide 3,000-point capacity where (1) point equals (1) monitor (input) or (1) control (output).

b. 2000 points of annunciation where one (1) point of annunciation equals 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module, 1 LED on panel or 1 switch on panel.

c. Alphanumeric Display and System Controls: Panel shall include an 854 character, expanded content multi-line QVGA LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

d. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary

1) The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation

2) All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory

3) Panels shall be capable of full system operation during new site-specific configuration download, master exec downloads, and slave exec downloads. Panels shall be fully operational during program modifications

4) Remote panel site-specific software and executive firmware downloads shall be capable of being performed over proprietary fire alarm network communications, and via TCP/IP Ethernet network communications. Ethernet access to any fire alarm panel shall be capable of providing access only to authenticated users through a cryptographically authenticated and secure SSL tunnel

5) Panels shall automatically store all program changes to the panel's non-volatile memory each time a new program is

downloaded. Panels shall be capable of storing the active site-specific configuration program and no less than 9 previous revisions in reserve. A compare utility program shall also be available to authorized users to compare any two of the saved programs. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.

6) Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software and up to 9 previous revisions. Sufficient file storage shall be provided for other related system documentation such as record drawings, record of completion, owner's manuals, testing and maintenance records, etc.

7) The media used to store the record copy of site-specific software and other related system documentation shall be electrically supervised. If the media is removed a trouble shall be reported on the fire alarm control unit.

e. The FACP shall provide the following features:

1) History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

2) Fire Alarm Control Panel (FACP) shall provide the necessary hardware to provide supplemental notification and remote user access to the FACP using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.

3) The means of providing supplemental email and SMS text messaging notification shall be agency listed for specific interfaces and for the purpose described in this section. The use of non-listed external third-party products and interfaces is not acceptable.

4) The fire panel internet interface shall be capable of sending automated notification of discrete system events via email and SMS text messaging to up to 50 individual user accounts and via email to up to 5 distribution lists.

5) Each user account and distribution list shall be capable of being configurable for the specific type of events to be received. Each account shall be configurable to receive notification upon any combination of the following types of events:

a) Fire Alarm
b) Priority 2
c) Supervisory
d) Trouble
e) Custom Action Messages
f) Maintenance Alerts to warn of excessive compensation

f. Required Functions: The following are required system functions and operating features:

1) Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have primary, based upon emergency condition-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

2) Noninterfering: An event on one zone does not prevent the receipt

of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.

3) Transmission to an approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.
4) Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.
5) Selective Alarm: A system alarm shall include: Indication of alarm condition at the FACP and the annunciator(s). Identification of the device /zone that is the source of the alarm at the FACP and the annunciator(s).
6) Operation of audible and visible notification appliances until silenced at FACP.
7) Closing doors normally held open by magnetic door holders.
8) Unlocking designated doors.
9) Shutting down supply and return fans serving zone where alarm is initiated.
10) Closing smoke dampers on system serving zone where alarm is initiated.
11) Initiation of smoke control sequence.
12) Transmission of signal to the supervising station.
13) Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, when specified detectors or sensors are activated, as appropriate.
14) Supervisory Operations: Upon activation of a supervisory device such as a fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
15) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
16) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition. Record the event in the FACP historical log.
17) Transmission of supervisory signal to the supervising station.
18) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
19) Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
20) Priority Two Operations: Upon activation of a priority two condition such as gas detection, chemical leak detection, intrusion alert, weather alert, the system shall operate as follows:
    a) Activate the system priority two audible signal and illuminate the LED at the control unit and the remote annunciator.
    b) Pressing the Priority 2 Acknowledge Key will silence the audible signal while maintaining the Priority 2 LED "on" indicating off-normal condition.

c) Record the event in the FACP historical log.
d) Transmission of priority two signal to the supervising station.
e) Restoring the condition shall cause the Priority 2 LED to clear and restore the system to normal.
f) System Reset: The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED.
g) "Should an alarm condition continue, the system will remain in an alarmed state.A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
h) WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
i) The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
j) Control relay functions associated with one of the 8 testing groups shall be bypassed.
k) The control unit shall indicate a trouble condition.
l) The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
m) The unit shall automatically reset itself after signaling is complete.
n) Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
o) Install Mode: The system shall provide the capability to group all non-commissioned points and devices into a single "Install Mode" trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.
p) It shall be possible to individually remove points from Install Mode as required for phased system commissioning.
q) It shall be possible to retrieve an Install Mode report listing that includes a list of all points assigned to the Install Mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.
r) Module Distribution: The fire alarm control unit shall be capable of allowing remote location of modules; interface of such modules shall be through a Style 7 (Class A)

supervised serial communications channel (SLC): Initiating Device Circuits Notification Appliance Circuits Auxiliary Control Circuits Graphic Annunciator LED/Switch Control Modules

s) In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/Command Center locations.

F. System Functional Operation

1. System Alarm Detection and Reporting.

a. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

1) The System Alarm LED shall flash.
2) A local Piezo-Electric signal in the control panel shall sound.
3) The LCD display shall indicate all information associated with the Fire Alarm condition, including: type of alarm point, its location within the protected premises, and the time and date of that activation.
4) All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (Alarm Indicating Appliances and/or relays) shall be activated.

a) A signal shall be sent to the Fire Department via radio master box and telephone dialer.
Provide a 16 zone radio masterbox and antenna. Installation shall meet all Fire Alarm system requirements for masterbox connections as provided by the Fire Department.
A signal shall be sent to a central station via telephone dialer. Provide (2) Cat 5E cable to Building telephone terminal board.
b) Close all fire doors.
c) Capture the elevator.
d) Shut down all HVAC units equipped with duct smoke detectors.

5) Unacknowledged alarm messages shall have priority over trouble messages, and if such an Alarm occurs during a Trouble sequence, the Alarm condition will have display priority.

2. System Trouble Detection: When a trouble condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

a. The System Trouble LED shall flash.
b. A local Piezo electric signal in the control panel shall sound.
c. The LCD display shall indicate all information associated with the Fire Alarm trouble condition, including: type of trouble point, its location within the protected premises, and the time and date of that activation.
d. If any of the available optional serially connected equipment is being used, then each of the connected peripherals will display/print the information associated with the Fire Alarm Control Panel condition, including the time/date stamping of the change of status event.

e. If applicable, all system output programs assigned via control-by-event equations to be activated by the particular point in trouble shall be executed, and the associated System Outputs (Trouble Indicating Appliances and/or relays) shall be activated.
f. Unacknowledged alarm messages shall have priority over trouble messages, and if such an Alarm occurs during a Trouble sequence, the Alarm condition will have display priority.

3. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
4. The evacuation alarm and alert signals shall be capable of being initiated automatically from the fire alarm control panel (FACP) and transmitted to any programmable speaker circuit, selected speaker circuits or all speaker circuits. Speaker circuits shall be fully programmable from the FACP. It shall be possible to create signaling/paging circuits without the need to rewire. Additional compensation shall not be awarded should the AHJ require additional signaling zones. This shall be accomplished via addressable signal control modules for each speaker/strobe shown on the drawings
5. The alarm signal, alert signal and live voice announcements shall be capable of manual transmission from the FACP to any speaker circuit, selected speaker circuits or all speaker circuits by manual selection of the associated speaker circuit control switches. The system shall not limit the quantity of circuits that may be programmed and shall not be contingent on wiring.
6. Live voice announcements, via the hand-held microphone or patched in warden phone, by use of speaker control switches, shall take priority over all previously activated alarm inputs. In addition to NFPA 72 requirements, the system shall be capable of priority live voice announcements over subsequent alarm conditions. In no case shall subsequent alarms disrupt emergency live voice announcements
7. Alarm speaker amplification equipment shall be sized, as a minimum, to provide the following wattage levels for each location type of alarm speaker:
   a. Unless otherwise indicated, set to .5 watt.
   b. Gymnasium, Cafeteria/Student Dining, Auditorium, rooms greater than 1,000 square feet and Mechanical rooms shall be set at 2 watts.
   c. Corridors shall be set at .5 watt.
   d. Classrooms shall be set at 1 watt.
   e. Offices shall be set at .25 watt.
   f. As a minimum, alarm speaker amplification equipment shall be sized to provide the above indicated wattage of input power to each location type of alarm speaker shown on the Drawings, plus twenty-five percent (25 percent) spare capacity to permit the addition of future alarm speakers.
   g. Alarm speaker amplifiers shall be paired to provide 100 percent redundancy. One back-up alarm speaker amplifier shall be provided for each primary alarm speaker amplifier. If any primary alarm speaker amplifier fails, its function shall be taken over by its dedicated backup amplifier. Provide dedicated power amplifiers for each speaker circuit (4 min.) with one dedicated backup per amplifier (one to one backup).
   h. Alarm tone and alert tone oscillators and pre-amplifiers shall be paired to provide 100 percent redundancy.
   i. As a minimum, each stairwell shall be provided with a dedicated notification appliance circuit.
   j. As a minimum, the system shall be configured as a two channel voice system.
   k. Within the individual assembly occupancies in this project, an alarm received during a program occupancy shall sound an alert alarm at a constantly attended location and perform the following actions.

l. Deliver a field programmable, digitized custom evacuation message to the occupants, detailing evacuation instructions.
m. A simultaneous message shall be delivered via all alarm speakers installed in remainder of the building directing evacuation using exits other than the assembly occupancy exit path.
n. Perform all control functions as detailed elsewhere in this specification.
o. An automatic announcement or tone evacuation signal shall be capable of interruption by the operation of the system microphone to give voice evacuation instructions overriding the pre-programmed sequences.

G. Field Devices
1. Addressable Circuit Interface Modules
a. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
b. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
c. There shall be the following types of modules:
1) Type 1: Monitor Circuit Interface Module:
a) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
b) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
2) Type 2: Line Powered Monitor Circuit Interface Module
a) This type of module is an individually addressable module that has both its power and its communications supplied by the two wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
b) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
3) Type 3: Single Address Multi-Point Interface Modules
a) This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions

(normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.

b) This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.

c) This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.

4) Type 4: Line Powered Control Circuit Interface Module

a) This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.

5) Type 5: 4-20 mA Analog Monitor Circuit Interface Module

a) This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.

6) All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2. Isolator Module: Isolator modules shall be provided every between every 25 devices and between floors to provide short circuit isolation for addressable notification appliance SLC wiring. Isolator shall be listed to UL 864. The Isolator shall mount directly to a minimum 2 1/8" deep, standard 4" square electrical box, without the use of special adapter or trim rings. Power and communications shall be supplied by the Addressable Controller channel SLC; dual port design shall accept communications and power from either port and shall automatically isolate one port from the other when a short circuit occurs. The following functionality shall be included in the Isolator module:
   a. Report faults to the host FACP.
   b. On-board Yellow LED provides module status.
   c. After the wiring fault is repaired, the Isolator modules shall test the lines and automatically restore the connection.

H. Addressable Manual Pull Stations
1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
2. Description: Addressable double- action type, red LEXAN. Station shall

mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Station shall be pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit. Where double-action stations are provided, the mechanism shall require two actions push top activation door to initiate an alarm.

3. Provide with a front showing red LED showing that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the station LED shall be on steady.
4. Provide a factory-fabricated, tamperproof, clear LEXAN enclosure shield and red frame that easily fits over manual pull stations which shall be hinged at the top to permit lifting for access to initiate a local alarm. Unit shall be NRTL listed. Lifting the cover shall actuate an integral battery-powered audible horn intended to discourage false-alarm operation. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

I. Addressable Analog Smoke Sensors
1. General Requirements for System Smoke Detectors:
2. Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
   a. Factory Nameplate: Serial number and type identification.
   b. Operating Voltage: 24 VDC, nominal and shall be two-wire type.
   c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
   d. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. Provide terminals in the fixed base for connection to building wiring. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit. Sensors shall include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors. Integral Addressable Module shall be arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Each sensor base shall contain an integral visual-indicating LED
   e. Each sensor base shall contain a magnetically actuated test switch to provide for easy pre-certification alarm testing at the sensor location.
   f. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
   g. Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit. Provide multiple levels of detection sensitivity for each sensor.

h. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
i. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI. Removal of the sensor head for cleaning shall not require the setting of addresses.
j. Bases: CO Sensor, relay output, sounder and isolator bases shall be supported alternatives to the standard base.

J. Addressable Sensor Bases
1. Standard base - Twist lock addressable base with address selection DIP switch accessible from front with sensor removed. Integral red LED for power-on (pulsing), or alarm or trouble (steady on). Locking anti-tamper design mounts on standard outlet box.
2. Sensor Base with remote device connection - All standard base features with wired connection for either a Remote LED alarm indicator or remote relay (relay is unsupervised and requires separate 24VDC)
3. Supervised Relay Bases - All standard base features and shall be available in either a 4-Wire Sensor Base to use with remote or locally mounted relay; requires separate 24 VDC, or as a 2-Wire Sensor Base to use with remote or locally mounted relay; no separate power required. Supervised relay operation shall be programmable and shall be manually operated from control panel.
4. Sensor base with built-in electronic alarm sounder - All standard base features and piezoelectric sounder shall provide high output (88 dBA) with low current requirements (20 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder shall operation shall be programmable and shall be manually operated from control panel.
5. 520 Hz Sensor base with built-in electronic low frequency sounder - All standard base features and piezoelectric sounder shall provide a low frequency 520 Hz Square Wave (85 dBA) with nominal current requirements (115 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder operation shall be programmable and shall be manually operated from control panel.
6. Emitted tone shall be a 520Hz Square Wave signal in compliance with the requirements of the 2010 edition of NFPA 72 for sleeping areas.
7. The 520Hz Sounder base shall be listed to UL 268 and UL464, Audible Signal Appliances.

K. Addressable Duct Smoke Sensor
1. Standard Addressable Duct Smoke Sensor Unit. Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct housing shall include relay or relay driver as required for fan shutdown.
2. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
3. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable independent of the sensor head for activation by other alarm initiating devices within the fire alarm system. Relay shall be mounted within 3 feet of HVAC control circuit.
4. Duct Housing shall provide a magnetic test area and Red sensor status LED and Duct Housing shall provide a relay control Yellow LED trouble indicator.
5. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
6. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing.

These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.

7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
8. Each duct smoke sensor shall be provided with a Remote Test Station with an alarm LED and test switch.
9. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

L. Addressable Heat Sensors
1. General Requirements for Heat Detectors: Comply with UL 521.
2. Thermal Sensor Combination type: Fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
3. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag. Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation.
4. Mounting: Twist-lock base interchangeable with smoke-sensor heads.
5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
6. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
7. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.
8. Unless otherwise indicated, sensors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for temperature by fire-alarm control unit.
9. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
10. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

M. Addressable CO Sensor
1. Addressable CO Sensor
2. The CO Sensor shall be an addressable carbon monoxide (CO) sensing module providing both CO toxic gas detection and enhanced fire detection, and shall be listed to UL 268, Smoke Detectors for Fire Alarm Signaling Systems and UL 2075, Gas and Vapor Detectors and Sensors; allowing systems to be listed to UL 2034, Single and Multiple Station Carbon Monoxide Alarms.
3. The CO Sensor shall include CO sensor element mounted in the sensor base which can be easily replaced without replacing the complete sensor base assembly.
4. The CO Sensor base shall provide address selection in the base allowing the address to remain with its location when the sensor is removed for service or type change.
5. The CO Sensor base shall include an integral red LED to indicate the power-on, trouble, test mode or alarm status.
6. CO sensor shall provide enhanced fire detection with the addition of two selectable

modes of operation: Nuisance Alarm Reduction Mode and Faster Fire Detection.

7. The CO Sensor shall provide a 10 year life expectancy before replacement is necessary or required.
8. The CO Sensor base shall report the following CO Sensor troubles: Communication loss, Disabled, Almost Expired 12 Months, Almost Expired 6 Months, Expired (End of Life), and Sensor Missing/Failed.

N. Addressable CO Sounder Base

1. The CO Sensing element shall support operation with a Sounder base; the CO Sensor Sounder base shall provide temporal code 3 (TC3) for fire, or temporal code 4 (TC4) for toxic carbon monoxide alarms.
2. The CO Sensor Sounder base shall be listed to UL464, Audible Signal Appliances.
3. CO sensor shall provide enhanced fire detection with the addition of two selectable modes of operation: Nuisance Alarm Reduction Mode and Faster Fire Detection.
4. The CO Sensor Sounder Base shall include CO sensor element mounted in the sounder base which can be easily replaced without replacing the complete sensor base assembly.
5. The CO Sensor Sounder base shall provide address selection in the base allowing the address to remain with its location when the sensor is removed for service or type change.
6. The CO Sensor Sounder Sensor base shall include an integral red LED to indicate the power-on, trouble, test mode or alarm status.
7. The CO Sensor Sounder base shall report the following CO Sensor troubles: Communication loss, Disabled, Almost Expired 12 Months, Almost Expired 6 Months, Expired (End of Life), and Sensor Missing/Failed.
8. The CO Sensor Sounder Base shall be interchangeable with the CO Sensor 520 Hz Sounder Base.

O. Notification Appliances

1. Notification appliances shall be fully addressable to allow for maximum flexibility in the creation of signaling zones. Systems that utilize conventional technology for notification appliances shall furnish and install an addressable module at each device to facilitate the desired operation specified. Systems that require addressable modules to support the desired operation shall insure ADA compliance.
2. Addressable Visible/Only: Addressable strobe shall be listed to UL 1971. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation the mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The V/O appliance shall be provided with multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.
3. Addressable Weatherproof Visible Only: Addressable weatherproof strobe shall be UL 1971 listed for indoor applications with strobe intensity selectable as 15 or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (WP75) or 185 cd (WP185). The appliances shall be acceptable for indoor and outdoor, extended temperature and extended humidity applications. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover and weatherproof mounting box. The V/O appliance shall be provided with multiple minimum flash intensities of 15, 75, WP 75, or WP 185 candela. The Candela levels shall be settable from the fire alarm control unit or by using a

hardware selector on the appliance.

4. Addressable Speaker: Addressable Speaker notification appliances shall be listed to UL 1480. Individual device level supervision and activation control shall be provided by the fire alarm control unit.
   a. Speakers shall be individually powered, addressed, and controlled from a compatible fire alarm control unit Signaling Line Circuit (SLC) using Unshielded Twisted Pair (UTP) cable and T-taps shall be allowed for Class B installation reducing wiring costs and wiring distances. Shielded cable shall not be required.
   b. Speakers shall provide for Fire Alarm and General Signaling functionality in a single unit, eliminating additional devices. Device “Self-Test” shall be supported by a compatible fire alarm control unit and shall be UL listed and NFPA 72 compliant. Speakers shall be UL listed to provide a 520Hz audio tone in compliance with NFPA 72 for sleeping areas.
   c. The speaker audio shall be provided by a standard 25VRMS or 70.7VRMS audio circuit using Unshielded Twisted Pair (UTP) cable. Shielded cable shall not be required.
   d. Speaker power taps shall be at a minimum of 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker shall have a minimum UL rated sound pressure level of 86dBA at 10 feet for the Standard Output version and 84dBA at 10 feet for the High Fidelity version.
   e. Speakers shall be available in either “Standard Output” with a minimum frequency response of 400 to 4000 Hz or in “High Fidelity Output” with a minimum frequency response of 200 to 10,000 Hz. Standard Output speakers shall use a multi-tapped speaker for audio/tone notification.
   f. Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either “FIRE”, “ALERT” or no labeling.
   g. The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.
5. Addressable Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker shall operate on a 25VRMS or 70.7VRMS NAC.
   a. Operational functions and features of Addressable Speaker above shall apply to this section. Operational functions and features of Addressable Strobe above shall apply to this section.
   b. Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either “FIRE”, “ALERT” or no labeling.
   c. The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.
6. Addressable Notification appliance operation shall provide power, supervision and separate control of speakers/horns/strobes and combination devices over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.
7. All Notification Appliances shall operate as a completely independent device allowing for specific location alerting fire alarm functions. Each visible device shall

be capable of operating on multiple notification zones or completely separate from all other notification devices, this allows “On the fly” program operation changes for fire alarm notification.

8. All Notification Appliances shall operate as a completely independent device allowing for appliances in handicap accessible rooms and other locations to operate on the same SLC and to activate individually based on an alarm condition in a room or as part of a general alarm condition where all appliances activate together.
9. Individual Notification Appliances shall be able to be grouped into zones (or operational groups) by central programming at the main fire alarm control unit.
10. Notification Appliances shall provide for “unobtrusive” testing. Each Notification Appliance shall be tested for audible and visible operation on an individual basis at the device or from the main fire alarm control unit, allowing for minimal invasive impact.
11. Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.
12. Each addressable notification appliance shall have electrical test point access without removing the device cover.

P. Exterior Strobe Light
1. Maxi-Signal 490S series. The exterior strobe shall also be of weather-resistant rain tight construction.
2. Provide weatherproof backbox.
3. Weatherproof strobe shall be installed where directed by the Fire Department.
4. Color of device shall be red.

Q. Magnetic Door Holders
1. Furnish and install, where shown on the plans, magnetic door holders, Autocall Model FM series. Magnetic door holders shall operate from 120VAC.
2. The housing and contact plates shall be brushed zinc finish. Units shall have a holding force of approximately 35 pounds.

R. Stopper Covers
1. Provide stopper covers on all manual pull stations. The protective shield shall be tamper proof, clear lexan with red frame installed over the fire alarm pull station. When the protective shield is lifted to gain access to the manual pull station, the protective shield shall sound a loud, piercing warning horn. The horn shall be battery powered and may be silenced by lowering and re-aligning the protective shield. Each stopper cover shall include a battery and the Electrical Subcontractor shall furnish two dozen spare batteries for replacement parts.

S. Remote Annunciator with Microphone and Speaker Select
1. Provide remote alpha numeric, LCD Annunciator(s). Each annunciator will have a backlit LCD display with message scrolling buttons, System Status LED’s for Power, Fire Alarm, Supervisory, System Trouble, Signal Silence, and Point Disabled, and key-enabled common control switches for Acknowledge, System Reset, Signal Silence, Drill, and Lamp Test. The LCD annunciators shall display all alarm and trouble conditions in the system. The annunciators shall connect to an Remote Unit interface.
2. Remote Microphone with Power and Trouble LED’s, two (2) form C contacts with

one activating when microphone is in use.

3. Speaker circuit annunciator control module for manual control of twenty four (24) individual programmable speaker circuits. Each speaker circuit button to have corresponding Alarm and Trouble indicator.
4. Remote annunciator, Speaker control module and Remote microphone to be housed in a single cabinet with glass door and lock.
5. Provide a graphic zone map adjacent to each LCD annunciator. The graphic zone map shall conform to Fire Department requirements.

T. Transmitter/Receiver Beam Smoke Detector with Reflector and Remote Test Station

1. The projected beam type smoke detector shall be a 4-wire 24 VDC device to be used with a UL Listed separately supplied 4-wire control panel. Unit shall be listed to UL 268 and shall consist of an integrated transmitter and receiver. The detector shall operate between a range of 15 ft to 330 ft (5 m to 100 m). The temperature range of the beam shall be -4° F to 131° F (-20° C to +55° C) [UL 268 listed temperature range is 32° F to 100° F (0° C to 38° C)]. The beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on the lenses. The unit shall include a wall mounting bracket. Testing shall be carried out by using a calibrated obscuration test filter. The reflective beam type smoke detector shall be an Autocall 100RU (330 ft/100 m).

U. Fire Alarm/Life Safety System Installation

1. Provide and install the system in accordance with the plans and Specifications, all applicable Codes, and manufacturer's' recommendations. All wiring shall be installed in strict compliance with all the provisions of the Rhode Island Fire Alarm Code and National Electrical Code, Power Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with National Electrical Code. Upon completion, the Electrical Subcontractor shall so certify in writing to the Owner.
2. Removal of a smoke detector will not interfere with the transmission of signal from manual stations, waterflow switches, and other initiating devices.
3. All Equipment shall be attached to a non load-bearing wall, and shall be held firmly in place. Fastening and supports shall be adequate to support the required load, and provide a safety factor of five.
4. As indicated on the Riser/Connection Diagram Drawings, each system alarm point or zone in the system shall be uniquely labeled within the Fire Alarm Control Panel. Names of the system point(s)/zone(s) shall be as defined by the Engineer.
5. Fire Sprinkler Activation detecting System(s) shall each be indicated on a separate zone in the Fire Alarm Control Panel.
6. Fire Alarm Control Panel will be mounted with the center of panel 60 inches above floor level.
7. All junction boxes shall be sprayed red, locked, and labeled "Fire Alarm". Wiring color codes shall be maintained throughout the installation in accordance with Rhode Island Fire Alarm Code.
8. Cable and Wiring.
   a. Conduit and Conductors: Provide complete wiring and conduit between all equipment. Unless otherwise specified within the Installation Manual of the specific equipment being used, all field wiring shall be minimum #14 Type in separate conduit, maximum 40% full, and shall be approved for use as Fire Alarm cable. Conduits of proper size shall be installed from the Control Panel; Equipment to field devices. All field devices shall be mounted upon U.L. Listed Electrical junction boxes. All splices in field wiring shall be made in U.L. Listed Electrical junction boxes. No wire nuts shall be allowed. All Electrical junction boxes shall be labeled as "Fire

Alarm System" with decal or other approved markings. The Fire Alarm/Life Safety Installation shall comply fully with all Local, State and National Codes, and the Local Authority Having Jurisdiction (AHJ).

b. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod. Conduit shall enter into the Fire Alarm Control Panel backbox only at those areas of the backbox, which have factory conduit knockouts.

c. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; an audible and visual trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

d. Fire alarm MC cable shall be allowed above ceilings, in attics and in other areas allowing surface wiring if so approved by the Local Authority Having Jurisdiction.

e. Cable shall be the type listed for Fire Alarm/Life Safety use and shall be installed per National Electrical Code.

f. Cable for Addressable/Intelligent Alarm Initiating Appliances (Manual Stations, Heat Detectors, and Smoke Detectors) shall be connected as shown on the riser diagram. Cable shall be installed from the Fire Alarm Control Panel to all devices in that Signaling Line Circuit (SLC) loop. The connection and continuity of the wires, which make up that SLC loop will be continuously supervised for shorts, opens, and ground circuit conditions.

g. Cable for Alarm Initiating Devices and Appliances (Manual Stations, Heat Detectors, and Smoke Detectors) shall be connected to the Fire Alarm Control Panel, and labeled as shown on the riser diagram. Cable shall be installed from the Fire Alarm Control Panel to all devices in that Initiating Device Circuit (IDC) loop. The connection of the cable to that loop will be continuously supervised for shorts, opens, and ground circuit conditions.

h. Cable for Alarm Indicating Appliances (Audible or Visual or combination signal(s)) shall be connected on a per zone basis. Cable shall be installed from the Fire Alarm Control Panel to all devices in that Indicating Appliance Circuit (IAC) loop. The connection of the cable to that loop will be continuously supervised for shorts, opens, and ground circuit conditions.

i. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per National Electrical Code.

j. All exposed cable below 84 inches from the surface of the finished floor, or other locations where the cable may become exposed and/or damaged, must be within a steel conduit.

k. Conduits must also be provided in elevator shafts and hoist ways. Cables within ducts or plenums must conform with the Specifications of the National Electrical Code.

l. Conduit shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or back boxes, except where conduit entry knockouts have been provided by the factory.

m. Cable shall meet all the manufacturer's requirements including shielding, twists, capacitance, resistance and gauge. The cable shall not be installed without approval of the manufacturer in writing.

V. Final System Acceptance.

1. The system will be accepted only after a Factory-Trained Distributor in the presence of the Electrical Subcontractor, the owner's representative and the Local Fire Marshal have accomplished a satisfactory test of the entire system, in accordance with NFPA 72. Upon completion of a successful test, the Electrical Subcontractor shall so certify in writing to the Owner. The Electrical Subcontractor shall pay all back charges assessed by the Fire Department for all fire alarm system tests.
2. The Electrical Subcontractor shall submit, in the Shop Drawings, a letter confirming that they will provide a U.L. listed testing company to provide the acceptance test.
3. The Electrical Subcontractor will present a complete set of "As- Built" Fire Alarm/Life Safety system Drawings, and the factory supplied Operator's Manual to the Building Owner's Representative and the local AHJ.
4. The Electrical Subcontractor shall provide the on-site services of an Authorized, Factory Trained technical representative to supervise all connections and fully test all devices and components of the system during installation phase.
5. The Electrical Subcontractor shall provide comprehensive Training on the operation, proper use, and testing of the installed Fire Alarm System to the Building Owner's Representative, and the local AHJ

W. Warranty
1. The Electrical Subcontractor shall warrant the completed fire alarm system, wiring and equipment, to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of the first beneficial use.

2.18 FLOOR BOXES

A. Recessed floor boxes shall be by Hubbell, Wiremold, or equal and shall have the following features:
1. Large Capacity Multi Service Floor Boxes
a. Multi-Service Floor Box: Hubbell CFB10G Series with 610GCC series cover and FB10 series internal device bracket(s) and appropriate HBL Series communication brackets to be coordinated with appropriate communications terminations. For on grade applications use CFB10GCR corrosion resistant series boxes.

B. Installation
1. Disconnect power before installation. For installation in accordance with National Electric Code and any applicable local codes and standards.
2. Do not interchange exposed metallic parts with exposed non-metallic parts.
3. Exposed conductors at any wiring junction may cause short circuits, electrical shock or fire. Proper wiring practices must be followed.
4. Provide adequate concrete thickness under the floor box to preserve the fire rating of the floor in accordance with national and/or local codes.
5. Power and communications wiring not separated by a physical barrier is a code violation.

C. Field Quality Control Testing and Inspection
1. Verify layout and installation of system to contract drawing.
2. Verify that all wiring junctions or connections have no exposed conductors prior to energizing circuits.
3. Verify that all bonding locations are code and standard compliant.
4. Verify that a physical barrier separates power and communication wiring.

D. Verify type of communications jacks required with Owner and Telecommunications system

installer.

E. Verify type of audio/visual jacks required with Owner and Audio/Visual consultant's drawings and Audio/Visual system installer.

F. Provide receptacles and technology outlets as indicated in floor box on Electrical and Technology drawings and provide conduit to above accessible ceiling from each individual technology outlet as indicated.

G. Coordinate cover color and finish with Architect in field.

2.19 FUSES

A. General
1. Furnish and install a complete set of fuses for all fusible equipment on the project as specified by the Electrical Drawings. Final tests and inspection shall be made prior to energizing the equipment. This shall include tightening all electrical connections and inspecting all ground conductors. Fuses shall be as manufactured by Mersen, Cooper Bussman, and Littelfuse, or equal.

B. Mains, Feeders and Branch Circuits
1. Fused circuits rated 601 amperes and above shall be protected by current-limiting Class L A4BQ fuses. Fuses shall be time delay and shall hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be UL listed and CSA certified with an interrupting rating of 200,000 RMS symmetrical amperes.
2. Fused circuits rated 600 amperes or less shall be protected by current-limiting Class RK1 time delay A2D (250V) or A6D (600V) or Class J time delay AJT fuses. Fuses rated 8 amperes and above shall have the Smart Spot blown fuse indicator. This indicator shall provide guidance for ascertaining if the opening was caused by an overload or a short circuit. No holes are permitted in the fuse body for the indicator function. Fuses shall hold 500% of rated current for a minimum of 10 seconds (30A, 250V Class RK1 case size shall be a minimum of 8 seconds) and shall be UL listed and CSA certified with an interrupting rating of 200,000 RMS symmetrical amperes.
3. Metal end caps of fuses rated 61 through 600 amperes shall be electrically connected to the fuse blades to facilitate safe voltage testing during OSHA required LOTO (lock out/tag out) procedures.

C. Motors and Motor Controllers
1. Motor Protection
a. All individual motor circuits shall be protected by Class RK1, Class J, or Class L time delay fuses.

2. Motors under 10 H.P.
a. ATDR fuses (Class CC) may be used on motors rated less than 10 H.P. at 480VAC and rated less than 5 H.P. at 240VAC. Fuse holders for Class CC fuses shall incorporate blown fuse indication.
b. Fuse sizes for motor protection shall be chosen from tables published for the appropriate fuse. Heavy load and maximum fuse ratings are also shown for applications where typical ratings are not sufficient for the starting current of the motor.

APPLICATION INFORMATION

LOW VOLTAGE FUSES FOR MOTOR PROTECTION

Three Phase Motor Fuse Selection UL Classes RK5, RK1, J, CC and L

MOTOR HP	FULL LOAD AMPERES	RECOMMENDED FUSE AMPERE RATING MOTOR ACCELERATION TIMES								
		MINIMUM 2 SECS.	TYPICAL 5 SECS.	HEAVY LOAD OVER 5 SECS.	MINIMUM 2 SECS.	TYPICAL 5 SECS.	HEAVY LOAD OVER 5 SECS.	MINIMUM 2 SECS.	TYPICAL 5 SECS.	HEAVY LOAD OVER 5 SECS.
460V		RK5–TRS (Tri-onic®)/RK1–A6D			J–AJT			UL CLASS CC ATDR		
1/2	1.1	1-4/10	1-6/10	2	1-1/2	1-6/10	2	3	3-1/2	4-1/2
3/4	1.6	2	2-1/4	2-8/10	2	2-1/4	2-8/10	3-1/2	5	6-1/4
1	2.1	2-1/2	3-2/10	4	2-1/2	3-2/10	4	5	6-1/4	9
1-1/2	3	3-1/2	4-1/2	5-6/10	3-1/2	4-1/2	5-6/10	6	9	12
2	3.4	4	5	6	4	5	6	8	10	12
3	4.8	5-6/10	7	9	6	8	9	12	15	17-1/2
5	7.6	10	12	15	10	12	15	15	25	30
7-1/2	11	15	17-1/2	20	15	17-1/2	20	25	30	-
10	14	17-1/2	20	25	17-1/2	20	25	30	-	-
15	21	25	30	40	25	30	40	-	-	-
20	27	35	40	50	35	40	50	-	-	-
25	34	40	50	60	40	50	60	-	-	-
30	40	50	60	70	50	60	70	-	-	-
40	52	70	80	100	70	80	100	-	-	-
50	65	80	100	125	80	100	125	-	-	-
60	77	100	125	150	100	125	150	-	-	-
75	96	125	150	175	125	150	175	-	-	-
100	124	175	200	225	175	200	225	-	-	-
125	156	200	225	300	200	225	300	-	-	-
150	180	225	250	350	225	250	350	-	-	-
200	240	300	350	450	300	350	450	-	-	-
250	302	400	450	600	400	450	600	-	-	-
300	361	450	600	-	450	600	-	-	-	-
		CLASS L–A4BT								
300	360	–	601	650						
400	477	–	800	900						
500	590	–	1000	1100						

Minimum - This sizing is recommended if motor acceleration times do not exceed 2 seconds. Minimum sizing with RK1, RK5, and Class J fuses will provide overload relay back up protection but may not coordinate with some NEMA Class 20 overload relays. Minimum sizing is generally not heavy enough for motors with code letter G or higher.

Typical - Suggested for most applications. Will coordinate with NEMA Class 20 overload relays. Suitable for motor acceleration times up to 5 seconds.

Heavy Load - Maximum fuse size in accordance with Table 2. If this fuse size is not sufficient to start the load, RK1, RK5, and J time delay fuse size may be increased to a maximum of 225% of full load amperes. Class CC fuses may be increased to 400% of full load amperes. The Heavy Load column should be used for Design E and high efficiency Design B motor fuse sizing.

3. Motor Controllers
   a. IEC style and NEMA style motor controllers shall be protected from short circuits by time delay fuses. Controllers and fuses shall be coordinated for Type 2 protection of the motor controllers based upon the motor controller manufacturer's published recommendations. The fuses shall be Class RK1 A2D (250V) or A6D (600V) or Class J AJT, Class CC ATDR or Class L A4BQ.
4. AC and DC Variable Speed Drives
   a. AC and DC drives not internally protected by high speed fuses shall be provided branch circuit protection by High Speed Class J (HSJ) fuses. Class J time delay AJT fuses are an acceptable alternative to the HSJ in by-pass applications.
5. Motor Control Centers
   a. To minimize arc flash incident energy, MCC's shall have fusible mains and maximum fuse ratings shall be as follows:

- A4BQ1200 for bolted fault currents greater than 40,000A
- A4BQ800 for bolted fault currents greater than 16,000A
- AJT600 for bolted fault currents greater than 14,000A
- AJT400 for bolted fault currents greater than 5,000A

Unit inserts (buckets) shall be fusible and protected by current-limiting Class J time delay (AJT) or Class RK1 time delay (A2D, A6D) fuses selected for Type 2 protection of the motor controllers based upon the motor controller manufacturer's published recommendations.

D. Other Equipment
1. Lighting and control circuits rated 600VAC and less shall be protected by Class CC time delay ATDR or ATQR fuses, sized according to the Drawings.
2. Switchboards, panelboards, and load centers shall utilize fully rated and listed components. Series rated overcurrent protective devices are not acceptable.

E. Labeling
1. Industrial control panel labels shall include a SCCR (short circuit current rating) and shall specify the overcurrent protection device upon which this rating is based as per the National Electrical Code.
2. Switchboards, panelboards, industrial control panels, and motor control centers shall include a label warning qualified personal of the potential arc flash hazard. The label shall be visible with equipment door closed.

F. Spares
1. Spare fuses amounting to 10% (minimum three) of each type and rating shall be supplied. These shall be turned over to the Owner upon project completion. Fuses shall be contained and cataloged within the appropriate number of spare fuse cabinets (no less than one), located per Drawings. Spare fuse cabinets shall be equipped with a key lock handle, be dedicated for storage of spare fuses and shall be ATFC.

G. Execution
1. To prevent mechanical damage to fuses; main, feeder, and branch circuit fuses are to be removed from equipment during transit and re-installed when equipment is to be energized.
2. As installed Drawings, showing actual fuses installed, shall be submitted to the Engineer after completion of the project.
3. Fuseholders capable of accepting Class H fuses are not acceptable.

H. Substitution
1. Fuse sizes indicated on Drawings are based on fuse performance and selectivity ratios. Alternative submittals to furnish materials other than those specified shall be submitted to the Engineer along with short circuit, selective coordination, and arc flash hazard studies.
2. Performance of any fuses submitted for substitution shall have:
   a. Indication integral with the fuse so that it indicates the voltage transient when the fuse is opened. This is a relative measure of how severe the fault was and gives information to the maintenance people to make them more efficient. No holes are permitted in the fuse body for the installation of indicators.
   b. Only the listed UL categories must be used, in order to reduce the possibility of arc flash injuries. Class RK5 and Class H are prohibited and could cause major liability should an arc flash occur.
   c. All end-caps of fuses must be electrically connected to the fuse blades to

prevent misreading of electrical testers during the required OSHA LOTO (Lock-Out Tag-Out) procedures. Misreading on the LOTO final voltage check could cause hazardous shock.

2.20 LIGHTING FIXTURES

A. Furnish all labor, materials and equipment required for a complete installation of lighting equipment specified on the lighting fixture schedule. This shall include plaster frames for all recessed fixtures whether or not itemized or specified on lighting fixture schedule which appears on Drawings.

B. Electrical Subcontractor shall assume all responsibility for the safe handling of all lighting fixtures which are furnished under this Section and other accessories and lamps until the final inspection has been made by the Architect.

C. Special fittings and materials that may be required to support fixtures shall be supplied as well as supports or grounds required to secure surface or pendant mounted fixtures on suspended ceilings unless otherwise noted. Fixtures shall be supported from the Building structure, and shall be independent of ducts, pipes, ceilings and their supporting members. This support shall be in addition to regular fixture support bars, and saddles. Fixtures mounted in association with suspended or integrated ceiling systems shall be supported above ceiling by threaded 1/4” diameter continuous galvanized steel hanger rods or #12 jack chain. Each such fixture shall have two supports per fixtures. Where duct work, pipes, type of Building construction materials and structural framing members provide obstructions or difficult support means, hanger rods shall be used in association with horizontal sections of steel support channels in an approved manner. Steel support channels shall be Unistrut, Kindorf, Huskey Products, or equal. Rigid steel conduit may be used instead of steel support channels for size and method of support. Exact mounting height of all stem supported lighting fixtures shall be determined on the job by Architect.

D. Fixtures, part or parts thereof (including lamps) determined defective upon completion of electrical installation shall be replaced by Electrical Subcontractor, at no cost to Owner.

E. Consult with General Contractor regarding arrangement of framing members to permit centering of recessed fixtures.

F. Consult with Ceiling Subcontractor and coordinate fixture locations and supports with suspended ceiling system.

G. Electrical Subcontractor shall be responsible for furnishing the specified recessed fixtures with proper mounting arrangement to be compatible with the type of ceiling construction in which fixture is to be mounted. If necessary, the type mounting arrangement shall be changed from that specified or indicated on fixtures schedule to conform to this requirement, at no additional cost to Owner. Submission of Shop Drawings of such recessed fixtures shall be interpreted to indicate that Electrical Subcontractor has verified ceiling construction, type and material with the Architect for the various areas of the project in which these fixtures shall be mounted. Shop Drawings of such fixtures shall be accompanied by a written statement indicating Electrical Subcontractor has verified such mounting arrangements with Architect and the date verified.

H. All suspended lighting fixtures shall be hung in association with improved aligner type hangers, except where noted.

I. In addition to fixture supports, surface mounted lighting fixtures shall be secured to surface which they mount at a minimum of two points on fixture housing to prevent rotation or

movement of fixture out of its normal position of alignment.

J. After installation and lamping of permanent lighting fixtures and with approval of the Architect, these fixtures may be used for lighting, and will not require re-lamping prior to completion of project, except where lamps are faulty or burnt out.

K. Lamping color temperature shall be as indicated on Drawings.

L. Lighting fixtures with multi wattage ballasts and drivers shall be labeled from the factory for the wattage specified to ensure compliance with Energy Code calculations.

M. All lighting fixtures that utilize LED (light emitting diodes) lamp sources shall be Energy Star rated or DLC (Designlights Consortium) qualified product listed, a kelvin temperature as scheduled having a color rendering index of 80 minimum and minimum L70 lifetime rating of 50,000 at 25°C ambient. LED array and driver packages shall have published IESNA LM-79 and LM-80 testing data as a standard manufactured offering. Individual component testing will not be accepted. LM-79 must be conducted at a laboratory listed in the U.S. Department of Energy's LED Lighting Facts approved testing laboratories list. Testing must be conducted within the accreditation effective and expiration dates detailed for a given laboratory. In-house LM-80 reporting of LED array from LED manufacturer will be accepted.

N. Where lighting fixtures other than the specified products are provided, the Electrical Subcontractor shall provide light level calculations in accordance with IESNA standards to justify that substituted fixtures are of equal performance to the specified products (applies to all lighting fixtures in all spaces).

2.21 MINERAL INSULATED METAL SHEATHED CABLE (MI CABLE)

A. Section Includes
1. Type MI mineral-insulated seamless metal sheathed cable.
2. Cable connectors and connections.

B. References
1. ANSI/NFPA 70 - National Electrical Code; UL 2196.

C. Submittals
1. Product Data: Provide for each cable assembly type.
2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

D. Qualifications
1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years documented experience and manufactured in North America.
2. Cable shall not off gas or propagate smoke.

E. Regulatory Requirements
1. Conform to requirements of ANSI/NFPA 70.
2. Furnish products listed and classified by Underwriters Laboratories, Inc. As suitable for purpose specified and shown.

F. Project Conditions
1. Verify that field measurements and conditions are as shown on Drawings.

2. Cable routing shown on Drawings is approximate unless fully dimensioned. Route cable to meet project conditions.
3. Where cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

G. Coordination
1. Coordinate work specified in this Section with work provided under other electrical work and the work of other trades.
2. Determine required separation between cable and other work.
3. Determine cable routing to avoid interference with other work.

H. Manufacturer's – Mineral-Insulated Metal-Sheathed Cable
1. Tyco Thermal Controls/Pyrotenax System 1850 2-hour fire rated, or equal.

I. Mineral-Insulated Metal-Sheathed Cable
1. Description: ANSI/NFPA 70, Type MI
2. Conductor: Copper
3. Insulation Voltage Rating: 600 volts.
4. Cable Temperature Rating: 75 degrees C.
5. Termination Temp. Rating: 90 degrees C.
6. Insulation Material: Magnesium oxide refractory mineral.
7. Metal-sheath Material: Seamless soft drawn copper.
8. Fire Rating: Cable assembly including supports shall have a 2-hour fire rating as listed and classified by Underwriters Laboratories, Inc.
9. Over jacket is available.

J. Wiring Connectors and Terminations
1. Cable Termination:
a. Tyco Thermal Controls/Pyrotenax Model Quick-Term Installation Sheet 638. (Solid M.I. conductor to approved solid rated lug is also available as a slight variation to the Quick-Term Termination.)

K. Examination
1. Verify that cable end factory temporary seals have remained intact, that the insulation has not been exposed to air, and that no moisture has entered cable insulation.
2. Verify that work of other trades likely to damage cable has been completed

L. Storage
1. Cables shall be shipped from the manufacturer with ends temporarily sealed against moisture ingress.
2. When cables are cut in the field, the end shall be sealed using standard sealing compound and PVC tape
3. Cable shall be stored in a clean dry location.

M. Handling
1. Cable shall be uncoiled by rolling or rotating supply reel. Do not pull from coil periphery or center
2. Take precautions necessary to prevent damage to cable from contact with sharp objects, including pulling over foreign material or sheaves.

N. Wiring Methods
1. Fire Rated Locations: Use only fire rated cable.
2. Use wiring methods indicated on Drawings and as specified herein.

O. Installation
1. Install products in accordance with manufacturer's instructions.
2. Bending:
   a. Not less than five (5) times the cable diameter for cable not more than ¾ inch (250 kcmil).
   b. Not less than ten (10) times the cable diameter for cable more than ¾ inches (350 and 500 kcmil).
3. Pulling:
   a. For all cables up to and including #1 AWG use 24 inch (250mm) or larger sheaves.
   b. For #1/0 through 250 kcmil inclusive, use 18 inch (460mm) or larger sheaves.
   c. For 350 kcmil and larger cables, use 24 inch (610mm) or larger sheaves.
   d. On pulls of over 360 degrees, contact manufacturer for assistance.
   e. 350 and 500 kcmil cables shall not be pulled more than 360 degrees in total.
4. Splicing: All fire rated splices shall be made in the factory.
   a. In the event a field splice is necessary, it must be approved by the engineer and made in field by personnel trained by cable manufacturer using manufacturer's components.
5. Terminations:
   a. Field made terminations shall be made with cable manufacturer's termination kits only. Stripping tools, crimping and compression tools available from the manufacturer shall be used for proper cable termination.
   b. Terminations must be completed immediately once started to avoid moisture ingress from surrounding air. Prior to completing each termination, test insulation resistance and follow manufacturer's drying procedures until insulation resistance reaches an acceptable level.
   c. Connections to ferrous cabinets for single conductor cables shall incorporate brass plates ¼ inch (6mm) thick by 4 inch (100mm) wide by proper length with ½ inch (12mm), ¾ inch (19mm), 1 inch (25mm) or 1-1/4 inch (32mm) drilled and tapped holes. Install per manufacturer's' Drawing.
   d. For applications using 90 degree C rating of cable, lugs shall be rated 90 degrees C.
6. Sheath Induction Reduction:
   a. When multi-phase circuits have paralleled single conductors, cables shall be run in groups having one of each phase in each group.
   b. Each set of paralleled conductors shall be separated by at least 2.15 single cable diameters.
   c. On balanced three-phase wye circuits neutral conductors may be located within the 2.15 cable diameter space between groups of phase conductors.
   d. Each group of cables shall be fastened tightly together, at least once between each cable support on horizontal runs and twice on vertical runs, using ½ inch (13mm) wide by 0.030 inch (0.75mm) thick stainless steel straps.

7. Exposed of Surface Installations:
   a. Cable may be secured directly to fire rated Building structure using an approved method such as one, or any combination, of the following:
      1) Straps: ½ inch (13mm) wide x 3-1/2 inch (90mm) long by 0.030 (0.75mm) thick stainless steel or copper straps. Each strap shall contain two ¼ inch (6mm) holes for securing with 3/16 inch (5mm) by minimum 1-3/4 inch (44mm) long steel anchors.

2) Steel struts and cable tray: Use only the steel strut framing system and support recommended by Pyrotenax. Aluminum or other materials are not acceptable.
3) Other approved method.

b. Supports shall not exceed six (6) feet on center horizontally, or six (6) feet vertically.
c. Cables shall be installed parallel to Building lines.

8. Embedded Installations:
a. Cables will be run in the same trifoil configuration as exposed installations.
b. Protect against damage during pulling, and during concrete pouring or backfill and tamping.
c. Where cables emerge from grade, provide PVC conduit, metal plate or angle iron. This protection shall minimally extend from 18 inches (460mm) below grade to 8 ft. (2.5m) above grade.

9. Wall or Floor Penetrations:
a. Provide sleeve to protect cable and penetration opening during pulling.
b. Provide approved fire stopping of all penetrations.

10. Neatly train and lace cable inside boxes, equipment, and panelboards.

P. Field Quality Control
1. Inspect cable for physical damage and proper connection.
2. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
3. Verify continuity of each conductor.
4. Prior to energizing cables, measure insulation resistance of each cable. Tabulate and submit for approval.

2.22 NAMEPLATES

A. Nameplates shall be furnished and installed on the switchboard and switchboard circuit breakers, panelboards, dry-type transformers, junction boxes, cabinets for all special purpose switches, disconnect switches, starters, zero sequence harmonic filters, and other controls furnished under this Contract, to designate the equipment controlled and function.

B. Nameplates shall be laminated white bakelite with 1/4" high black recessed letters. Nameplates shall be securely attached to the equipment with galvanized screws or rivets. Adhesives or cements will not be permitted.

C. Power branch circuit junction boxes shall be identified with circuit's panel(s) origin and circuit number(s) by means of black fibre pen.

D. All pull boxes and junction boxes shall be identified as to system and function by means of black fiber pen.

E. Disconnecting means (disconnect switches and enclosed circuit breakers) nameplates shall indicate purpose and identification of the circuit source that supplies the disconnecting means.

2.23 OUTLET BOXES AND ACCESSORIES

A. Outlet boxes and accessories shall be as manufactured by Steel City, Appleton, Raco, or equal.

B. Lighting outlets in concrete ceilings, walls and columns shall be 4" octagonal rings, 4" deep with round bottom plate. Where concrete slab is less than 5" thick, boxes shall be 2-1/2"

deep.

C. For wood framing and furred ceilings use 4” octagonal outlet boxes, bar hangers and covers. 4-11/16” boxes and covers shall be used where 1” conduit is involved.

D. Where outlets occur in beams or ribs of pan type concrete construction, a 4” shallow pan outlet, 3/4” deep, shall be used with conduit entering the back of the box.

E. All fixture outlet boxes shall have 3/8” solid make fixture studs and all auxiliary fixture stems shall be supported from 3/8” male fixture studs.

F. All outlets in walls other than lighting outlets in concrete shall be Series 52171, 4” square boxes with single of 2- gang raised covers, Series 52C50, of the proper depth required for the particular wall construction and finish. Where the wall construction or finish will not permit a neat cut around the raised cover, Series GW235 boxes shall be used.

G. Outlets in 2” partitions shall be 4” square, 1-1/4” deep, with raised cover.

H. Outlet boxes for weatherproof concealed work and exposed rigid conduit work shall be suitable cast or malleable iron conduit fittings, Crouse-Hinds Company, Appleton, Killark, or equal, and shall have threaded conduit hubs.

I. Outlet boxes recessed in exterior walls will be required to be sealed internally at the openings and seams and sealed to air/vapor barrier.

J. Provide 100% airtight plastic switch and outlet boxes at exterior walls, unit demising walls, and at ceiling lighting fixture locations between units, equal to Thomas and Betts Nutek Airtight F-WSW, 2-FWSW, 3-FWSW, F-WOCT, FWSWBX and F-WRD Series.

2.24 PANELBOARDS

A. At each location indicated on the plans, furnish and install an appropriate panel of the ampacity and voltage rating shown on the Drawings.

B. All panels shall be of the safety dead front circuit breaker type for service on three phase, four wire mains unless otherwise specified. All panels shall be of code gauge steel.

C. Panels shall be surface or flush mounted, as indicated on the plans, and installed so that the top circuit breaker is no more than 6'-0” above the finished floor.

D. The panelboards shall bear the Underwriters' Laboratories Label.

E. All buses shall be copper. All panelboards shall have a circuit directory card mounted in a frame with plastic cover installed on the inside of the door. All directory cards shall be properly filled in, using a typewriter, and indicating areas and devices served by each circuit.

F. All circuit breakers shall be of quick-make and quick-break type on manual operation, trip-free, and with inverse time characteristics and shall have bolted bus connections; plug-in circuit breakers will not be allowed.

G. Panelboard trims shall have single doors. Trims and doors shall be made of code gauge, full finish sheet steel. The trim and doors shall be factory finished on both sides. All panelboards shall be keyed alike.

H. Panelboards shall contain circuit breakers indicated on panelboard schedule on the Drawings. Two and three pole breakers shall be common trip type.

I. All panelboards shall be equipped with a neutral bar having one solderless connector for each circuit as indicated and with all required knockouts.

J. Panelboards requiring 200% neutrals and isolated ground shall be as indicated on the Drawings.

K. Panelboards shall be Square D, Type NQOB for 120/208 volt, Type NEHB for 277/480 volt, and I-Line for main distribution panelboards, Eaton/Cutler-Hammer, Siemens, or equal.

L. Provide panelboards with Nema 4X enclosure in Kitchen, Servery, and other wash down areas.

M. Circuit breakers which are rated at 1200 amps or more shall have Arc Energy Reduction complying with National Electrical Code 240.87.

N. Fully Rated equipment shall be provided; Series Rated equipment is not acceptable.

2.25 POKE-THRUS

A. Poke-thru device shall have been examined and tested by Underwriters Laboratories, Inc. to comply with UL514A and/or UL514C, as applicable and tested to Canadian Standard C22.2 and bear the “UL” mark. The poke-thru shall conform to the standards set in the National Electrical Code, Section 300.21.

B. Poke-thru device shall be for use in 2-hour rated, unprotected reinforced concrete floors and 2-hour rated floors employing unprotected steel floor units and concrete toppings (D900 series designs) or concrete floors with suspended ceilings. Fire resistive designs with suspended ceilings shall have provisions for accessibility in the ceiling below the poke-thru device fittings.

C. Poke-thru device shall have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.

D. Poke-thru device shall be suitable for use in air handling spaces in accordance with Section 300.22C of the National Electrical Code.

E. Floor-mounted service fittings shall be assembled units suitable for carpet and tile floors and include scrub water finish flange.

F. Fire-rated poke-through assemblies with recessed devices shall be with up two (2) 20A duplex receptacles and multiple center compartment ports capable of accepting voice, data and/or A/V outlets, (1) 3/4” power conduit/junction box, (1) 1-1/4” communications conduit stem, and (1) 2” communications conduit stem for voice, data and or A/V wiring in 8” hole; Hubbell System One S1R8 Series, Legrand “Evolution 8AT” Series, or equal.

G. Verify type of communications jacks required with Owner and Telecommunications system installer.

H. Verify type of audio/visual jacks required with Owner and Audio/Visual consultant’s drawings and Audio/Visual system installer.

I. Provide receptacles and technology outlets as indicated in poke thru on Electrical and Technology drawings and provide conduit to above accessible ceiling from each individual technology outlet as indicated.

J. Coordinate cover color and finish with Architect in field.

2.26 PUBLIC SAFETY SIGNAL BOOSTER SYSTEM

A. Provide a signal booster system complete with all components and wiring required for compliance with all applicable Codes and Regulations. The system shall include but not be limited to the following:
   1. One donor antenna to be located on the roof. Run a ½" plenum rated non-radiating coaxial cable from the directional antenna to the Bidirectional Amplifier (BDA). Cable shall be equal to ICA12-50JPLW (1/2" plenum coax).
   2. This Specification is based upon an NFPA Compliant Bird Technologies TX/RX Rescue Line Signal Booster II system. The BDA shall be a Bird Technologies TX/RX Rescue Line Signal Booster II, RFS Cell Wave, or Radio Solutions Inc., or equal. Frequencies shall be coordinated with the Fire and Police departments and the amplifier shall meet all Fire and Police department communications requirements.
   3. Provide a ½" plenum rated radiating cable from the BDA to above the corridor ceilings on each floor. Provide radiating plenum rated cable above ceilings where shown on the Drawings. Radiating cable shall be supported every 5'-0". Provide antennas at a minimum of one every 200' along the radiating cable routing. Provide any additional cabling in strict accordance with manufacturer's Specifications as well as current National Electrical Code to provide complete coverage for the system. A pre and a post signal strength test shall be provided at the job site. Signal strengths shall be noted on a set of plans both pre and post test.

B. Vertical riser backbone cabling and associated splitters, couplers, and taps shall be installed in two hour rated electric rooms and shafts. Splitters, couplers, and taps throughout system shall be accessible for testing, future service, and/or replacement. Provide access panels where required. Where vertical riser backbone cabling exits two hour rated enclosure provide fire stopping around penetrations. Cabling between the BDA and the Alarm Monitoring Panel shall be two hour rated type.

C. Signal Strength
   1. The Fire and Police Department radio test shall check the signal reception in several locations on the floor area. Signal strength shall provide for clear reception throughout the Building utilizing the type of hand held radio unit that is used by the Fire and Police Department. Quantity of test locations shall be determined and conducted by the local department representative. Each floor of the Building shall be divided into a grid of approximately twenty (20) equal areas. A maximum of one (1) area will be allowed to fail the test per floor. A spot located approximately in the center of a grid area will be selected for the test. Once the spot has been selected, prospecting for a better spot within the grid area will not be permitted. Field strength testing instruments are to be recently calibrated (1 year) and of the frequency selective type incorporating a flexible antenna similar to the ones used on the hand held transceivers.

D. Required Signal Levels
   1. Signal strength shall provide for clear reception throughout the Building utilizing hand held radio units of the type(s), which are used by the Fire/Police Department.

Signal strength testing shall follow TSB-88 standards using delivered audio quality measurements (DAQ).

2. A minimum signal strength of –95 dBm (DAQ4) shall be available on over 99% of the floor area required to be covered when transmitted from the fire department.
3. A minimum signal strength of –95 dBm (DAQ4) shall be received at the fire department system from over 99% of the floor area required to be covered.

E. Primary Power
1. The emergency responder radio coverage system shall be powered by a dedicated independent circuit of sufficient size. The circuit shall be clearly marked. The location of the electrical panel shall be clearly marked at location approved by the fire official. The primary power source shall be supplied from a dedicated twenty (20) ampere branch circuit and comply with NFPA 72.

F. Secondary Power
1. The emergency responder radio coverage system shall be equipped with a secondary source of power. The secondary source of power shall be a backup battery system which is serially connected to the BDA system (no UPS units). The secondary power supply shall supply power automatically when the primary power source is lost. The secondary source of power shall be capable of operating the emergency responder radio coverage system for a period of at least 12 hours at 100% system operation capacity. All components of the battery backup system shall be housed completely in a NEMA 4 or 4X cabinet and mount below the BDA. System shall have front panel display and alarms. Monitoring the integrity of power supplies shall be in accordance with NFPA 72. Unit shall be TX/RX 6160 Battery Option.

G. Alarm Monitoring Panel
1. A dedicated monitoring panel shall be provided adjacent to the fire alarm control panel to annunciate the status of the signal booster. The monitoring panel shall provide visual and labeled indication of the following for the booster:
   a. Normal AC power
   b. Signal booster trouble
   c. Loss of normal AC power
   d. Failure of battery charger
   e. Low battery capacity
   f. Antenna malfunction
2. The above mentioned alarm points shall be outputs from the BDA system as dedicated relay points. These shall also be monitored via addressable monitor modules to the fire alarm system.

H. All equipment shall have a current FCC Certification.

I. Equipment integrator shall be a certified service center with factory certified technician(s).

J. Warranty: The BDA shall include a 5 year equipment warranty. Include any necessary costs for equipment to contain this warranty level.

K. Submittals
1. Submit manufacturer’s data on system and components including Shop Drawings, floor plans with layout of all equipment, cabling, riser diagram for project (typical riser diagram is not acceptable), and mounting equipment and details.
2. Provide copies of personnel certifications in submittal.

2.27 PULL BOXES, JUNCTION BOXES AND WIREWAYS

A. Pull boxes shall be of code gauge galvanized steel with screw covers to match. Pull boxes and wireways shall be as shown on Drawings and/or comply with the National Electrical Code and/or job conditions, with steel barriers separating systems.

B. Wireways shall be of code gauge steel, baked enamel manufactured standard sections and fittings, with combination hinged and screw covers, as manufactured by Square D "Square-Duct," Bee Line, Cope or equal.

C. Conductors passing through pull boxes and wireways shall be identified to indicate their origin and termination. Provide nameplates for all pull boxes.

D. Refer to Drawings for Handhole specifications.

2.28 SCOREBOARDS

A. Furnish as hereinafter specified wall mounted Fair-Play electronic scoreboards as indicated on Drawings. Each scoreboard shall include all equipment as hereinafter specified and shall be a Model BB-1620-4 LED Digit with metric clock. Equipment in this Section shall be as manufactured by Fair-Play, Daktronics, Nevco, or equal.

1. Scoreboard Construction

a. BB-1620-4 LED Digit scoreboard

Provide BB-1620-4 scoreboards as indicated on Drawings, 9' 0" x 5' 0" displaying:

1) Automatic second-by-second display of time remaining or time elapsed in minutes and seconds for periods up to 99:59 minutes or less. Metric clock shows tenths of a second and seconds during last minute, also two hour memory in case of power loss.
2) Period number 0 through 9
3) Bonus arrows
4) Team scores 0 through 199
5) Team fouls 0 through 99
6) Uniform number 0 through 99
7) Total fouls for individual player 0 through 9
8) Volleyball and wrestling captions
9) Time Advantage Clock
10) Next possession indicators
11) Gloss white enameled captions: "HOME" and "VISITOR"
12) Operator's master console with running time display, 10 ft. flexible cords to operate all functions and carrying case required
13) Control receptacles with covers
14) Assortment of spare lamps and fuses
15) Complete set of operating and maintenance instructions
16) Scoreboard housing shall be of rigid completely enclosed, all aluminum construction, and are provided with brackets for wall mounting. Service access for exchange of lamps of plug-in components is from the front of the housing and no tools shall be required. Exposed exterior surfaces shall be immersion etched and finished in dark non-reflecting enamels with gloss white captions and trim. Color to be selected by Architect.
17) Receiver for wireless control.

b. Display Modules

LED digit numerals 12 in. high, for time and score and 10 in. high for period. All LED digits have a life expectancy of over 100,000 operating

hours. Each numeral is covered by Lexanâ material protecting them from damage due to stray basketballs and volleyballs. Numerals shall appear amber, red and green on a jet-black background. Bonus arrows and possession arrows are red.

c. Electronic Systems
Electronics to be solid state low voltage encased in completely “plug-in” paks.

d. Battery Operated Control Console with Wireless Transmitter
1) Shall be Model MP-70 with padded carrying case. Requires 120V AC power of battery source and draws 12 watts. Construction shall be an aluminum case 12-3/4” long by 2-1/4” high by 8” deep with 4 rubber slide-resistant feel. Operating features shall include a two-line LCD readout showing information as sent to the scoreboard display as well as constant display of time remaining or time lapsed; a changeable color coded keypad to allow key identification change by sport, numeric key pad, plus and minus keys for quick sequential data entry, a push-type horn button and a positive action rocker switch for the “Time In” and “Time Out” function.
2) Electronic features shall include a program mode allowing change in sport controlled or accommodation of a sport rules change, a memory circuit to retain information if power interrupted and electronic foul memory.
3) Furnished with one battery with charger and one transmitter for battery operated wireless control.
4) Provide one Control Console for each scoreboard.

e. Horn
1) The horn is a special Electronic constant duty scoreboard horn with a decibel level of 100.

f. Power Requirements
1) Model BB-1620-4: 120V.AC, 1 phase, 50/60Hz - 168 watts

g. E.T.L./Electrical Testing Laboratory Approval
1) This scoreboard carries the E.T.L. label signifying this organization’s testing and approval as a safe and dependable design.

B. Furnish and deliver as hereinafter specified Fair-Play electronic LED digit shot timers as indicated on Drawings. The shot timers shall be a Model ST-1410-4 LED digit and include all the equipment as hereinafter specified.

1. Shot Timer System
a. ST-1410-4 Timer System
The timer system operates from the MP-70 Scoreboard Control and consists of the following:
1) Provide a Shot Timer Hand Switch for each Control Console provided.
2) Display modules with vibrating horn and 18" power cord
3) 10 Ft. cords w/plugs on each end.
4) Receiver for wireless control.

b. Shot Timer Construction
The timer display unit shall be constructed of an all metal frame for indoor use and shall be approximately 17" x 20". Approximate wt: 50 lbs.

c. Display Modules
LED digit numerals shall be 12" high. All LED digits have a life expectancy of over 100,000 operating hours. Each numeral is covered by Lexanâ material protecting them from damage due to stray basketballs and

volleyballs. Electrical connection to the timer display is by flat flexible printed Mylar circuitry. Insuring proper socket and connector alignment. Numerals shall appear red on a jet black background. Each display incorporates a vibrator horn and comes with 18" power cord.

2.29 SHORT CIRCUIT COORDINATION SELECTIVE COORDINATION STUDY

A. The Study shall be conducted by the switchgear manufacturer.

B. The Study work shall be conducted under the applicable Standards of the American National Standards Institute (ANSI) and the National Electrical Code (NEC). Specifically, the following standards shall apply:

ANSI-C37.010-1972 Standard Application Guide for AC High Voltage Circuit Breakers.

ANSI-C37.5-1969 Calculation of Fault Currents for Application of Power Circuit Breaker Rated on a Total of Current Basis.

ANSI-C37.13-1963 Low Voltage AC Power Circuit Breakers (600 Volt Insulation Class).

C. The basic scope of the Study is the power system, from the power supplier’s service point, through the main secondary distribution system. The studies organization shall identify in its proposal the limits of the system that will be studied.

D. The Study organization shall prepare a single-line diagram of the power system. This diagram shall identify all components considered in the Study and the ratings of all power devices. (This includes, but is not limited to, transformers, circuit breakers, relays, fuses, busses and cables). Reference numbers shall be used on the diagram related to key items in the report. ANSI device function numbers shall be used on protective relays.

E. Short Circuit Study:
1. A Short Circuit Study shall be performed which shows the momentary and interrupting fault duties on each bus shown on the single line diagram. A computer shall be used to perform calculations on all 3 phase faults. In addition, an impedance listing shall be prepared showing bus-to-bus impedance values reduced to a common MVA base referenced to a single-line diagram for ease in reviewing data.
2. Study each fault interrupting device related to the calculated duty and recommend changes when appropriate.
3. The Study shall start from utility incoming switches and shall extend through to all panelboards.

F. Coordination and Selective Coordination Study
1. The Study organization shall perform a comprehensive protection device coordination and selective coordination Study covering all devices identified on the single line diagram. Using a practical compromise between protection of electrical equipment and coordination of devices “downstream”, provides settings for all adjustable protective devices shown on the diagram. Selective Coordination Study shall be provided as per National Electrical Code Article 700.
2. Study the application of devices versus system ends and recommend new or additional devices that are needed for adequate protection.
3. Prepare time/current coordination curves to illustrate the protection and coordination achieved with the recommended settings of protective devices. These curves shall reflect the following (where applicable):
Appropriate NEC protection points

Appropriate ANSI protection points
Magnetizing in-rush points of transformers
One-line diagram of the system identifying the device plotted
Short circuit current levels used for construction

G. Arc Flash Study
1. The Study organization shall perform an Arc Flash Study as per OSHA. The Electrical Subcontractor shall provide all labeling as per the Arc Flash Study.

H. The Study organization shall submit three (3) bound copies of a report which shall contain the following information:
1. An executive summary which identifies all significant problems and all recommendations for significant equipment changes.
2. A tabulation of all protective devices identified on the one-line diagram which their ratings compares with respective fault duty as calculated in the Study.
3. A tabulation of the settings recommended on all adjustable protective devices with references to the single-line diagram and to coordination curves.
4. Copies of all time/current coordination curves developed in the Study.
5. The analysis of problems that lead to specific recommendations included in the executive summary.
6. The single-line diagram of the system studies, including all ratings, identifications described.
7. Copies of all computer results referenced to the single-line diagram and the impedance listings.
8. A ground fault Study for all breakers specified with ground fault, including the associated zero sequence impedance diagrams.

I. Short circuit and ground fault Study shall be submitted with panelboard Shop Drawings to verify that available fault currents fall within panelboard/ breaker ratings. Coordination Study may follow, but shall be submitted with the switchboard Shop Drawing.

J. Necessary field studies shall be accomplished at no additional expense to the contract.

2.30 STARTERS

A. Motor starters shall be furnished and installed by the Electrical Subcontractor except as noted otherwise in other Sections of this Specification.

B. All motor starters shall be of the maintained contact type and have individual running overload protection in each phase and shall be provided with two sets of auxiliary contacts (one normally open and one normally closed).

C. Starters shall be of size and type required for the particular motor horsepower and voltage.

D. Locate starters adjacent to panel feeding same unless otherwise indicated on the Drawings.

E. Manual starters shall be of the toggle mechanism type for full voltage starting.

F. Magnetic starters shall be across-the-line type, with means for remote control, except maintained contact type starters shall be used only where noted for specific items of equipment.

G. All starters shall have overload reset button, pilot light to indicate on or off and hand-off-auto switch in cover unless otherwise indicated.

H. Starters shall be furnished in the enclosures called for on the Drawings and shall be grouped whenever possible.

I. Motor starters, where grouped, shall be mounted on a new 3/4" thick exterior grade plywood mounting board finished to match starter enclosures.

J. All starters and remote control stations furnished under this Section shall have laminated plastic engraved nameplates designating the equipment controlled. Letters shall be 1/4" high.

K. Motor starters and controls shall be Square D, General Electric, Siemens, or equal.

L. All magnetic starters furnished under this Section which are connected to circuits operating at more than 120V shall have built-in control transformers with 120V secondary control supply.

M. Thermal trips for all motor starters supplied under this Section shall be ambient temperature compensated.

2.31 SURGE PROTECTIVE DEVICES (SPD's)

A. Scope
1. The Electrical Subcontractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the Drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment; switchboard, emergency panelboards, optional standby emergency panelboards, and the computer panelboards.

B. References
1. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

C. Submittals – For Review/Approval
1. The following information shall be submitted to the Engineer:
a. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).
2. Where applicable the following additional information shall be submitted to the engineer:
a. Descriptive bulletins
b. Product sheets

D. Submittals – for Construction
1. The following information shall be submitted for record purposes:
a. Final As-Built Drawings and information for items listed shall incorporate all changes made during the manufacturing process.

E. Qualifications
1. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
2. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
3. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
4. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

F. Manufacturer's
1. Eaton / Cutler-Hammer products, Current Technologies, Liebert, or equal.
2. The listing of specific manufacturer above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturer listed above is not relieved from meeting these Specifications in their entirety.

G. Voltage Surge Suppression - General
1. Electrical Requirements
a. Unit Operating Voltage – Refer to Drawings for operating voltage and unit configuration.
b. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
c. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
d. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

e. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
f. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

MODES	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

2. SPD Design
a. Maintenance Free Design – The SPD shall be maintenance free and shall

not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

b. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

c. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this Specification shall not be accepted.

d. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

e. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

1) Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.

a) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

b) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

c) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

2) Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

3) Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

4) Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event

with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

a) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

f. Overcurrent Protection

1) The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

g. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

h. Safety Requirements

1) The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

H. System Application

1. The SPD applications covered under this Section include the switchboard, emergency panelboard, optional standby emergency panelboard, and the computer panelboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

2. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
CATEGORY	Application	Per Phase	Per Mode
C	Switchboard	250 kA	125 kA
A	Computer Panelboards	120 kA	60 kA
A	Emergency Panelboards and Optional Standby Emergency Panelboards	120 kA	60 kA

3. SPD Type – All SPDs installed on the line side of the service entrance disconnect

shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

I. Switchboard, Emergency Panelboard, Optional Standby Emergency Panelboard, and the Computer Panelboard Requirements:
1. The SPD application covered under this Section includes computer panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
a. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
b. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
c. The panelboard shall be capable of re-energizing upon removal of the SPD.
d. The SPD shall be interfaced to the panelboard via a direct bus bar connection.
e. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
f. The SPD shall be of the same manufacturer as the panelboard.
g. The complete panelboard including the SPD shall be UL67 listed.
2. Switchboard Requirements:
a. The SPD application covered under this Section is for the switchboard location. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
b. The SPD shall be of the same manufacturer as the switchboard.
c. The SPD shall be factory installed inside the switchboard at the assembly point by the original equipment manufacturer.
d. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
e. The SPD shall be integral to switchboard as a factory standardized design.
f. All monitoring and diagnostic features shall be visible from the front of the equipment.

J. Factory Testing
1. Standard factory tests shall be performed on the equipment under this Section. All tests shall be in accordance with the latest version of NEMA and UL standards.

K. Installation
1. The Electrical Subcontractor shall install all equipment per the manufacturer's recommendations and the Drawings.

L. Warranty
1. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable National or Local Code.

2.32 TELEPHONE, DATA, VIDEO OUTLET AND CONDUIT SYSTEM

A. Furnish and install back boxes and conduits as called for on the Drawings.

B. Refer to Drawings for back box requirements and locations.

C. Where back boxes are located in environmental air plenum ceiling areas, the conduits shall be run to the nearest corridor located outside the environmental air plenum area.

D. Actual back box locations and equipment shall be confirmed in the field with Architect and Owner before installation.

E. Provide blank cover plate for each back box location.

2.33 THERMAL SWITCHES

A. Thermal switches shall be NEMA Type 1 toggle switch for normal duty with thermal overload relay. Switch enclosures shall be of a type approved for the location and atmosphere in which it is mounted. Thermal switches shall be installed where called for or where required by Code. Thermal switches shall be provided with pilot where called for on the Drawings.

B. Thermal switches shall be as manufactured by Square D, Eaton, Siemens, or equal.

2.34 TIME CLOCKS

A. Provide time clocks where shown on the Drawings for the control of lighting.

B. Time clocks shall be shall be Tork DLC400BP, Intermatic, Paragon, or equal.
1. Provide a 4 zone lighting controller with photosensor input (Tork model EPC2 photosensor to be supplied with controller).
2. Memory Module shall be capable of being programmed at any one location and inserted into DLC400BP (with memory module socket) in any other remote location.
3. Optional programmer shall be available (Model MMP), capable of accomplishing Windows based settings on a PC for easy duplication of Memory Modules or individualized programs for multiple locations.
4. Each zone shall be capable of independent, user settable turn On and Off light level set points ranging from 1 to 100 footcandles.
5. Three position slide switches shall be provided for each of the 4 zones allowing for user settings based on
   a. time of day or
   b. combination time of day and light level or
   c. light level.
6. Controller shall provide 30 Amp general purpose isolated contacts (unpowered) for each zone as well as a 500 ma, 24VDC output.
7. Controller shall have 1 digital input per channel for:
   a. remote contact closure which can be used to turn corresponding outputs On/Off outside of the normal control time or
   b. remote timed override which can be accomplished for the corresponding outputs with the use of Tork model SSA200R-24.
8. Enclosure shall provide separate wiring compartments for power connections and auxiliary connections.
9. Controller shall be capable of local override On or Off to the next scheduled event using the keypad for each zone.
10. Each zone shall be capable of astronomic function, adjustable from 10-60 degrees Northern or Southern latitude. Each zone can additionally be offset +/- 1-299 minutes for both sunset and sunrise.
11. Controller shall provide automatic daylight saving time (which can be omitted). Leap year adjustment shall be compensated for automatically.
12. Controller shall have 365 day holiday capability with 24 single dates and 4 seasons of unlimited duration.
13. Controller shall be capable of 99 set points with separate scheduling for each day

of the week.

14. Controller shall have back-up capability:
    a. Schedule shall be retained for 40 years without power,
    b. real time shall be retained for 6 months using a field replaceable 9V lithium battery.
15. Unit shall have a NEMA type 3, metal indoor/outdoor enclosure.

2.35 WIRE AND CABLE

A. Wiring shall be a minimum of #12 AWG solid, except motor control circuit wiring and fire alarm system wiring may be #14 AWG. Wiring for 120V branch circuits which exceed a distance of 100' from the panel to the last outlet shall be #10 AWG, 190 ft. from the panel to the last outlet shall be #8 AWG and 280 ft. from the panel to the last outlet shall be #6 AWG minimum, wiring for 277V branch circuits which exceed a distance of 200' from the panel to the last outlet or light fixture shall be #10 AWG, and 300 ft. from the panel to the last outlet or light fixture shall be #8 AWG minimum. The Electrical Subcontractor shall be required to perform voltage drop calculations on all branch circuits in which the actual proposed routing of the circuit exceeds 100 ft. to insure a maximum voltage drop of 3% is not exceeded. Wire sizes shall be increased to maintain the maximum 3% voltage drop.

B. Wires and cables shall be single conductor, except as otherwise specified or indicated on Drawings. Wires of sizes #8 AWG and larger shall be stranded, while wires of sizes smaller than #8 AWG shall be solid. In general, conductors shall be of soft drawn copper and shall have a conductivity of not less than 98% of the ANSI Standard for annealed copper, except as otherwise specified or indicated on Drawings. Aluminum conductors shall only be used where specifically indicated on the Drawings. Pressure type connectors shall be used at all terminals.

C. Wire shall be Type THWN-2, XHHW or approved equal, rated 90 degrees C. minimum and suitable for wet and dry locations.

D. MC cable may be used for branch circuit wiring only, where run concealed, where allowed by Code and approved by the Authority Having Jurisdiction. Type MC cable shall be supported and secured at intervals not exceeding six feet.

E. Wire and cable shall be by one of the following: Phelps Dodge Copper Products Corp., General Cable Co., AFC Cable Systems, Triangle Conduit and Cable Co., or equal.

F. Terminal lugs and splice connectors shall be of an ampacity equal to the circuit on which they are utilized.

G. Emergency feeders that cannot be run in conduit below grade shall be Mineral Insulated Metal – Sheathed Cable (MI Cable), refer to Specification Section.

H. All wiring where run in environmental air plenums shall conform to Article 300-22 of the National Electrical Code.

I. Wiring shall be supported from the Building structure, and shall be independent of ducts, pipes, ceilings and their supporting members.

2.36 WIRING DEVICE PLATES

A. All device plates shall be Specification Grade, .032” thick, Type 430, stainless steel, brushed finish. Plates shall be of appropriate type and size for all wiring and control devices.

B. Plates shall be set so that all edges are in contact with the mounting surface. Plaster fillings will not be allowed. Multi-device locations shall have one common device plate.

C. Device plates shall be by the same manufacturer as devices.

D. All receptacle device plates shall be labeled with circuit origination and circuit number. Letters/numbers shall be 1/4" high in black.

E. Plates for surface type boxes shall not overlap boxes and shall be designed for use with surface boxes.

F. All receptacle device plates for circuits connected to the emergency power distribution system shall be labeled as "Emergency Circuit".

G. Device plates for weatherproof receptacles shall be clear Polycarbonate "In-Use" type, pad lockable.

H. Labels shall be provided via Brother P-Touch, or equal.

2.37 WIRING DEVICES

A. Light Switches
1. All local wall switches shall be of the flush quiet toggle type, as follows, or as manufactured by Pass and Seymour, Inc., Leviton Manufacturing Co., or equal.
2. All switches shall be suitable for the control of tungsten filament lamps, and shall carry the proper marking of the Underwriters' Laboratories.
3. Local switches shall be installed in such a position that they shall bear evenly and truly, and be secured on the axis of the supporting members.
4. Under no circumstances are wooden wedges, shims or blocks to be used in truing up local switches. Should the outlet box in any case come too far back of the finished surface, recess boxes and screws of the proper length to reach the box shall be used of such a size as to form a shoulder at exactly the proper point to retain the switch in position.
5. Switches shall be rated 20 amperes, 120 - 277 volts, equal to the following:
Single Pole Switches - Hubbell HBL1221
Double Pole Switches - Hubbell HBL1222
Three-Way Switches - Hubbell HBL1223
Four-Way Switches - Hubbell HBL1224
Switch with Pilot Light - Hubbell HBL1221PL
Key switches shall be equal to corresponding switches above.
6. Refer to Drawings for Specification of Dimmer Switches.
7. Color of switches shall be white, unless otherwise noted.

B. Receptacles
1. Duplex receptacles shall be grounding type, rated 20 amperes, 125 volts. Receptacles shall be back and side wired with screw type terminals or pressure type, screwless terminals having suitable conductor release arrangement.
2. Special receptacles for single equipment, where required, shall have additional grounding leg and shall be of capacity for the equipment to be connected.
3. In general, convenience receptacle circuits shall be independent of lighting circuits and shall not be controlled by lighting circuit breaker switches or lighting switches, unless specifically indicated on the Drawings.
4. Receptacles shall be as follows, or as manufactured by Pass and Seymour, Inc., Leviton Manufacturing Co., or equal:

a. Tamper resistant normal circuit receptacles duplex receptacles – Hubbell HBL5362TR.
b. Tamper resistant receptacles with isolated ground - Hubbell IG5362TR – Color of receptacles shall be orange.
c. Tamper resistant computer circuit duplex receptacles – Hubbell HBL5362TR – Color of receptacles shall be gray. All receptacles circuited to “C” panelboards shall be gray.
d. Tamper resistant emergency circuit duplex receptacles – Hubbell HBL5362TR – Color of receptacles shall be red.
e. GFCI duplex receptacles installed on the exterior of the Building shall be “Weather Resistant” type.
f. Tamper resistant duplex receptacles controlled by Digital Plug Load Room Controllers – Hubbell BR20C2TR.

5. USB Charger Devices shall be as follows, or as manufactured by Pass and Seymour, Inc., Leviton Manufacturing Co., or equal:
   a. 20 amp, 2 USB chargers and duplex tamper resistant receptacle (5.0 amp) – Hubbell USB20A5W.
   b. 20 amp, 4 USB charger receptacle (5.0 amp) – USB4W.
6. GFCI Receptacles
   a. General Description: Straight blade, non-feed-through-type. Comply with NEMA WD 1, NEMA WD 6, UL 498, Federal Specification W-C-596, and UL943, Class A. Include indicator light that is lighted when device is tripped. Must have self-test feature (conducts an automatic test every three seconds, ensuring ground fault protection. If ground fault protection is compromised, power to the receptacle must be discontinued.
   b. Tamper resistant duplex GFCI receptacles, rated 20 amperes, 125 volts. Receptacles shall be as follows, or as manufactured by Pass and Seymour, Inc., Leviton Manufacturing Co., or equal:
      1) Hubbell – GFTRST20.
7. Color of receptacles shall be white, unless otherwise noted.

2.38 ZERO SEQUENCE HARMONIC FILTERS

A. Quality Assurance
1. Manufacturer shall be ISO 9001 certified.
2. Transformers shall be CSA certified and UL listed.
3. Transformers shall be EPA Energy Star listed.
4. Transformers shall be factory tested to CSA C9.
5. Transformers shall meet all relevant CSA, EPA, IEEE, NEMA, NFPA, and UL standards.

B. Submittals
1. Shop Drawings shall include:
   a. Enclosure dimensions.
   b. Mounting devices.
   c. Terminals.
   d. Taps.
   e. Internal and external component layout.
   f. Amperage (neutral).
   g. kVA rating.
   h. Voltage.
   i. Frequency.
   j. BIL level.
   k. Insulation class.

C. Operations and Maintenance Manuals
1. Operations and Maintenance Manuals shall include:
a. Recommended environmental conditions.
b. Recommended periodic inspections and maintenance.

D. Materials
1. Type 'I_0Filter™', Zero Sequence Harmonic Filter (Dry Type) to CSA C9.

E. Product Description – The design of the zero sequence harmonic filter, described in this Specification, shall be optimized for harmonic rich environments that are characterized by high neutral currents. These filters shall:
1. Provide an ultra-low zero sequence impedance path for all third order, load-generated zero sequence harmonic currents, including I_3, I_9, I_{15}, I_{21}.
2. Reduce neutral current between the point of filter application and the power source.
3. Reduce voltage and current distortion.
4. Reduce voltage and current imbalance.
5. Reduce CMN (neutral-ground voltage) at the point of application.
6. Reduce current crest factor.
7. Reduce average and peak phase.
8. Increase voltage stability during single-phase disturbance.
9. Reduce system losses.
10. Improve system power factor.
11. Harmonic cancellation shall be by electromagnetic means only. No capacitors or electronics shall be used.

F. Device Configuration
1. Type: ANN.
2. Insulation Class: 220^0C.
3. Temperature Rise: 150 Deg. C.
4. System Frequency: 60 Hertz.
5. System Voltage: 208 Volts.
7. BIL: 10,000 Volts (windings 1000V or less).
8. Rating: As indicated on Drawings.

G. Filter Characteristics
1. Key Requirements
a. Zero sequence reactance at 60Hz: <0.3.
b. Zero sequence impedance at 60Hz: <0.9.
c. Neutral connection shall be rated at three times the ampacity of the phase current.
2. Basic Requirements:
a. Built to the following Standards: CSA C9-M1981, CSA22.2 No.47-1977, UL-506, ANSI C75.110, and NEMA ST-20.
b. Three-phase, common core construction.
c. Convection air-cooled.
d. Copper Windings.
e. Type: ANN.
f. Insulation Class: R.
g. Temperature rise: $150^{0.}$
h. Voltage Class: 1.2kV.
i. BIL Rating: 10kV.
j. Magnetic field at 1.5 feet: max. 0.1 Gauss.
k. Full load Efficiency at 170°C: EPA Energy Star requirements.
l. Sound level: per C57.12.91.

m. Enclosure: ventilated, drip-proof NEMA-1.
n. Finish: PQI super white power coat.
o. Anti-vibration pads shall be used between the core and the enclosure.

3. Options:
a. Over-temperature alarm - wired to internal terminal strip:
1) Contact (one per set point): normally closed.
2) Set point: 180°C.
3) Epoxy vacuum impregnation.

H. Vendor Information:
1. Evidence of significant relevant application experience.
2. Quantitative performance data including before/after effect on voltage distortion at load panels that demonstrates the capability to achieve the harmonic mitigation called for in this Specification.
3. Product technical Specification.
4. Pertinent product application information.

I. Certification:
1. Manufacturer shall be ISO 9001 certified.
2. Device shall be CSA certified and UL listed.
3. EPA Energy Star listed.

J. Warranty:
1. Manufacturer shall guarantee that the product will perform as described in Section E of this Specification Section.
2. Manufacturer shall warranty the product against defective materials and workmanship.
3. Minimum terms and conditions: 15 year, with standard limited liability clauses.

K. Acceptable Mfr and Product:
1. Power Quality International, Inc. – I.Filter™, Powersmiths, Square D, or equal.

PART 3 - EXECUTION

3.1 CLEANING, ADJUSTING AND TESTING

A. At the completion of the work, all parts of the installation shall be thoroughly cleaned. All devices, equipment, conduits, and fittings shall be completely cleaned of grease, metal cuttings, dirt which may have accumulated during construction, and protection covers. Any discoloration or damage to parts of the Building, its finish or furnishings due to failing to properly clean the electrical system shall be repaired by the Electrical Subcontractor without cost to the Owner.

B. The Electrical Subcontractor shall test all work and equipment as directed by the Architect and by Authorities Having Jurisdiction, furnish all equipment, necessary personnel and the electrical power.

C. The entire installation shall be tested for shorts, grounds and open circuits and all defects shall be corrected before acceptance of his work. All work shall be demonstrated to be in proper operating condition to the complete satisfaction of the Architect and Owner.

D. Coordinate all start up, operation and testing activities with the Project Manager, General Contractor and the Commissioning Agent per Specification Section 01 91 00.
1. Electrical Subcontractor tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Commissioning Specification, Section 01 91 00, for further details.

2. System verification testing is part of the Commissioning Process. Verification testing shall be performed by the Electrical Subcontractor and witnessed and documented by the Commissioning Agent. Refer to Commissioning Specification, Section 01 91 00, for system verification tests and commissioning requirements.

3.2 CONCRETE WORK

A. The General Contractor shall provide concrete work for site lighting pole bases.

B. The General Contractor shall provide duct and conduit envelopes and pads for electrical equipment. The General Contractor shall provide 4” concrete pads for all floor mounted electrical distribution equipment.

C. The Electrical Subcontractor shall furnish all equipment anchor bolts and shall be responsible for their proper installation and accurate location.

3.3 CONDUIT WORK

A. All wiring shall be installed in heavy wall rigid steel unless otherwise noted below and run concealed except as indicated on the Drawings. Branch circuit wiring in hung ceilings, furred spaces or exposed may be installed in electrical metallic tubing. Panelboard feeders may be run in electrical metallic tubing except panelboard feeders run underground or in concrete slabs shall be in heavy wall rigid steel conduit as specified above or PVC. All exposed conduit in spaces indicated as mechanical rooms and where installed exposed below the 8' level elsewhere on the project shall be rigid steel conduit. Conduit extensions in metal partitions may be made with flexible metal conduit, with grounding conductor.

B. Connections to portable and permanently mounted motorized equipment and motors, as well as the equipment housing, shall be made with approved liquid tight flexible metal conduit. Flexible connections shall be a maximum of 18” long and with grounding conductor. Flexible connections shall be used prior to attachment to equipment housings.

C. Conduit ends shall be cut square, threaded and reamed to remove burrs and sharp edges. Field threads shall be of the same type and have the same effective length as factory cut threads. Excessive exposed threads will not be allowed. Turns, wherever required in exposed conduit runs shall be made by the use of factory-made bends, or field made bends. Condulets, or in the event of a multiplicity of conduits making the same turn, a steel junction box with a removable steel cover may be used. Offsets and bends for changes in elevation of exposed conduit runs shall be made at walls or beams and not in open spaces between walls or beams. Conduits shall be routed so as not to interfere with the operation of maintenance of any equipment. The entire job shall be done in a neat and workmanlike manner. Steel supports or racks shall be galvanized steel channel and fittings, Unistrut, Kindorf, Husky Products Company, or equal.

D. All conduit work shall be carefully cleaned and dried inside before the installation of conductors. Wire shall not be pulled into conduit system until Building is completed. Plug conduit ends to exclude dust, moisture, plaster or mortar while Building is under construction. No lubricants or cleaning agents which might have a deleterious effects on conductor coverings shall be used for Drawing conductors into raceways.

E. Drawings, in relation to routing of conduits, are diagrammatic. The number and size of conduits and wire shall be furnished and installed as indicated by the Drawings. Conduits shall be routed in the field so as to be coordinated with the Building structure. Concealed conduit shall be as short and direct as possible. Exposed conduit shall be run in straight lines parallel to walls, beams and columns and with right angle bends and threaded conduit

fittings. All conduit in concrete slabs shall be run above bottom steel reinforcing, below top reinforcing and column ties. Conduits passing through floors, walls and beams shall be of such size, number and in such locations so as not to impair the strength of the construction. At time of roughing conduits in concrete slab area, prior to pouring of slab, the Electrical Subcontractor shall consult the Structural Engineer for coordination and approval of size, spacing and method of conduit installation in slabs and walls, as well as penetration of such. Particular attention shall be given to the installation of conduits at grouped areas, such as panelboard, cabinet and pull box entrances.

F. All metal conduit buried in the earth or fill shall be coated with two coats of heavy asphalt paint over its entire length, including couplings.

G. Raceways in ceiling spaces shall be routed in such an approved manner as to eliminate or minimize the number of junction boxes required, but also shall be routed in an orderly and organized manner. Support rods and clamps shall be furnished and installed as directed by the Architect. Support of conduits by use of wire is strictly prohibited. Conduits shall be supported and secured by conduit support devices.

H. Where rigid metal conduit is threaded in the field, a standard conduit cutting die providing 3/4” taper per foot shall be employed. Threadless coupling shall not be used on rigid metal conduit except where specifically allowed by the Architect. Running threads shall not be used on rigid metal conduit.

I. Conduit work shall be installed in such a manner to keep exposed threads to an absolute minimum, and in no case shall more than three threads be left exposed after the conduit work is made up tight. This requirement applies to all conduit work, including conduit buried in earth or fill or in concrete.

J. Minimum size conduit shall be 1/2” nominal trade size.

K. A minimum 3/16” diameter twisted nylon plastic type fish cord shall be furnished and installed in all empty raceways. Provide a tag on each end of fish cord indicating the location of the other end.

3.4 ELECTRIC SERVICE

A. Consult with Rhode Island Energy, hereinafter called the Utility Company, with respect to providing service and metering to the Building.

B. Primary Service:
1. The project shall be served from a utility company pole and shall run underground to a pad mounted transformer.
2. Transformer shall be installed on a concrete pad where shown on the Drawings. The exact location for terminating primary and secondary conduit at the transformer shall be coordinated with the Utility Company. All 90° risers into transformer pad shall be rigid galvanized steel conduit.
3. The Utility Company shall furnish and install primary cable.
4. Transformer shall be furnished and installed by the Utility Company. Primary connections at the transformer shall be by the Utility Company.
5. The Electrical Subcontractor shall coordinate all work related to installing the primary services with the Utility Company. The Owner will pay for all backcharges incurred by the Utility Company.
6. The Electrical Subcontractor shall furnish and install an extra Schedule 40 PVC duct from the utility co. pole to the transformer pad as shown on the Drawings.

C. Secondary Service:
1. The Electrical Subcontractor shall furnish and install secondary conduit and cable from the pad mounted transformer to the main disconnecting device. Secondary connections at the transformer shall be by the Electrical Subcontractor. Terminal connectors at the transformers secondary service shall be furnished and installed by the Electrical Subcontractor. Secondary service characteristics shall be 480 volt, three phase, four wire.
2. The Electrical Subcontractor shall coordinate with the Utility Company to ensure the installation of the secondary service shall conform with the Utility Company's requirements.
3. Metering shall be provided at the transformer as indicated on Drawings, by the Utility Company.

D. Division of responsibility with respect to the underground services shall be as follows:
1. The General Contractor shall be responsible for the work and materials required for the following:
a. Excavation.
b. Backfill.
c. Transformer pad.
d. Concrete encasement of conduit.
e. Resurfacing of grades.
2. All other materials, equipment and labor required for the complete ductbank shall be furnished and installed by the Electrical Subcontractor under this Section, including the following:
a. Primary and secondary raceways, including handholes.
b. Grounding system.
c. Pull strings.

3.5 EQUIPMENT CONNECTIONS

A. The Electrical Subcontractor shall provide all connections to all equipment requiring electrical service, including power cables, branch circuit extensions, fire alarm cables, motors, controllers, lighting fixtures and all other equipment and systems specified or shown on the Drawings.

3.6 EXTERNAL CABLE TV SERVICE

A. Furnish and install from utility pole to the Building, as shown on the Drawings, Schedule 40 PVC duct with pull wire for Cable TV service. Consult with the Cable TV Company regarding this service and do all work according to their requirements.

B. The Electrical Subcontractor will be responsible for providing complete Cable TV service to the Building.

C. The Cable TV Company will install the Cable TV cable to the Building. The Owner will pay for all backcharges incurred by the Cable TV Company.

D. Provide pull strings for entire run of conduit for service cabling from Cable TV service origination to point of demarcation. Provide pull string for spare conduit.

3.7 EXTERNAL TELEPHONE SERVICE

A. Furnish and install from utility pole to the Building, as shown on the Drawings, Schedule 40 PVC duct with pull wire for Telephone cable installation. Consult with the Telephone Company regarding this service and do all work according to their requirements.

B. The Electrical Subcontractor will be responsible for providing complete telephone service to the Building. Coordinate number of lines required with the Owner prior to installation.

C. The Telephone Company will install the telephone cable to the Building. The Owner will pay for all backcharges incurred by the telephone company.

D. Provide pull strings for entire run of conduit for service cabling from telephone service origination to point of demarcation. Provide pull string for spare conduit.

3.8 FIRE STOPPING

A. Electrical installations in hollow spaces, vertical shafts and ventilation or air handling ducts shall be so made that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations through fire-resistance rated walls, partitions, floors or ceilings shall be firestopped using approved methods to maintain the fire-resistance rating. Refer to Section 07 84 00 for Firestopping. All fire stopping material and installation will be by the Electrical Subcontractor.

3.9 GROUNDING

A. Grounding methods shall be in accordance with the Rhode Island Electrical Code Article 250 and Local Utility Company Regulations.

B. Furnish and install from the main service switch to the street side of the water meter a stranded copper grounding conductor in rigid steel conduit. If the water service pipe is of material which is not electrically conductive, furnish and install approved copper plates or rods buried and grounded below grade, to which the main service grounding conductor shall be connected.

C. Connections to the water pipe shall be made by a suitable ground fitting or lug connection to a plugged tee.

D. The required equipment grounding conductors and straps shall be sized in compliance with National Electrical Code and shall be provided with green insulation equivalent to the insulation on the associated phase conductors.

E. Flexible metallic conduit equipment connections utilized in conjunction with branch circuits shall be provided with suitable green insulated grounding conductors connected to approved grounding terminals at each end of the flexible conduit.

F. The neutral conductor of all circuits shall have an identifying marking preferable a covering of white, readily distinguishable from the other conductors. This wire shall be unbroken from the distribution switch to the outlet.

G. Each Electrical expansion fitting shall be provided with a bonding jumper.

H. Ground metal frame of Building. Where metal of frame of Building cannot be grounded, provide concrete encased electrode as per National Electrical Code.

3.10 HVAC WIRING

A. Wiring for low voltage temperature control equipment is included under Section 23 00 00.

3.11 INSTALLATION OF OUTLETS

A. If any discrepancy is found to exist between the electrical plans and any other Drawings associated with the project, notify the Architect at once and have location verified before outlets are installed. Any reasonable change in location of outlets and equipment prior to roughing shall not involve additional expense to the Owner.

B. Consult with the Ceiling Subcontractor regarding the centering of outlets in ceiling tile.

C. Whenever outlets of any system are installed in brick, masonry or concrete construction, furnish and install the necessary boxes and conduit in connection therewith so that the General Contractor may build them in as the work progresses. Box offsets shall be made at all outlets to provide for proper adjustment to finished surfaces.

D. Through-wall boxes will not be permitted. Outlet boxes shall not be mounted back to back, but shall be staggered a minimum of 12” on center.

E. Knockouts in any boxes shall not be left open and all boxes not having equipment mounted on them shall be provided with blank covers.

F. Bar hanger type outlets shall be used in hollow framed partitions other than those of the masonry or construction block type, with bar hanger supported from two partition studs. Bar hangers shall be secured to metal type partition studs with self- threading metal screws, or drill through hangers with caddy (or equal) clips shall be used.

3.12 INSTALLATION REQUIREMENTS

A. All equipment mentioned in these Specifications or those on the Drawings shall be furnished new except where noted and completely installed and adjusted and left in a clean, safe and satisfactory condition, ready for operation and all supplies, appliances, and connections of every sort and description necessary to the operation of the equipment shall be furnished and installed to the satisfaction of the Architect and Owner.

B. The Owner will not be responsible for materials and equipment until they have been tested and accepted.

3.13 MOTOR AND CONTROL WIRING

A. The Electrical Subcontractor shall provide all wiring, including conduit, wire, junction boxes, disconnecting switches, and overcurrent protection, to and between all motors, starters, control devices and related electrical equipment whether specified or shown under Section 26 00 00 or other Sections, except where such items are factory wired as well as factory mounted on the driven equipment.

B. Unless otherwise specified, the Electrical Subcontractor shall mount and align all starters, control devices, safety switches, power factor correction capacitors and other related electrical equipment whether specified in this or other Divisions of this Specification, except where such items are factory mounted on the driven equipment. The Electrical Subcontractor shall determine the correct rotation of any equipment connected to a polyphase motor and connect motor for this rotation before equipment is started.

C. Unless otherwise specified, all wiring to motors, control equipment and related electrical equipment shall run in rigid conduit or EMT, with flexible metal conduit connections or liquid- tight flexible connections where specified elsewhere. Conduits shall be large enough to accommodate motor branch circuits and grounding conductors whether or not

so indicated on Drawings. Wire sizes shall be as shown or to comply with the National Electrical Code.

3.14 PROJECT CLOSEOUT

A. A certificate of completion shall be issued by the Electrical Subcontractor indicating that the installation is in conformance with the Construction Documents and all applicable Local, State and Federal Statutes and Codes. Final inspection by the Engineer shall be conducted after receipt of the Certificate of Completion. At minimum, life safety items shall be 100% complete including emergency lighting systems, the fire alarm system, and the emergency standby system before the Electrical Subcontractor request for final inspection. If final inspection by the Engineer proves that the emergency lighting systems, the fire alarm system, and the emergency standby system are not 100% complete, the Engineer will backcharge the Electrical Subcontractor at his hourly rate for re-inspection.

3.15 SLEEVES, INSERTS AND SUPPORTS

A. The Electrical Subcontractor shall lay out and install his work in advance of the pouring of concrete floors and walls.

B. Furnish and install all inserts, conduit hangers, anchors and steel supports necessary for the support and installation of all electrical equipment.

C. Where openings are required in walls and floors for the passing of raceways, ducts or busways, the Electrical Subcontractor shall furnish the General Contractor with the necessary information regarding dimensions and locations so that he may install suitable concrete stops to provide these openings. Such openings shall be by the General Contractor in such a manner so as not to interfere with the fireproof integrity of the Building.

D. The Electrical Subcontractor will be held responsible for the location of and maintaining in proper position, sleeves, inserts and anchor bolts supplied and/or set in place by him. In the event that failure to do so requires cutting and patching of finished work, such work shall be done at the Electrical Subcontractor's expense by the General Contractor.

3.16 SPECIAL COORDINATION INSTRUCTIONS

A. Coordination with the work of other trades is referred to within various parts of this Section. The following special instructions shall also be carefully noted:
   1. The Electrical Subcontractor shall obtain from the HVAC Engineer copies of all Shop Drawing prints showing the ductwork installation as it will be put in place on the project. These Drawings shall be thoroughly checked by the Electrical Subcontractor and the routing of all conduits and installation of all outlets and electrical equipment shall be coordinated with the ductwork so as to prevent any installation conflict. Such coordination shall be done prior to roughing-in conduits, outlets and electrical equipment.
   2. Locations of all wall outlets shall be verified with the Architect prior to roughing in conduits. Refer to details and wall elevations on the Architectural Drawings; mounting heights indicated on these Architectural Drawings and/or specific dimensional information given to the Electrical Subcontractor by the Architect shall take precedence over such information indicated on the Electrical Drawings.
   3. Refer to all other Drawings associated with this project. Any equipment which requires an electrical supply circuit, switch, controls and connections, even though not indicated on the Electrical Drawings, shall be furnished and installed as directed by the Architect. Locations of lighting fixtures shall conform to the architectural reflected ceiling plans.

4. Refer to Architectural Drawings for areas in which the concrete slab is poured on grade. In these areas a moisture proofing membrane will be installed on the grade fill or earth prior to pouring of slab. Electrical conduits shall be so installed, where possible, to avoid the necessity of penetrating this moisture proofing membrane. Such penetration of the membrane shall only be made when specifically allowed by the Architect, and shall be made only at locations directed by the Architect.

3.17 UNDERGROUND DUCTBANK

A. Furnish and install ductbank as herein specified and as shown on the Drawings. The entire length of ductbank must be inspected and approved by the Utility Company prior to being covered.

B. Materials shall be as follows:
1. Conduit-PVC Schedule 40.
2. Conduit supports (duct system) shall be molded plastic with interlocking lugs and skeletonized structure. Minimum separation 3-1/2 inches.

C. Duct System shall be as follows:
1. The size and number of conduit shall be as indicated on the Drawings.
2. The entire length of ductbank shall be excavated and graded before any conduit is laid.
3. The ductbank shall be set on undisturbed earth.
4. The conduit shall be installed so that the top is a minimum of 36 inches below finished grade.
5. Changes in direction shall be made by long sweep bends. Minimum radius 25 feet except that at the end of a run within 10 feet of termination, manufactured bends may be used having a minimum radius of 36”.
6. Conduit base and intermediate spacers shall be installed a maximum of 5 feet on centers. Spacers shall not be placed one above the other but shall be staggered a minimum of 6”.
7. All conduit joints shall be made watertight by means of a sealing compound before the coupling is installed. Joints in conduit shall be staggered. Minimum space between joints in adjacent conduit shall be 6”.
8. When the required number of conduits have been installed, securely tie the assembly together at distances not exceeding 7 feet. Tie shall consist of three turns of No. 18 iron wire. Separate ties required for low tension and high tension conduit runs.
9. Where conduit is encased, the duct envelope shall be of monolithic construction.
   a. Pouring of concrete shall be continuous throughout the length of construction. The end of the pour shall be interlocked or sloped. If the installation is halted, the ends of the conduit shall be plugged.
   b. Concrete shall not be poured until the conduit installation has been inspected and approved.
10. After the installation is completed, each conduit shall be cleaned and identified. A standard flexible mandrel and stiff bristle brush shall be pulled through each conduit. The mandrel shall be not less than 12” long and the diameter approximately 1/4” less than the conduit.
11. Install approximately 12” below the top of the trench above each conduit or direct buried cable a 6-inch wide plastic warning tape. Tape shall be yellow in color with black letters reading “Buried Electric Lines.”
12. Electric handholes shall be precast and shall be installed where indicated. The exact location of each handhole shall be determined after careful consideration has been given to the location of other utilities, grading and paving. The location of each handhole shall be approved by the Architect before installation.

Handholes shall be monolithically constructed precast-concrete having the required strength as established by ASTM A 79 Grade 60 and inside dimensions by the Drawings or Specifications. Frames and covers shall be delivered on the job unpainted and, after approval, shall be given two (2) coats of asphalt paint. In unpaved areas, the top of handhole covers shall be approximately 1-2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, provide a brick collar to elevate temporarily the handhole cover to existing grade level. Where duct lines enter handholes, the sections of duct may be either cast in the concrete or may enter the handhole through a square or rectangular opening of suitable dimensions provided in the handhole walls. Where openings are provided for the entrance of duct lines, the space between ducts and between ducts and handhole walls shall be caulked tight with lead wool installed over the handhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance. All handholes shall be provided with double-lockable type covers.

3.18 WIRE AND CABLE

A. Wiring for all branch circuits and feeder circuits shall be color coded as follows:

1. 3-phase, 4-wire, 208Y/120 volts:

Phase	Color
A	Black
B	Red
C	Blue
Neutral	White
Equip. Ground	Green

2. 3-phase, 4 wire, 480Y/277 volts:

Phase	Color
A	Brown
B	Orange
C	Yellow
Neutral	Gray
Equip. Ground	Green

3. Connections to terminal shall be arranged Phase A, B, C from left to right.
4. Signal system shall be color coded differently from electrical systems described above.
5. For large size conductors available only in black, use colored plastic tape at all ends and where connections and splices are made for the specified color code identification. Tape shall be wrapped around the conductor three complete turns.

B. In each case, the phase wires shall be connected to the phase supply mains in proper rotation to assure a balanced condition on the panel. The circuit numbers assigned on the Drawings are used for convenience only and need not designate the circuit on the panel to which that circuit may be connected. However, the circuit numbers and circuit description are required to be typewritten on the panelboard directory at the conclusion of the work, and shall represent the circuits as actually connected to the panelboard.

C. Joints and splices shall be made in an approved manner and shall be equivalent, electrically and mechanically, to the conductor insulation. Solid conductors shall be spliced with approved wiring connectors. Conductors of Size No. 8 AWG and larger shall be connected by use of solderless pressure connectors; these joints and splices shall be taped with one wrap of varnish cambric tape and then a minimum of three wraps of No. 88 Scotchbranch (3M Company) all-weather vinyl plastic electrical tape, or equal Permacel or Plymouth Company. Each wrap of tape shall be half-lapped. Conductors of Size No. 4 AWG or larger shall have two coats of insulating varnish applied over the tape.

D. Switch leg wiring shall be the same color as the phase conductor from which it is supplied.

3.19 ALTERNATES

A. Refer to Alternates, Section 01 23 00, for alternates affecting the scope of work under this Section.

B. The work of this Section, which is required by the scope of work as stated in the Alternates, Section 01 23 00, shall comply with the applicable quality and performance requirements for similar work under this Section.

C. The alternates which effect the Electrical Sections are Add Alternates #1, 3, 5, 6, and 7. Refer to Drawings.

3.20 EXISTING WORK AND DEMOLITION

A. The Electrical Subcontractor shall survey the existing electrical system and notify the Owner of any possible problems or issues pertaining to disconnection or removal of any existing electrical equipment, etc. Particular care shall be taken to avoid creating hazard or causing unnecessary disruption of services in adjoining areas.

B. All electrical equipment, devices, lighting fixtures, etc., shall be disconnected and removed in any area scheduled for renovation by the Architect. All wiring associated with removed or disconnected equipment shall be removed back to next active outlet of panelboard. Raceways shall be capped at nearest coupling immediately outside of area to be renovated.

C. The Electrical Subcontractor shall reroute and reconnect all existing circuiting which originates or passes through the renovated areas but serves other areas not being renovated. These circuits shall be extended as required to the existing panelboards.

D. All equipment removed shall be turned over to the Owner unless indicated to be re-used or scrapped. All existing electrical equipment as designated by the Owner shall be stored at a location as directed by the Owner. All other equipment not to be retained by the Owner shall be removed from the premises in a legal and proper manner by the Electrical Subcontractor.

E. Provide blank coverplates for all obsolete boxes that are to remain.

F. Refer to Section 02 41 19 for Selective Demolition requirements.

END OF SECTION

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section presents specific commissioning requirements for the Central Falls High School project to be met in addition to other commissioning requirements, including but not limited to Section 01 91 13 “General Commissioning Requirements.”

1.2 RELATED COMMISSIONING SECTIONS

A. Section 01 91 13 General Commissioning Requirements

B. Section 22 08 00 Commissioning of Plumbing

C. Section 23 08 00 Commissioning of HVAC

1.3 ABBREVIATIONS

A. See Section 01 91 13 for abbreviations and definitions.

1.4 CONTRACTOR REQUIREMENTS

A. Meet all the requirements of Section 01 91 13 “General Commissioning Requirements.”

B. Provide factory start-up and required technical personnel for participation in Owner’s Commissioning.

C. Construction and Acceptance Phase

1. Provide submittal data, commissioning documentation, O&M data and training related to Commissioning, including information from equipment suppliers.
2. Attend meetings necessary to facilitate the Commissioning process (refer to Section 01 91 13 and PART 3 of this specification for more information on meetings).
3. Review the commissioning Issues Log for items related to contracted work and assist the commissioning team in addressing and resolving these issues.
4. Complete commissioning checklists provided by Stephen Turner Inc. and return completed checklists to the General Contractor. Startup checklists may require specific input from the Equipment Supplier such as a copy of the Manufacturer’s Startup Checklist.
5. Address any available Owner and Design Professional punch list items before final commissioning testing. Discrepancies and problems shall be remedied before commissioning testing of the respective systems.
6. Execute commissioning tests, which will be developed and led by Stephen Turner Inc. Testing will start at the components level, will proceed to the system level, and will end with inter-system testing.
7. Correct issues (differences between required and observed performance) as interpreted by Stephen Turner Inc., the Owner, and the Design Professional and retest the equipment.
8. Provide training of the Owner’s operating staff, as required in PART 3 of this specification and elsewhere in the Contract Documents.

9. Assist and cooperate with Stephen Turner Inc. Provide skilled technicians familiar with this building to assist with commissioning testing.

D. Warranty Period

1. Execute seasonal or deferred commissioning testing, as applicable, witnessed by Stephen Turner Inc. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.5 INCLUDED SYSTEMS

A. For the following systems and components, Stephen Turner Inc. will develop pre-functional checklists (PFCs) that are completed by the Trade Contractors (TC) and Functional Performance Tests (FPTs) that are executed by the Trades with Stephen Turner Inc., as indicated.

Building Systems to be Commissioned	Pre-Functional Checklists	Functional Performance Testing
Electrical Systems		
Lighting and Lighting Controls	Yes	Sampling
Generator	Yes	100%
Connections to Equipment Listed in Section 019113	Yes	Support

B. The work provided under this Division that is listed above is included in the scope of the Commissioning activities to meet the Owner's goals.

C. In addition to component and systems level commissioning of the work listed, participation in inter-system testing and integrated commissioning of interrelated work is required. For list of all commissioned work see Section 01 91 13 "General Commissioning Requirements."

PART 2 – PRODUCTS

2.1 SEE COMMISSIONING SECTION 01 91 13

PART 3 - EXECUTION

3.1 COMMISSIONING TEAM PARTICIPATION

A. Each trade including all Sub-contractors, Tier Contractors, manufacturers' start-up personnel, as well as direct Equipment Suppliers shall designate personnel to be responsible for coordinating commissioning activities with the Commissioning Authority as required in Section 01 91 13 "General Commissioning Requirements."

3.2 CONTRACTOR RESPONSIBILITIES

A. Execution requirements for the following are in Section 01 91 13 "General Commissioning Requirements" with additional specific requirements for this Division stated below.

3.3 COMMISSIONING MEETINGS

A. Additional requirements for this Division:

1. Attendance of regularly scheduled commissioning meetings is required by at least one (1) representative from the Contractor(s) for the systems being commissioned during delivery, installation, and start-up, and when checklists and tests are being performed.
2. As specific issues arise, a representative from each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor will be required to attend the meeting to assist in resolutions.

3.4 SUBMITTALS

A. Additional requirements for this Division:

1. Electrical coordination drawing submittals shall include complete electrical metering plans and interface to the non-electrical meters that are integrated with the system.

3.5 PRE-FUNCTIONAL CHECKLISTS

A. No additional requirements for this Division.

3.6 O&M MANUALS

A. No additional requirements for this Division.

3.7 EQUIPMENT START-UP

A. Additional requirements for this Division:

1. For all commissioned systems and equipment, one copy of the equipment manufacturer's or Contractor's start-up report shall be provided to Stephen Turner Inc. for review and to document that the equipment is installed, operational, and ready for commissioning testing.
2. For all third party testing required elsewhere in this specification or by code, provide test reports to Stephen Turner Inc. for review and to document that the testing has been performed. Coordinate dates for third party testing in advance with Stephen Turner Inc. to allow commissioning personnel to witness selected tests.

3.8 COMMISSIONING TESTING

A. Additional requirements for this Division:

1. Each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor shall assist the installing contractor in commissioning testing.
2. Initial Testing
   a. Stephen Turner Inc. will witness the Initial tests. The contractor will be responsible, as required, to put the system in various modes of operation, to fix minor problems found during the test (i.e. problems that can be fixed without delaying the completion of the test), and to perform the testing.
   b. Stephen Turner Inc. will provide all commissioning team members (General Contractor, contractors, Design Professional, Owner, etc.) the commissioning test procedures prior to scheduled testing. If no comments are received from a

particular commissioning team member, that shall constitute acceptance of the commissioning test procedures as is.

c. Stephen Turner Inc. shall schedule the commissioning testing once all commissioning checklists have been completed by the contractor and accepted by Stephen Turner Inc.

3. System Level Testing

a. Commissioning testing will be conducted after initial testing but prior to occupancy of the building. This testing will provide both the owner and Contractor with documentation that the system operated correctly according to the Owner's Project Requirements. These tests are typically performed at the room level, where a sample of rooms is selected for review.

b. Stephen Turner Inc. will lead this portion of commissioning testing. The contractor will be responsible, as required, to put the system in various modes of operation, to fix minor problems found during the test (i.e. problems that can be fixed without delaying the completion of the test), and to witness the testing. Where Stephen Turner Inc. develops a procedure for the test the contractor shall implement the test to the satisfaction of Stephen Turner Inc.

c. Contractors shall attend and operate equipment during commissioning testing as required by the specific test being performed.

4. Inter-System Testing

a. Additional inter-system testing is required under the Owner's Commissioning process to ensure that work in this Division is properly interoperable with other work. Contractors shall participate in system level and inter-system testing. Testing will include operation under both normal power and emergency power where applicable; change-over and transition between different operating modes; and complete exercising of systems through all modes and sequences.

1) HVAC and hot water systems

2) BAS system

3) Metering system

4) Plumbing systems including but not limited to Domestic Hot Water and pumps

5) Lighting controls, indoor and outdoor

6) Power systems

7) Emergency power systems, including recovery from utility power loss

3.9 SITE OBSERVATIONS AND VERIFICATION

A. No additional requirements for this Division.

3.10 DOCUMENTATION OF COMMISSIONING ISSUES

A. Additional requirements for this Division:

1. Each direct equipment supplier, and each supplier of other equipment not adequately represented by technical personnel from the responsible Contractor shall assist the installing contractor in resolving commissioning issues.

3.11 TRAINING

A. No additional requirements for this Division.

3.12 AS-BUILT DRAWINGS

A. No additional requirements for this Division.

END OF SECTION 26 08 00

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Section 27 10 00

STRUCTURED CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of a Contract, including conditions of the Contract and Division 1 of the Specifications, shall apply to the Work in this Section.

B. Drawings and general provisions of the Contract, including all portions of the Project Manual are hereby made a part of this Section. Refer to paragraph titled “Quality Assurance” in this section and to Division 1 for requirements for Communications Integrators. Throughout this and related Sections, “Integrator” shall not be limited to the singular and masculine and shall refer to one, or more than one, Communications Integrator. The Terms “Communications Integrator” and “Communications System Integrator “shall be used interchangeably and shall be understood to represent the communications integrator responsible for the furnishing, configuring, testing, programming, warranting and ensuring all work is performed in accordance with manufacturer’s requirements and recommendations for the work identified in this SECTION.

C. Any qualifications or certificates required in this specification may be requested by the Architect as part of the post-bid qualifications review. Such review shall commence subsequent to the bid submission, as none of this information is required as part of the bid submission. In the event that the Architect requests qualification or certification documentation such documentation shall be provided within 3 business days.

1.2 SUMMARY

A. Work Included. The scope of work of this Section consists of the installation of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances and services necessary and/or incidental to properly complete all cabling work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Owner, as being required and in general, is as follows:

1. Fiber Backbone, Outdoor Fiber Vault, Outdoor fiber splice, and Fiber distribution cable for audio, horizontal Category 6A, Category 6 and multipair Category 5e wiring, connecting devices, terminations, faceplates, patch panels, equipment racks with vertical cabling management and all related equipment, to complete installation, and testing of the systems to be used as signal pathways for voice, high-speed data, wireless access point cabling and video surveillance transmission. See T2.60 and T2.70 for fiber and other cabling required in building and on site in this section.
2. Fiber patch cords for every cabled port in the IDF closets and MDF.
3. Provide and install the following faceplates and jacks: WAP2, WAP4, OWAP, PH (WALL PHONE), Data face plates (D1, D2, D3, D4, T1, T2), F (data for fax machines to local IDF), C### (see below), A1 (A1 must have a blank port), A2 (must have blank port), A3 (to include PA console cable, and must have blank port) and A4 (to include PA console cable and VES data cables, and must have blank port), A5, A6, NP (similar to PH wall phone, same mounting requirements), N1, N2, N4, (N designated data is cabled to the

wall rack in Reception 112A) and E (steel blank faceplate installed over empty back box). Furnish and install blank port inserts for blank ports in all faceplates.

a. Camera locations and VES locations on the drawings reflect actual camera and device locations (Camera locations denoted by a camera symbol with a C followed by 4-5 numbers such as C0346). Electrical integrator is responsible for a single gang back box to mount the camera at the symbol location (unless recess mounted). Electrical integrator to install back boxes required for VES as provided by access control integrator. Electrical integrator shall provide a 1 in. conduit from this camera mount back box and the VES back boxes to an accessible ceiling space near the camera, VES symbols on drawings. Terminate the permanent link Cat6A cable (for the camera, and VES devices) from the local IDF/MDF in another back box secured to the building structure near the 1 in. conduit from the camera, and VES mounting back box with a single Cat6A yellow data jack (or multiple yellow jacks, if the back box for terminating permanent link cables can serve cameras in nearby locations) and faceplate. 28 00 00 communications integrator shall furnish and install yellow Cat6A patch cord from permanent link termination jack to camera, and VES via the 1 in. conduits connected to the mounting back boxes. Cameras, and VES devices are furnished and installed by 280000 communication integrator. Cat6A cables from the local IDF/MDF shall not be connected directly to the cameras or VES equipment. See details on T2.30.

4. Furnish and install any other faceplate and jacks that are reasonably assumed to be primarily for data, wireless, cameras or voice. A1, A2, A3, A4 must all have an available blank port for PB (panic button) cable pass through. Provide and install blank port inserts at all blank ports on all faceplates.
5. Nameplates, labels and tags for cables, faceplates and patch panels. Coordinate with Owner.
6. Testing and Certification.
7. Label all Tel/Data conduits that terminate in a room on both ends (do not label stub ups from faceplates).
8. All above ceiling WAP2, WAP4 and OWAP outlets shall be denoted on the ceiling tile grid below the outlet with a ½ in. green dot sticker. Mark location of all camera, and VES data back boxes (the permanent link back boxes) above ceiling tiles in a similar fashion with a ½ in. yellow sticker. Any data back boxes above ceiling tiles shall be denoted below on ceiling tile grids with a ½ in. blue dot sticker.
9. All wall phone back boxes (PH and NP locations) shall be a min of 6 in. away from any side wall, corner, door jamb or adjacent back box or any other device or marker board/tack board. One foot clear from the center of the PH back box is required in all directions. Wall phone (PH and NP symbol) faceplates shall be stainless steel with two phone mounting posts. Coordinate thermostat locations a minimum of 6in away from back boxes with HVAC contractor.
10. Coordinate, furnish and install all cabling as coordinated by each communication integrator and the electrical integrator for 27 50 00 and 28 00 00 to complete the work in the following sections: 27 50 00 – Distributed Communications and Monitoring; 28 00 00 – Electronic Safety and Security. All cabling shall comply with the respective sections manufacturer's requirements and shall not void any manufacturer's warranty.
11. At all table tops with termination/popup data and AV devices, install all data cables provided by the furniture supplier in the floor boxes below the table. Where an HDMI floor jack is noted (provided by 274000 communications integrator as a V3 symbol) furnish and install an HDMI cable from the floor jack to the table top HDMI pigtail provided by the furniture integrator. Do not over size HDMI cables; all extra HDMI cabling shall fit inside the floor box. Utilize the cable management provided by the furniture integrator to hide and dress all cabling. Furnish and install at all V3 floor jack locations one Networx USB 2.0 adapter, USB A female to USB B male, (5 pack part number is AD-USB-AFBM-5).

Connect USB cable provided by furniture integrator to the adapter, then connect the adapter to the V3 faceplate.

12. All faceplates (except PH and NP faceplates as specified above) shall be white thermoplastic unless specified or noted on the drawings otherwise.
13. All above ceiling mounted back boxes shall have the jacks face to the side or down. No above ceiling mounted back boxes shall have the data jacks facing toward the deck above.
14. Fiber to Altronix Netway units (Netway units by 28 00 00) at light poles on the site plan with camera symbol designations. 120v power is available at light poles for equipment.
15. Fiber to theater racks as detailed on T2.60/
16. Any cabling traversing above or between open and closed ceiling spaces, and above open grid type ceilings, shall be wrapped in black nylon wrap to fully hide the cabling color.
17. Wireless access point devices and controllers installation (both Provided by Owner, installed by integrator of this section). Integrator shall furnish and install 15’ Cat6A green patch cords (1’ green Cat6A patch cords for interior wall mount locations) at all WAP2, WAP4 and OWAP locations. OWAP locations shall use outdoor rated Cat6A green patch cords.
18. Ensure all floor boxes have stub ups for data and audio-video in the same room as the floor box. Coordinate with electrical integrator.

B. The work of this Section is shown on Technology Drawings numbers designated by a T.

C. No corridors or spaces are air plenums. No cabling needs to be plenum rated.

D. The below naming of two or more distinct and different manufacturers or model numbers is for the purpose of establishing a standard of quality, design, functionality, and appearance and is not intended to establish these manufacturers and/or products as the only acceptable products, nor is it intended to limit the submittal of substitute products and/or manufacturers which are equal to the established standards. Equal products may be submitted and will be reviewed for their equivalency in meeting the established standard.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. All Sections of Division 27 and Division 28

B. SECTION 05 31 00 – STEEL DECKING See for restrictions concerning the hanging of material, cable tray, mounts, brackets, hooks, and other items from the roof or decking

C. SECTION 01 23 00 - ALTERNATES

D. The following related work or material shall be provided under the designated trades and under the listed SECTION:

1. Specialty Equipment: DIVISION 11, “EQUIPMENT”

2. Field Painting: DIVISION 9, “FINISHES”

3. SECTION 23 00 00- HVAC

4. SECTION 26 00 00 - ELECTRICAL

5. SECTION 22 00 00 - PLUMBING

6. SECTIONS of DIVISION 27

7. SECTION 28 00 00

8. SECTION 12 68 00-SEAT AND TABLE ASSEMBLIES

9. SECTION 14 22 00 – COMPACT TRACTION ELEVATORS

10. SECTION 08 71 00 – DOOR HARDWARE

11. SECTION 08 11 13 - HOLLOW METAL DOORS & FRAMES

12. SECTION 08 35 23 ACCORDION FOLDING DOORS for WON doors

13. SECTION 27 08 00 – COMMISSIONING OF COMMUNICATIONS

14. SECTION 11 61 00 – THEATER AND STAGE EQUIPMENT

15. ARCHITECTURAL DRAWINGS - DOOR SCHEDULE

E. Unless otherwise indicated, the following work is not included as part of the 27 10 00 Communication Systems Integrator's responsibilities in this SECTION, except for coordination, and is to be performed by others as indicated:

1. Empty conduits for cable pathways to accessible point above finished ceiling or below floor shall be provided by the electrical integrator to ensure distance limitations of cables as determined by standards. A minimum of two 2" conduits per classroom and into office suits, and a minimum 2" into offices and other rooms is required for pathing. RCDD of this section shall coordinate with electrical contractor to have the electrical contractor furnish and install conduit paths to ensure cabling distance limitations are maintained. RCDD of this section shall notify architect of any discrepancies.

2. Floor boxes and poke through devices shall be provided by the electrical integrator.

3. Device boxes with plaster rings for data shall be provided and installed by the electrical integrator.

4. Clock system backboxes shall be installed by the electrical integrator and provided by the 27 50 00 Communications integrator.

5. Telephone system, installation and cross connections and devices provided by Owner contractor.

6. Speaker/paging system backboxes shall be installed by the electrical integrator and provided by the 27 50 00 Communications integrator.

7. Structural blocking to support wall and ceiling mounted equipment shall be provided by the General Contractor.

8. Computers and monitors and final connections to wall outlets shall be provided by the Owner.

9. Interface with public utilities telephone service shall be arranged and provided by the Owner.

10. Wide Area Network connections shall be arranged and provided by the Owner.

11. CATV service and connections to installed systems shall be arranged and provided by the Owner.

F. The installation, operating cost and maintenance of the controlled environmental conditions, for equipment located on site by the manufacturer, NFPA 70B, or as specified in these specifications shall be the responsibility of the General Contractor.

1.4 SYSTEM DESCRIPTIONS

A. Proprietary Equipment: Specified Manufacturers: To conform and integrate with currently established systems within the district at various school locations, drawings and specifications have been based on the Lock N Charge Fuyl mobile device charging stations

Manufacturer:	Item:	Part Number:
LocknCharge	FUYL Tower 15	LNC3-10439
LocknCharge	Network Kit	10224

C. General: This system shall provide a cabling infrastructure system for voice and high speed data. Furnish and install complete systems consisting of patch / cross connection panels, all fiber-optic cabling, multimode fiber-optic cabling, multimode cabling to any outdoor digital signs, outdoor copper and fiber, main distribution frame (MDF) racks (two post relay rack type and four post type, and intermediate distribution frame (IDF) racks (non-server type, two post). Provide and terminate fiber and cabling as per the network riser detail drawing (T2.60) in all locations noted therein or as designated or inferred on the drawings. Provide appropriate amount of fiber termination ports in all areas to terminate all fiber. Provide all equipment as noted on the drawings or otherwise for a complete and functioning system. Ensure all fiber counts are correct independent of the quantities shown on T2.60. Where discrepencies occur, provide the higher cable count. Higher fiber counts may be submitted if it is economical to do so, however all fiber shall be terminated unless noted otherwise. The horizontal four pair Category 6A copper cabling system shall be guaranteed to exceed all TIA-568-C.2 link and channel performance requirements and be capable of supporting 10G Base-T (802.3an) and ISO/IEC 11801 applications for a total distance of 100 meters with equipment cords. The system shall be guaranteed to meet all Cat6A requirements

D. This specification describes the desired form, function and performance of the backbone and horizontal cabling system. It is the responsibility of the installer of this section to provide a fully functional system in accordance with the intent and stated performance of this specification or better. Provide all communications wire, cable, fiber-optic cable, devices and related facilities installed complete as shown or as implied on the Contract Documents for fully functional systems, including, but not limited to:

1. Data, Voice, Fax, WAP and CCTV horizontal cabling and Fiber Backbone Cabling System, grounding and equipment including but not limited to:

   a. Fiber Optic Backbone Cabling (armored indoor and armored outdoor)
   b. Fiber Optic Cabling for CCTV and Audio/Video (armored indoor)
   c. Fiber Optic Cabling for Video Surveillance and Digital Sign (armored outdoor)
   d. Fiber Optic Connectors

e. Fiber Optic Patch Panels and fiber patch cords
f. Equipment Racks
g. Vertical Cable Managers
h. Cabling Distribution Support
i. Category 6A Data cabling (BLUE)
j. Category 6A WAP cabling (GREEN)
k. Category 6A CCTV cabling (YELLOW)
l. Category 6A VES cabling (YELLOW)
m. Category 6A Voice cabling (WHITE)
n. Category 6A Smart Clinic cabling (ORANGE)
o. Category 6A Fax cabling (GREY). All fax lines are to be run as a typical data cable.
p. Category 6A for any other requirements (GREY)
q. Category 6A RJ-45 Style Jacks (colors specified below)
r. Category 6A flat Patch Panels
s. 25 pair copper riser cabling from MDF to each IDF for legacy copper requirements.
t. Cable tray sized 6 in. H x 24 in. W in MDF/IDFs, over racks, and connecting racks to plywood back boards and conduit entrances into the rooms.
u. Cabling Distribution Support (J hooks where no cable tray provided)
v. Stainless Steel Wall Phone face plates with two posts and recessed jacks
w. 110 blocks mounted on plywood backboard for riser cabling and another 110 block for homerun Cat6A cable (gray) from MDF to each elevator equipment room location (see faceplate details and drawing locations).
x. Grounding and bonding of cable tray, racks and conduits
y. Ensure all cabling is protected from paint and paint overspray. Any cabling found with paint on the jacket shall be removed and replaced at no expense to the owner.
z. Flat horizontal two RU cable manager in the middle of the racks.
aa. All cabling shall be terminated in the IDFs or MDF as shown on the zone coverage drawings. Any deviations shall be brought to the attention of the architect.
bb. Provide and install two 2 in. conduit feed throughs from all sound closets to the accessible space of speaker placement areas for speaker and other cabling for the sound systems. Coordinate with 274000 communications integrator and 11 61 00 Theater Integrator.
cc. Furnish and install 1 in. conduit through the exterior walls at all noted locations for cable path to exterior mounted wireless access point devices. Exterior camera locations shall have single gang back boxes for camera mounting. Seal conduits with re-enterable type silicone sealant after installation, and seal conduit sides to the building with color matched sealant. Conduits shall be cut flush to exterior wall and shall be above finished ceilings on the interior of the building. Contractor of this section is responsible for sealing.
dd. All exterior back boxes shall be sealed at conduit connections and at all seams and mounting screw locations. All exterior back boxes shall be sealed to the building with color matched sealant. Contractor of this section is responsible for sealing.
ee. All exterior devices shall be sealed to the building with color matched sealant (card readers, cameras, camera pendant arms, speaker faceplates, ADA push buttons, video entry devices, and any conduit exiting the building above grade). Contractor of this section is responsible for sealing.
ff. Any rough block locations that receive a back box or device (such as card readers or ADA push buttons) shall have the rough face block ground down flat for the

devices to be installed and sealed to the building. General Contractor shall be responsible for grinding block.

gg. Ensure exterior camera back boxes are single gang (with conduit stubbed to above accessible ceiling space inside building) and all exterior siding around the back boxes leaves no gaps beyond an 1/8” around back boxes. Gaps shall not be visible beyond the camera housing. Coordinate back boxes in exterior walls and siding requirements with General Contractor.

E. Work Not Included: The following work is not included in this section:

1. All computer workstations / printers and associated software (Provided by Owner)

2. Telephone system and instruments (Provided by Owner)

3. Public Address / Intercom System (Provided by 27 50 00)

4. Master clock system and secondary clocks (Provided by 27 50 00)

5. Digital signage system software (Provided by Owner)

6. Network electronics (Provided by Owner)

7. Wireless access point devices and controllers installation (Provided by Owner, installed by integrator of this section). Integrator shall furnishes and installs 15’ Cat6A green patch cords (1’ green Cat6A patch cords for interior wall mount locations) at all WAP2, WAP4 and OWAP locations. OWAP locations shall use outdoor rated Cat6A green patch cords.

8. Gym, Auditorium, and Student Commons sound and control systems (Provided by 11 61 00)

F. Coordination: Coordinate device locations with furnishings and equipment.

1.5 REFERENCE SPECIFICATIONS, STANDARDS AND CODES

A. Comply with the referenced codes and standards and with the Contract Documents. Where conflicts occur, the more stringent shall apply.

B. Work shall meet or exceed the standards and procedures of the following:

1. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.

2. ANSI/TIA 568-C.2, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components

3. ANSI/TIA/ 568.3-D Commercial Building Telecommunications Cabling Standard, Part 3: Optical Fiber Cabling Components Standard

4. ANSI/TIA/ 569-D Commercial Building Standards For Telecommunications Pathways And Spaces

5. TIA-568.0-D Generic Telecommunications Cabling for Customer Premises

6. TIA-568.1-D Commercial Building Telecommunications Cabling Standard

7. TIA-568-C.2 Balanced Twisted Pair Cabling Components

8. TIA-568.3-D Optical Fiber Cabling Components Standard

9. ANSI/TIA 606-B Administration Standard for Commercial Telecommunications Infrastructure

10. ANSITIA TIA-607-C Generic Telecommunications Bonding And Grounding (Earthing) for Customer Premises

11. ANSI/TIA -862-B Intelligent Building Systems Cabling Standard

12. ANSI/TIA-942-A Telecommunications Infrastructure Standard for Data Centers

13. ASTM D 4566-05, Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable, 2005

14. BICSI Telecommunications Distribution Methods Manual (TDMM) Current Edition

15. BICSI Information Transport Installation Manual (ITSM) Current Edition

16. ISO/IEC 11801 – Information Technology – Generic Cabling for Customer Premise

17. IEEE 802.3 Standard for Information technology -Telecommunications and information exchange between systems - Local and metropolitan area networks – Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

18. IEC 61156-1, Multicore and Symmetrical Pair/Quad Cables for Digital Communications – Part 1: Generic Specification, 2005

19. NFPA-70 National Electrical Code current edition

20. NECA/BICSI-568-A Standard for Installing Commercial Building Telecommunications Cabling

21. Federal Communications Commission Part 15 and Part 68

22. UL 444 – Standard for Safety of Communications Cable

23. UL 1666 – Standard for Safety of Flame Propagation Height (CMR)

24. NFPA 262 – Flame Travel and Smoke of Wires and Cables (CMP)

25. BICSI Outside Plant Design Reference Manual, Current Edition

In the event of conflicts, the more stringent provisions shall apply.

1.6 COORDINATION

A. When articles, materials, operations or methods related to execution of telecommunications

work are noted, specified, or described in the specifications or are indicated or reasonably implied on drawings and schedules, execute work as appropriate to provide complete and proper function, operation and installation.

B. The drawings utilize symbols and schematic diagrams to indicate items of work. These symbols and diagrams will not typically identify dimensions nor will they identify inclusion of specific accessories, appurtenances and related items necessary and appropriate for a complete and proper installation and operation. The Communications Integrator shall install work complete and ready for proper operation, including related items not specifically identified, shown, indicated or specified. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on architectural drawings and on shop drawings approved by the Communications System Integrator and Architect. When abbreviations appear on the drawings or specifications in upper or lower case letters, with or without periods, the resultant work shall be as stated above.

C. The drawings include details for various items, which are specific with regard to the dimensions and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work. Work shall not proceed until actual field conditions and requirements are verified by the Communications Integrator.

D. The drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions.

E. Where a PB symbol is present, provide a minimum of one blank port in the A faceplate at the PB location for PB wiring.

F. Coordinate with HVAC integrator the exact placement of ALL AC units, condensate and drain lines, to ensure NO AC unit is installed above ANY rack or plywood backboard in the MDF and all IDFs. No drain lines shall be routed above an equipment rack or plywood back board.

G. Coordinate elevator camera installation and card reader cabling with elevator integrator. Communications integrator of this section is responsible for all cabling and terminations of elevator CCTV camera installation except for traveller cabling. Elevator integrator is responsible for traveller cabling and connections to traveller cabling. Coordinate cabling requirements of elevator camera with 28 00 00 communications integrator. Equipment and camera power required for camera installation and connections to cabling (other than traveller cable) is the responsibility of the 28 00 00 communications integrator.

H. The communications integrator of this section shall ensure that the General Contractor and painting integrator acknowledge that painting of or over spray on any category cable or video/backbone telecommunications fiber optic or high pair count Category 5e cable is not acceptable. Any painted or over sprayed cable(s) shall be replaced at no cost to the Owner. Painted cable will not be covered as part of a manufacturer’s extended warranty. Painted cable, in addition to obscuring the print legend may act as an accelerant or create an additional flame spread and smoke hazard in the event of a fire, and as such, is considered a life safety issue. Paint can also breakdown the jacket of cables, as per manufacturers claims.

I. Coordinate with Hollow Metal Doors & Frames integrator and Door Hardware integrator for all conduit required for electrified doorways or future proofing of doorways. Conduits shall be furnished and installed by the electrical integrator.

J. Coordinate with Architect and Owner the termination labeling scheme to be used in the IDFs/MDF and room faceplates.

K. Coordinate with Plumbing and Fire Suppression integrators during coordination meetings to prevent any plumbing, drain, wet pipe, or fire suppression pipes from running over any racks in the MDF and IDFs. Sprinkler heads are not permitted above any rack locations, or within 2' from the front or back of any rack. Sprinkler heads shall not be placed directly above plywood back boards, or within 1' of the plywood back board.

1.7 SUBMITTALS

A. General: Architect may require submittal submission within 90 days of bid award. Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, Section 01300 and Section 26 00 00. Submittals shall be made as one complete package.

B. The Submittal shall include, but shall not be limited to the following:

1. Product Data for each component specified, including detailed manufacturer's specifications. Include data on features, ratings, and performance. Include dimensioned plan and elevation views of components. Provide an index and tabulated pages referencing the equipment in the specification. Any submittal received without a full index and tabulated pages shall be returned without action.

2. Provide qualification/certification data for firms and persons specified in the "Quality Assurance" article to demonstrate their capabilities and experience. Provide evidence of applicable registration or certification.

3. Field test and observation reports from qualified inspecting and testing personnel indicating and interpreting test results relative to compliance with performance requirements of the installed systems.

4. Final schedule of cables as specified in Part 3.

5. Shop drawings, prepared in AutoCAD, readable in AutoCAD Release 2010 or newer, detailing the cabling systems.

C. Shop drawing submittals shall include but shall not be limited to the following:

1. Construction plans indicating the following:

a. Locations of all voice, data & audio/visual backbone cables with identification numbers.

b. Location of termination racks and backboards.

2. System riser diagram indicating general arrangement of interconnections between system components on each floor of the building, identifying number and type of cables in each raceway.

3. Horizontal cabling, fiber, concentrator enclosures, MDF/IDF racks, and cross connect

system. Include front-view details identifying all components, cabling connections, and cable identification numbers.

D. Cable Schedules: Prior to substantial completion, prepare and submit cable schedules for each of the communication systems installed under this section describing the as-built condition of the systems. Prepare cabling schedules in tabular form. Include the following information in each schedule:

1. Fiber Optic and Horizontal Cabling System Schedule:

a. IDF/MDF room number
b. Cable ID
c. Origination Patch Panel & Port Number.
d. Destination Room (old and new numbers if they change during construction)
e. Destination Room faceplate location and jack number.

E. It is intended for the Submittal data to be complete and accurate at the first submission. If the submittal is returned marked “Resubmit” only one additional submission will be permitted. IF THE SECOND SUBMITTAL IS NOT ACCEPTABLE, OR IF THE SUBMITTAL IS NOT MADE WITHIN THE SPECIFIED TIME FRAME, THE RIGHT OF SUBSTITUTION AND SELECTION WILL BE LOST. THE OWNER WILL SELECT THE SPECIFIED ITEM. THAT ITEM IS TO BE PROVIDED AND SHALL BE PROVIDED AT NO ADDITIONAL COST.

F. A minimum period of 15 working days, exclusive of transmittal time, will be required in the Owner’s office each time Shop Drawings, Product Data, layout drawings, catalog data and brochures are submitted or resubmitted for review. A minimum period of 20 working days exclusive of transmittal time will be required for reviewing substitute materials or manufacturer. These time periods shall be considered when scheduling the work.

G. If proposed equipment deviates from the Specification or Drawings, indicate in writing on Company letterhead those differences and provide sufficient data to justify acceptance. FAILURE TO INDICATE DEVIATION OR SUBSTITUTIONS IMPLIES FULL COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.

1.8 RECORD DRAWINGS

Provide Record Drawings in accordance with Division 1 for requirements regarding Project Record Documents.

“As- Built” record documentation for telecommunications work shall include:

System function diagrams.
Communications flow diagrams.
Manufacturers’ description literature for equipment.
Connection and programming schedules as appropriate.
Equipment material list including quantities.
Spare parts list with quantities.
Details not on original Contract Documents.
Test Results
Warranties
Release of Liens

Operation and Maintenance Manual:

Refer to Section 01 33 00 - Submittals for requirements pertaining to Operation and Maintenance Data.

The Communication System Integrator shall submit manuals in accordance with Division 1 containing manufacturers' brochures of items installed by the Communication System Integrator.

The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate specification sections.

Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

Operations manuals for components and for system as a whole.

Maintenance manuals for components and for system as a whole.

Point-to-point diagrams, cabling diagrams, construction details and cable labeling details.

List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.

Emergency instructions for operational and maintenance requirements.

Delivery time frame for replacement of component parts from suppliers.

Recommend inspection schedule and procedures for components and for system as a whole.

Complete "Reviewed" shop drawings and product data for components and system as a whole.

Troubleshooting procedures for each system and for each major system component.

Closeout Submittals:

1. As-Built Drawings: Update Shop Drawings to create final As-Built Drawings. Submit digitally in AutoCAD 2010 or later format on a CD. Each faceplate shall show the faceplate port number and terminating servicing closet room number with patch panel letter and port number.

2. Maintenance Data: Include three copies: maintenance and repair procedures.

3. Digital copies of all training materials and videos of all training provided on USB drives.

4. Warranty paperwork certified and provided by both the installer (installer/integrator warranty min 15 years) and the cable manufacturer warranty (min 15 years). Warranty certificates shall include contact numbers.

5. Submit costs for repairs and service not covered under warranty (ie: owner requested

changes, acts of God, vandalism, misuse).

6. PDF of product data and O&M manuals shall contain bookmarks for every section and item submitted.

1.9 QUALITY ASSURANCE

Equipment and materials required for installation under these specifications shall be the current model and new (less than one year from date of manufacture), unused and without blemish or defect.

A. Installer Qualifications: Installer shall engage a registered communications distribution designer (RCDD) as part of the communications integrator team. Such RCDD can be an employee or consultant, but must be certified by the Building Industry Consulting Service International (BICSI). RCDD shall perform post bid review of the cable plant and bring any discrepencies to the attention of the architect within 60 days of bid. RCDD shall provide to Owner and Architect rack elevations for all racks in MDF and IDFs when actual cable plant is determined, to include UPS devices, patch panels (Cat6A and fiber), CCTV system and NVRs, access control servers, phone equipment, intrusion system equipment, switching and wireless equipment and owner equipment. Coordinate equipment with integrators of the appropriate sections and owner. RCDD shall ensure no cable lengths are over distance limitations set forth in the standards, and shall bring any discrepancies to the attention of the architect within 60 days of bid. Coordinate actual rack placements in MDF and IDFs with architect and owner. RCDD shall review outdoor fiber plant design and bring any discrepancies to the attention of the architects. RCDD Is intended for post bid review and coordination. Post bid review and discrepancies noted shall be completed and reported to the architect within 60 days of bid award. Any discrepancies noted after 60 days shall be remedied (additional floor coring, remote equipment cabinet to include power and fiber, or other remediation equipment or labor) by the communications integrator of this section at no expense to the Owner.

B. Manufacturer Qualifications: Manufacturers shall be experienced in manufacturing components listed and labeled under TIA-568.0-D, TIA-568.D-1, TIA-568-C.2, TIA 568C.3-D.

C. Comply with the following:

1. TIA-568.0-D, Generic Telecommunications Cabling for Customer Premises

2. TIA-568.1-D, Commercial Building Telecommunications Cabling Standard

3. TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards

4. TIA-568.3-D, Optical Fiber Cabling Components Standard

5. ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.

6. ANSI/TIA/EIA-14A Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant.

7. ANSI/TIA -569-D, Telecommunications Pathways and Spaces.

8. ANSI/TIA -606-B, Administration Standard for Commercial Telecommunications Infrastructure

9. ANSI/TIA-607-C, Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises.

10. BISCI Telecommunications Distribution Methods Manual Standards, most recent volume.

D. All wiring must be run end to end with no splices (except for fiber, where splices may be specified to be provided in certain locations). Terminated cables shall be punched down meeting approved methods. Any cables found to be spliced must be replaced at communications integrator's expense.

E. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

F. Work Coordination: Coordinate Work of this Section with owner's contractor for the telephone switch and telephone instruments, planned equipment, 27 40 00 communications integrator, wide area network (WAN) installed by Owner, 28 00 00 communications integrator for CCTV placements and the Technology Director of the School District.

1. Record agreements reached in meetings and distribute record to all participants in the meetings.

2. Adjust the arrangements and locations of distribution frames, patch panels, and cross connects in equipment rooms and wiring closets to accommodate and optimize the arrangement and space requirements of the telephone switch, LAN equipment, CCTV Equipment and WAN equipment.

G. Communications integrator must be certified by the cabling manufacturer to install, terminate and warrant copper and fiber cabling systems. Provide proof of manufacturers' certification for systems to be installed.

1.10 SUPPORT MATERIALS

A. Furnish support materials described below that match products installed, are packaged for storage, and are identified with labels clearly describing contents.

1. Cable: One 1000ft spool of each size and type used for Project. Furnish on reels.

2. Patch Panel Units: one of each type for each 50 installed, but not less than one.

3. Connecting Blocks: one of each type of each 100 installed, but not less than one.

4. Outlets Assemblies: one of each type for each 100 installed, but not less than one.

1.11 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the

communications integrator under other requirements of the Contract Documents.

B. Special Warranty: The data cabling system, including workstation outlets, cabling, connectors, patch panels and other connecting hardware, shall be warranted to be free from defects in material or faulty workmanship, and shall meet the performance requirements of TIA-568.0-D, TIA-568.1-D, TIA-568-C.2, TIA 568.3-D. The cabling system shall conform to the ANSI/TIAIEIA-568-C, specifications for any current or future application, which supports transmission over a properly constructed horizontal cabling system, which meets the channel, and/or basic link performance as described in TIA-568.0-D, TIA-568.1-D, TIA-568-C.2, TIA 568.3-D.

C. The warranty shall cover material, services, and operation of the cabling system, end to end to include connectors/terminations, for both copper and fiber. The warranty shall cover the operation of system to run minimum 1GB transmission on horizontal cabling category 6 systems, 10GB transmission on horizontal cabling category 6A systems, and 10GB on Multi-Mode OM4 or Single Mode OS2 Fiber backbone as noted without exceeding the standard attenuation limit.

1. Special Warranty Period by Installer and Manufacturer: 15 Year MINIMUM from date of acceptance. Provide warranty from Installer and Manufacturer. Installer shall submit warranty tests to manufacturer on behalf of the owner and deliver the manufacturer warranty to the owner when complete. Provide copies of warranties to the Architect.

D. The manufacturers of connectivity and cabling will certify installing communications integrator on the project to be warranted.

E. The communications integrator at both the company and installing technician level must be certified with the connectivity and structured cabling to be installed in the project that the communications integrator will be installing.

F. The communications integrator will supply a letter or other document that will detail the certification in regard to the connectivity and cabling systems installed to the Technology Services Department and/or Construction Manager prior to the final inspection and close of the project.

G. All test results and warrantees for connectivity and structured cabling shall be submitted to the Technology Director (Minimum two copies of test results will be required in electronic format). Submittals must be received prior to substantial completion. Communications integrator is responsible for obtaining warranties for cabling. Provide ALL warranties the cabling system qualifies for.

H. Uncertified communications integrators will be required to remove structured cabling and pay for replacement by another certified communications integrator if the installation is not in compliance with certifying manufacturer or contract standards at no additional expense to the Owner.

J. Certifying manufacturers may be required to do inspections of cabling systems on project.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be suitably packaged by manufacturers to prevent damage during shipment and handling. Damaged materials will not be acceptable for use.

B. Store materials on site in clean, dry storage area. Materials stored below 32^{o}F; are required to be reconditioned and stored at room temperature (68^{o}F) for 24 hours prior to installation.

Do not install cable below 32ºF.

PART 2 - PRODUCTS

MATERIALS:

Manufactured Products:

Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer.

Equipment Assemblies and Components:

Components of an assembled unit need not be products of the same manufacturer, but must meet TIA Category 6A or 6, depending on cable type, criteria as a complete permanent link.

Manufacturers of equipment assemblies shall assume complete responsibility for the final assembled unit.

Components shall be compatible with each other and with the total assembly for the intended service.

Moving parts or elements of equipment of the unit normally requiring lubrication shall have means provided for such lubrication and shall be adequately lubricated at the factory prior to delivery.

Factory cabling shall be identified on the equipment being furnished and on cabling diagrams.

Any equipment listed by manufacturer and/or model number is for performance criteria comparison only. In no way is it implied that the specific product must be provided. All equipment to be provided shall be ‘’ unless noted as proprietary in the specification.

2.0 SYSTEM DESCRIPTIONS

A. Proprietary Equipment: Specified Manufacturers: To conform and integrate with currently established systems within the district at various school locations, drawings and specifications have been based on the Lock N Charge Fuyl mobile device charging stations

Manufacturer:	Item:	Part Number:	Quantity:
LocknCharge	FUYL Tower 15	LNC3-10439	4
LocknCharge	Network Kit	10224	4

2.1 NETWORK BACKBONE CABLING

A. General:

1. The following types of backbone cables shall be used on this project:

a. Single-Mode (SM) 9/125um fiber and OM4 Multimode 50/125um fiber cable for 10GB backbone distribution of data, voice, video, CCTV and video transmission backbone.

2. All Single-Mode and Multimode fiber for the backbone shall be terminated with LC duplex style connectors.

3. All fiber shall be indoor/outdoor grade and armored unless noted otherwise.

4. Determine splicing locations, provide and install splices and equipment and all requirements to provide designed intent on T2.60 network riser detail, and T2.70 site details (in ground vault locations which will house the fiber splices are shown) and technology drawings. It is the responsibility of the communications integrator of this section to ensure a fully functional fiber plant (both single mode and multimode). Provide a loss budget analysis to verify the system will function appropriately in accordance with standards over the proposed link before pulling fiber. Coordinate with owner for network electronics specifics. RCDD shall approve loss budget analysis prior to work being performed. Forward copy of loss budget analysis to the architect.

5. Fiber terminations shall be at the top of rack one in all IDFs and the MDF unless a wall enclosure is specified or noted on the drawings. Below the fiber shall be phone then cctv cabling. Coordinate with architect and owner on patch panel layouts. In the second designated rack, at the top of the rack will be data then wap cabling. Coordinate with architect and owner on patch panel layouts.

6. Fiber (OS2 and OM4) trunk/back bone cabling shall be installed with A to B polarity, such that the owner shall be able to use straight through fiber patch cords to connect equipment on each end.

7. OM4 multimode fiber to Netway enclosures at all light poles with cameras shall be terminated with LC duplex connectors to plug directly into the SFP modules in the Netway enclosure. Ensure proper service loop and strain relief for these fibers in the enclosure. Netway enclosure and SFP modules are by 28 00 00. Terminate both fiber pairs at each pole, one will be a spare pair.

8. Integrator for this section is responsible for all cabling and fiber cabling (see T2.30, T2.60 and T2.7), and all fiber terminations except for fiber to theater racks noted on T2.60. This fiber shall be terminated at both ends by the Theater Section. Leave coiled 25’ at each.

B. OS2 Single-Mode Fiber-Optic Cable- SM 9/125um:

1. The fiber-optic cable shall be tight buffer indoor/outdoor factory-fabricated, jacketed, low-loss, glass-type, fiber-optic single-mode, operating at 1310 nanometers (nm) and 1550nm.

   a. Strands Per Cable: as per drawing details. See T2.60 and T2.70

   b. The light guide building cable shall meet the following technical specifications:

      1. Fiber Dimensions: 9 micron core 250 micron coating 125 micron cladding 900 micron buffering
      2. Fiber Identification: Individually color-coded PVC buffer.
      3. Buffer Material: PVC
      4. Jacket Material: PVC
      5. Operating Temperature: -40 to 158. F

2. In cables with more than twenty-four fibers, the fibers shall be encased in sub-units and

stranded around a dielectric central member. Sub-unit color code shall follow the same guidelines as the color coding for the tight buffers.

3. The cable jacket color shall be yellow for cables containing single-mode fibers, Aqua or Erika Violet for OM4 multimode fibers. (Colored tape will not be used to re-identify jacket color).

4. The cable shall be all dielectric.

5. The individual fibers shall be color coded for identification. The optical fiber color-coding shall be in accordance with ANSI/TIA-598-A, “Optical Fiber Cable Color Coding.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another. The following color codes will be used:

    a. Blue.
    b. Orange.
    c. Green.
    d. Brown.
    e. Slate.
    f. White.
    g. Red
    h. Black.
    i. Yellow.
    j. Violet
    k. Rose
    l. Aqua

6. Jacket Printing: The outer cable jacket shall be marked with the manufacturer’s name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two feet. The print color shall be black. The printing shall be permanent and legible for the life of the cable.

7. The fiber-optic cable shall meet the following standards:

    a. ISO 11801 2nd edition
    b. EN 50 173 2nd edition
    c. TIA-568C.3
    d. ANSI/TIA/EIA-492
    e. TELECORDIA GR-409
    f. ICEA S-83-596
    f. OFNR rated.
    g. NEC Section 770.

8. The optical fiber shall be single mode 9/125-micron fiber with the following characteristics:

a. 1310nm: maximum attenuation, .5 dB/km
b. 1550nm: maximum attenuation, .50 dB/km
c. The attenuation of the cabled fiber shall be uniformly distributed throughout its length such that there are no discontinuities greater than 0.2 dB in any one-kilometer length of fiber.

9. The cable shall meet the following EIA cable tests:

a. Impact EIA-RS-455, FOTP-25
b. Compression EIA-RS-455, FOTP-41
c. Flexure EIA-RS-455, FOTP-104
d. Tensile Bending EIA-RS-455, FOTP-33
e. Temperature Bending EIA-RS-455, FOTP-37
f. Twist Testing EIA-RS-455, FOTP-85
g. Flame Test (OFNR) UL 1666 (NEC)

10. Packing and Shipping:

a. The cable shall be packaged in cartons and/or wound on spools or reels. Each package shall contain only one continuous length of cable. The cable packaging shall be constructed so as to prevent damage to the cable during shipping and handling.
b. Wooden reels shall be plainly marked to indicate the direction in which it would be rolled to prevent loosening of the cable on the reel.

11. The cable shall be OS2 SM grade cable, of type appropriate for design intent. For all indoor/outdoor applications cable shall bear the appropriate listing for Indoor OFNR and Outdoor markings. All cable shall be armored. Single mode fiber by Corning, Belden or equal.

C. OM4 Fiber-Optic cable MM 50/125um. Strands as per T2.60 and T2.70 details.

1. The fiber-optic cable shall be factory-fabricated, jacketed, low-loss, glass-type, fiber-optic multi-mode, graded index, operating at 850 nanometers (nm), and 1300 nm.

a. Strands Per Cable: as shown on riser drawing T2.60 and T2.70
b. The light guide building cable shall meet the following technical specifications:

1) Fiber Dimensions: 50 micron core 250 micron coating 125 micron cladding 900 micron buffering
2) Fiber Identification: Individually color-coded PVC buffer.
3) Buffer Material: PVC
4) Jacket Material: PVC
5) Operating Temperature: -40 to 158. F
6) Storage Temperature: -40 to 158. F

2. In cables with more than 24 fibers, the fibers shall be encased in sub-units and stranded around a dielectric central member.

3. The cable jacket color shall be Aqua or Erika Violet for cables containing OM4 multi-mode fibers. (Colored tape will not be used to re-identify jacket color). Sub-unit color

code shall follow the same guidelines as the color code for tight buffers.

4. The cable shall be all dielectric.

5. The individual fibers shall be color coded for identification. The optical fiber color-coding shall be in accordance with ANSI/TIA/EIA-598-A, “Optical Fiber Cable Color Coding.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another. The following color codes will be used:

    a. Blue. .
    b. Orange.
    c. Green.
    d. Brown.
    e. Slate.
    f. White.
    g. Red
    h. Black.
    i. Yellow.
    j. Violet
    k. Rose
    l. Aqua

6. Jacket Printing: The outer cable jacket shall be marked with the manufacturer’s name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every 2 ft. (e.g., “COMPANY — 01/94 — 50/125 MICRON — Type OFNR-(UL) 00001 FEET”). The print color shall be black. The printing shall be permanent and legible for the life of the cable.

7. The fiber-optic cable shall meet the following standards:

    a. ANSI-FDDI.
    b. ANSI/TIA/EIA-568.3-D for 400 meter lenghts @ 10gb data rates.
    c. ANSI/TIA/EIA-526-14.
    d. ICEA S-83-S96.
    e. TR-NWT-000409.
    f. UL 1666.
    g. OFNR rated.
    h. NEC Section 770.
    i. ISO 11801

8. The optical fiber shall be multi mode 50/125-micron fiber with the following characteristics:

    a. 850nm: maximum attenuation, tight buffered, 3.0 dB/km Minimum Modal bandwidth, 4700 Mhz.km.
    b. 1300nm:maximum attenuation, tight buffered, 1.00 dB/km Minimum Modal bandwidth, 500 MHz.km.
    c. The attenuation specification shall be a maximum attenuation for each fiber
    d. The attenuation of the cabled fiber shall be uniformly distributed throughout its length such that there are no discontinuities greater than 0.2 dB in any one-kilometer length of fiber.

9. The building cable shall meet the following EIA cable tests:

   a. Impact EIA-RS-455, FOTP-25
   b. Compression EIA-RS-455, FOTP-41
   c. Flexure EIA-RS-455, FOTP-104
   d. Tensile Bending EIA-RS-455, FOTP-33
   e. Temperature Bending EIA-RS-455, FOTP-37
   f. Twist Testing EIA-RS-455, FOTP-85
   g. Flame Test (OFNR) UL 1666 (NEC)

10. Packing and Shipping:

    a. The cable shall be packaged in cartons and/or wound on spools or reels. Each package shall contain only one continuous length of cable. The cable packaging shall be constructed so as to prevent damage to the cable during shipping and handling.

    b. Wooden reels shall be plainly marked to indicate the direction in which it would be rolled to prevent loosening of the cable on the reel.

11. The cable shall be OM4 indoor/outdoor distribution cable. For all indoor/outdoor applications, cable shall bear the appropriate listing for Indoor OFNR and Outdoor markings. All cable shall be armored. OM4 fiber by Corning, Belden or equal.
12. See T2.60 for Multi-Mode OM4 cabling required. All pairs at poles will be terminated with LC duplex connectors.

D. Fiber Termination Hardware:

1. Provide/install/terminate all fiber provided as shown on the network riser drawings. All fiber shall be terminated with LC style terminations unless noted otherwise; different colors shall be used for SM and MM. Each fiber termination shelf shall include appropriate cable slack storage, labeling and strain relief.

2. Fiber termination shelves shall be mounted at the top of the rack containing the electronic equipment.

3. Cable Connectors: LC-style duplex connectors shall be used on all fiber (unless noted otherwise). Polish: Flat PC; Termination procedure: pigtail splice (SM and MM) or fuse on connectors. Insertion loss of connectors shall not be greater than .5Db

2.12 OUTDOOR FIBER LOCATIONS – SEE T2.70

A. Furnish and install from IDF 106A to the digital sign a 2 pair outdoor grade armored OM4 multimode fiber cable. Terminate with LC duplex connectors. Terminate IDF side in the fiber enclosure in the rack for backbone cabling, clearly labeled, and terminate the sign side inside the sign with a min 3’ service loop.
C. Furnish and install fiber from IDF 106 as shown on T 2.60 Terminate with LC duplex connectors. Terminate IDF side in the fiber enclosure in the rack for backbone cabling, clearly labeled, and terminate the pole side inside the Netway enclosure (furnished and installed by 28 00 00 subcontractor) with a min 3’ service loop. See 28 00 00 for Netway enclosure specifics.
E. Include fiber terminations above when sizing fiber enclosures in IDF 106.

2.2 FIBER PATCH PANELS

A. Fiber Optic Patch Panel in Rack Mount Enclosure in MDF & IDFs.

1. Patch panels shall have an anodized aluminum finish.

2. Patch panel shall have a clear cover on rear.

3. Patch panels shall be 6-Pack quad LC (24 fiber) type plates (as appropriate for the type of fiber being terminated) to terminate every strand of fiber in an enclosure no larger than four RU

4. Rack enclosure shall mount in a 19 in. equipment rack.

5. Rack enclosure shall have a front door with cable management and be constructed of durable polycarbonate plastic and black powder coated 16-gauge steel. Enclosure by Belden. Label fibers, to include origination location and fiber pairs, on the front of each enclosure.

2.3 NETWORK HORIZONTAL CABLING

A. General:

1. The following types of data/signal cables shall be used on this project:

a. 4 pair Category 6A cable for distribution of Data signals. (Blue)

b. 4-pair Category 6A cable for distribution of Camera/CCTV/VES signals. (Yellow)

c. 4-pair Category 6A cable for distribution of Voice signals (White)

d. 4-pair Category 6A cable for Wireless signals (Green).

e. 4-pair Category 6A cable for Smart Clinic (Orange)

2. TERMINATION HARDWARE: The following types of connectors shall be used on this project:

a. Category 6A Jacks, WHITE (VOICE), BLUE (DATA), GREEN (WAP/OWAP), YELLOW (CCTV), VES/VCS (RED).

B. Augmented Category 6 (6A) Cable DATA, VOICE, CCTV/VES, WAP/OWAP, and other faceplates as shown on drawings.

1. The Category 6A cable shall use the color code indicated below:

a. All Category 6A cable for D1, D2, D3, D4 shall be Blue

b. A1, A2 A3, A4 (data cables and jacks blue, voice cables and jacks white, PA cable and jacks black, VES cable yellow, jack red, fax cable and jack gray), PH (white cable and jacks), and WAP/OWAP (green cables and jack), Camera cables yellow and yellow jack.

c. All Category 6A cable for VES/CCTV/Cameras shall be Yellow

d. Fax lines requirements shall be terminated as a typical data cable, with gray cable and gray jack.

e. All Category 6A cable for the VES system shall be Yellow, jacks red.

f. All Category 6A for Smart Clinic (all NP, N1, N2, N4 faceplates/jacks) shall be orange. All cabling shall terminate in 112A wall rack (see below)

g. Any other Category 6A required shall be Gray.

h. Colored tape may not be used to re-identify jacket color.

i. Provide homerun Gray Cat6A cables from the MDF 110 blocks on plywood back board to each elevator machine room, leave 30' coiled in elevator machine room. Label cable at both ends.

2. The cable shall be composed of 23-gauge bare solid copper conductors. Cable shall be jacketed with the appropriate material to meet applicable CMR or CMP flame ratings and printed every two feet with the print legend. There shall be no shield required in the sheath.

3. Each sheath shall contain four unshielded copper twisted pairs. Each pair shall have a different twist ratio per foot from the other pairs to achieve the necessary crosstalk requirements.

4. The cable shall be tested to operate at 500MHz MIN.

5. The cables shall meet or exceed the following standards:

a. IEEE 802.3an

b. ICEA 580-576.

c. Canadian Standards Association IWC FT4.

d. National Electric Code - Article 800.

e. Proposed ANSI X3T9.S requirements for UTP at 100 Mbps and 155 Mbs ATM.

f. Cable manufacturer must be ISO-9002 Certified.

g. TIA-568-C.2 Category 6A

h. ISO/IEC 11801E2.1 Category 6A

i. IEC 61156-5 CAT 6A Horizontal cable

6. In addition to complying with the above listed standards, all Augmented Category 6 (6A) cables shall meet or exceed the following criteria:

a. Testing shall be in accordance with procedures in the referenced standards unless otherwise stated.

b. All cables shall meet, as a minimum, the requirements of:

1. CSA
2. NEC
3. UL444
4. TIA-568.2-D Category 6A
5. ISO/IEC 11801-1 Class E Category 6A

c. Factory splices of the insulated wire are not allowed in any portion of the cable, Butt-welded conductors prior to insulating are permitted.

d. Nominal OD: .320" or less

e. Conductor DCR: 9.38 ohms/100m MAX

f. DCR Unbalanced: 4% MAX

g. Mutual capacitance:5.3nF/100m NOM
h. Capacitance unbalance pair/ground: 330pF/100m MAX
i. Prop delay skew: 45 ns/100m MAX
j. Nominal velocity of propagation: 66% nom
k. Operating temp range: -20C to 75C

The cable shall be LANMARK-10G2 Category 6A by Berk-Tek or equal

2.4 TERMINATION HARDWARE

A. Modular 8 position modules:

1. Termination hardware shall be designed with an integral locking mechanism, which upon insertion of a modular plug provides maximum pullout strength at the plug/jack interface.

2. All modular 8-position jacks shall be RJ-45, T 568B wired.

3. The jacks shall meet or exceed the following standards:

a. TIA/EIA-568-C.2 Transmission Performance Specifications for 4-pair 100 Ω Augmented Category 6A Cabling and the TIA-568-C.2 Balanced Twisted Pair Cabling Standards

4. The modular jacks shall meet the following electrical performance and certification requirements:

a. The modular jacks shall meet TIA/EIA-568-C.2 Transmission Performance Specifications for 4-pair 100 Ω Augmented Category 6A Cabling and the TIA-568-C.2 Balanced Twisted Pair Cabling Standards
b. Near End Crosstalk (NEXT) and Attenuation measurements shall be made per applicable TIA-568-C.2 standards for Cat 6A.

5. The modular jacks shall meet the following requirements:

a. Connector-insulation displacement connectors shall be capable of accepting 23 gauge AWG solid conductor wire.
b. Terminated in accordance with TIA-568-C specifications.

6. The jack shall be approved to work in all applications up to 10 Gb/sec, including, but not limited to 1Gb/sec and 100 Mb/sec TP-PMD (100 meters over UTP, per ANSI X3T9.5), proposed 155 Mb/sec ATM, 16 Mb/sec token ring, 10 Base T and 4Mb/sec token ring.

7. The Cat6A modular jacks shall use the color code indicated below:

a. RJ45 jacks in D1, D2, D3, D4, A1, A2, A3 A4, PH, and WAP/OWAP:
1) D1, D2, D3, D4 RJ45 jacks shall be Blue
2) A1, A2, A3, A4 RJ45 data jacks Blue, RJ45 Voice jacks White, RJ45 PA jacks Black, RJ45 VES jacks Red.
b. CCTV/Camera RJ45 jacks shall be Yellow

c. WAP2, WAP4, OWAP RJ45 jacks shall be Green

d. Fax jacks Gray.

e. NP, N1, N2, N4 jacks shall be orange

Category 6A jacks shall be Leviton eXtreme QuickPort 6110G type.

2.5 PATCH PANELS

A. Category 6A- Data, WAP, Voice and Camera/CCTV, and cabling to 112A in Smart Clinic

1. All copper patch panels shall be quick port “loadable” flat patch panels. Copper cables shall be terminated with appropriate Cat6A jacks, (order appropriate color jacks, see below) then installed in the patch panel. Terminate copper for a neat and orderly installation. Furnish and install cable management at the rear of the patch panel to support Cat6A cabling. Cat6A jacks shall be the same color as the jacks at the far end of the cable (see Technology Drawing T2.10). Blanks inserts shall be installed in all unused ports in the patch panel. Patch panels by Leviton, part number 49255-L24 for 24 port patch panel, and 49255-L48 for 48 port patch panel. Provide label above all port clearly legible, with text fully fitting the label. A magnifying lens shall be over each port to easily read the label beneath it.
2. Patch panel ports shall be color coded as per the jack color at the far end of the jack as specified above.

2.6 110 BLOCKS AND CROSS OVER CABLING

A. Provide and install on plywood backboard in MDF 110 wiring block with legs for elevator phone line cross over cabling and fax cables. Leviton 41aw2-100 with legs.

B. Terminate elevator phone lines to 110 Blocks on plywood backboard. Cross connect phone line service provider’s DEMARC for fax lines to 110 block and verify lines function by testing each phone line.

2.7 CAT 5e MULTIPAIR CABLE

A. Provide non-plenum multi-pair Cat 5e cable from the MDF to each IDF as shown on the T2.60 drawing. Terminate and label both ends on 110 blocks in IDFs and MDF. Label each end with the far end destination. Indoor by Belden, IBDN25P 0081000 or equal.

2.8 EQUIPMENT RACKS

A. Furnish and install: All two post racks in MDF (provide and install as shown on the drawings), two post racks in IDFs (provide and install as shown on the drawings). Two post racks shall be 7 ft. tall, aluminum or steel floor-mounted and have mounting rails for standard 19 in. equipment. Provide racks as per technology drawing details. Provide and install at all two post racks (MDF, IDF, and other areas where a two post rack is shown on the drawings or as specified) a Cable Runway Elevation Kit, black, by Chatsworth, 4” - 6” high part number 10506-706 and a 3” Channel Rack to Runway Mounting Plate, black, by Chatsworth, for use with 20” – 24” cable tray, part number 12408-724. Rack deflection shall not be more than 1 in. at top of rack. Two post racks shall be part number AR201 by APC, with AR8400 hardware by APC.

B. All racks shall be properly grounded and bonded in accordance with ANSI/TIA/EIA-607, A minimum six AWG green conductors shall be used for grounding to room ground bus bar. See T2.40.

C. Furnish and install above two post racks and four post racks horizontal cable trays (24 in. W x 6 in. H minimum) connecting all racks. A horizontal cable tray shall connect the plywood backboard telecommunications on the ¾ in. thick AC-grade or better fire-retardant plywood with at least two coats of flame-retardant paint with the two post racks. All cable tray shall be no more than 6 in. away from top of racks. In the MDF, connect the two rows of racks with cable tray over them. All rooms with cable tray shall have cable tray extending to the plywood back boards and the conduit entrance in the room. See enlarged MDF and IDF plans for cable tray layouts.

D. Double-sided vertical cable management sections shall be provided for each two post rack. Vertical management sections may be integrated into the rack design or attached separately. Vertical management sections shall be provided for both sides of each individual rack. If more than one rack is installed in a row, a single vertical management section may NOT be used to adjoin two racks. Two 12 in. wide double-sided vertical cable management sections shall be provided for each two post rack (Belden, Leviton) except in IDF 321B- in this room, provide 6 in. double sided vertical cable managers on each side of the three racks, and except in the MDF, for the single two post rack, provide 6 in. double sided vertical cable managers on each side of this rack.

E. Four post racks: provide three four post racks in the MDF (as shown on the drawings, includes one owner rack, and CCTV/security rack and PA rack). Provide part number AR3105 NetShelter racks by APC . Racks shall include tops, sides and vented front and rear lockable doors. Furnish six AR8005 cage nut packs by APC .

F. Wall rack: In Reception 112A furnish and install 10RU wall mounted rack by middle Atlantic, part number EWR-10-22SD3.The mount shall be pivot style. Provide two 2 in. conduits from the top of rack to above the ceiling. Provide quad power outlet on bottom of rack on wall. Provide two Leviton 49255-L24 24 port patch panels.

1. All racks shall be properly grounded and bonded in accordance with ANSI/TIA/EIA-607. A minimum six AWG green conductor shall be used for grounding. See T2.20.

H. UPS DEVICES

1. Furnish and install in every IDF rack and in every two post and four post MDF rack two 120v30a rack mounted UPS devices, SMART3000RMXL2U by Eaton/Tripp Lite or equal. UPS input cord shall have 10’ L5-30P plug. Connect each to the L5-30R outlets above the racks. UPS shall have one L5-30R output receptacle.
2. Furnish and install network card options in all UPS devices. Part number WEBCARDLXE by Tripp Lite or equal.
3. Furnish and install one SU1500RTXLCD2U UPS with WEBCARDLXE by Tripp Lite or equal in bottom of 112A wall rack.

2.9 CABLE TRAY AND ACCESSORIES

A. Electrical integrator (26 00 00) to provide and install two 120v30a twist lock outlets above all racks, to the bottom of the cable tray at the rear of the racks. Outlets shall be placed at the edge of the cable tray, directly above the back of the racks. No electrical cables shall be run inside the cable tray. Coordinate rear of rack location with architect.

B. 27 10 00 integrator shall furnish and install cable drop outs where cabling drops out of cable tray above equipment racks and enters vertical wire management panels and at plywood backboards.

C. 27 10 00 integrator shall supply and install all cable tray shown on the technology drawings and cable tray from the equipment racks to the plywood backboard if cable tray is not shown on the drawings. Provide 20 in to 24 in. wide, 6 in. deep, with dropout section at plywood backboard. Cable tray shall be within 6 in. above the racks.

D. 27 10 00 integrator shall utilize a two-tier cable tray section above all racks to allow for a neat and orderly cable service loop. Main cable tray below the service loop, directly above the racks, shall be within 6 in. from the top of the racks.

2.10 FIBER PATCH CORDS

A. Furnish and install Single Mode OS2 and Multi-Mode OM4 LC duplex patch cords in the MDF and IDFs for every fiber port cabled, at both ends of the fiber cable (except for far end of pole devices, where the fiber termination directly connects to the Netway device GBIC). Provide 70% in 10 ft. lengths and 30% in 15 ft. lengths.

2.11 OUTDOOR CATEGORY 6A CABLE

A. An outdoor shielded grade Cat6 cable shall be run for each pole mounted camera. See T2.30 & T2.70.
B. Provide lightning suppression for all outdoor copper cabling.
C. Outdoor cable shall be outdoor grade Cat6 gel flooded cable, part number OSP6AU by Belden, 10139885 by Berk-Tek .
D. The electrical integrator shall furnish and install flex conduit inside each light pole from the Netway enclosures up to the camera pendant mount arms for the camera Cat6 cabling. Cat6 shall not be run loose in the poles. Every attempt will be made to separate the power in the pole from the camera cables.

2.12 OUTDOOR CABLE VAULT

A. The cable distributions vault shall be a buried medium duty vault with a polymer concrete cover. Cover shall be secured with penta-head bolts. Carson M-series 36 model 3660-PR, Quazite by Hubbell, Shutter Box Series Grade Level Box by Channel Communications, . A light weight cover shall NOT be used. Load rating of vault shall be T22 with a T22 cover.

B. The conduit system shall connect from various locations as shown on the electrical and technology site plans.

C. The vault shall be a medium-duty, HDPE vault providing cable management and protection of fibers. Carson M-series 36 model 3660-18, Quazite, Shutter Box .

D. Cabinet shall be 3’ wide by 5’ long by 36” deep. Provide extension, Carson M-series 36 model 3660-18X (or extensions by Quazite or Shutter Box as applicable) .

2.13 FIBER OPTIC GEL CLOSURES (Quantity 1, Vault #1, for up to 24 pair OM4 MM fiber)

A. The fibers shall be fusion spliced with a protective sleeve covering (buffer tubing) and stored in an organizer. For each fiber, a minimum of 18 inches of spare coiled fiber in buffer tube is required.

B. All splices shall be housed in a “closure within a closure” scheme, in which the area between the inner and outer closure is totally filled with a re-enterable encapsulating compound.

C. The inner closure shall house and support a splice tray organizer which holds in-place the splice trays. The splice trays shall house a splice block for protected fusion splices. The tray shall be large enough to route the fibers before and after each splice such that there are no detrimental effects to the signal properties at the wavelengths specified for the fiber. Each splice tray shall

have its own cover.

D. The outer closure shall be suitable for a straight, butt, or branch splice and provide a protective housing made to receive an encapsulating compound. The splice case shall be made of thermoplastic, thermoset, or stainless steel material, with structural members as part of the mold (i.e., ribs or waffle structure).

E. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure or any cable part. It shall be fast curing and adhere to surfaces throughout its expansion.

F. The encapsulating compound shall act as a moisture block and shall be safe to the touch and contain no Isocyanates. Dry encapsulant shall not be used.

G. End plates shall be factory drilled to fit the cable(s) outer diameter.

H. Fiber splice box shall be Tyco Electronics Corporation Model FOSC 450, sized as appropriate for vault by ADC or Marconi. Size per fibers shown on T2.60. Provide all accessories and splice trays for a complete installation.

I. Provide uni-strut to secure the enclosure to the sides of the vault above the conduit runs. Provide all accessories required to secure enclosure.

2.14 SPLICE TRAYS

A. To facilitate the transition between outside plant cable and the connectorized cable assemblies, the fibers shall be fusion spliced and protected with a heat shrink protective tubing slid over the splice.

B. The splice shall be held in a splice tray large enough to route fusion splices. The splice block shall be affixed in a splice tray large enough to route fibers before and after each splice, such that there are no detrimental effects to the signal properties at the wavelengths specified for the fiber.

C. Each splice tray shall have its own cover.

D. The splice tray shall be positioned in the fiber optic terminal assembly, and provide a minimum of 18 inches of spare coiled fiber in buffer tube in the patch panel before the splice tray. Attenuation of the fusion splice shall not exceed 0.2 dB. Provide trays and accessories for a complete installation.

2.15 FIBER SPLICING

A. Outside plant fiber splices shall be fusion type and made along the fiber route where indicated.

B. The splices shall exhibit an insertion loss not greater than 0.2 dB.

C. All splice measurements shall be made at 1300 nm, plus or minus 5 nm.

D. All splices shall be mounted in splice trays.

2.16 PROPRIETARY EQUIPMENT FUYL TOWER LOCK N CHARGE

A. Furnish and install four Lock N Charge towers part number LNC3-10439 with network kit part number 10224 in each.
B. Install in locations noted on the floor plans

2.17 NEMA ENCLOSURE FOR WALL PHONES IN GYM

A. At PH locations in the gym, and at the loading dock, furnish and install an Altelix 14 in. x 12 in. x 6 in. NEMA 4x enclosure that is lockable. Green and white label on outside shall read “PHONE”.
B. Install PH faceplate and jack inside this enclosure.
C. Part number NF141206-T01

2.18 RG6 COAX CABLING

A. Furnish and install, as shown on T2.60, rg6 coax cabling from the MDF to the rack in 112A.
B. Terminate cabling with F type radial crimp connectors, leaving 25’ coiled in the MDF, and 10’ coiled in the 112A rack location, above ceiling.
C. Cabel shall be 18awg, have a solid bare copper conductor, and be tri-shielded (foil plus 77% aluminum braid, plus foil shield)
   1. Nominal conductor DCR: 6.4 ohm/1000ft
   2. Nominal outer shield DCR: 4.6 ohm/1000ft
   3. Outer conductor DCR 4.6 ohm/1000ft
   4. Nom. Capacitance conductor to shield: 16.2 pF/ft
   5. Nom impedance: 75 ohm
D. Furnish and install RG6 coax cable by Belden, part number 7915A or equal

PART 3 - EXECUTION

3.1 DISTRIBUTION OF CABLING WITHIN THE SCHOOL

A. Main Distribution Facility: The Main Distribution Facility (MDF) is a dedicated and secured room within the school that will host a major portion of the network equipment. Equipment racks shall be provided in the MDF, which shall support:

   1. Wide area network (WAN) access equipment.

   2. A majority of the local area network (LAN) equipment including the router, switching, and uninterruptible power systems (UPS).

   3. Termination of fiber cabling from IDF(s) and other areas.

   4. Termination of data cabling from MDF service zone workstation jacks.

   5. Termination of voice, WAP and CCTV cabling from MDF service zone workstation jacks

   6. MDF- shall have multiple systems:

      a. Category 6A - Rack Mounted
      b. Fiber Optics - Rack Mounted
      c. Category 6A horizontal voice cabling - Rack Mounted.
      d. Intrusion detection and access control system- rack and back board mounted
      e. Servers- Rack mounted

g. Intra-building communications System Control Cabinet
h. Telecommunications and CATV entrance facilities.
i. CCTV system
j. PA system components

B. Intermediate Distribution Frames: (IDF) are dedicated and secured rooms within the school that will host a satellite portion of the technology infrastructure equipment. two post equipment racks shall be provided as per the drawings in each IDF, which shall support:

1. Local area network (LAN) equipment including the switching, and uninterruptible power systems (UPS).

2. Termination of fiber cabling from MDF.

3. Termination of data cabling from IDF service zone workstation jacks.

4. Termination of voice cabling from IDF service zone workstation jacks.

5. Termination of CCTV cabling from IDF service zone.

6. Termination of PA cabling from IDF service zone

7. Other system equipment if necessary

8. PA system components

3.2 PROTECTION OF SYSTEMS AND EQUIPMENT

Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on sides with securely fastened protective rigid or flexible waterproof coverings.

During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

As determined by the Owner, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Owner shall be final.

Painted surfaces shall be protected with removable heavy kraft paper, sheet vinyl , installed at the factory and removed prior to final inspection.

Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.

3.3 WORK PERFORMANCE

Coordinate location of equipment and conduit with other trades to minimize interference.

Coring, cutting and fire stopping shall be provided by 26 00 00

3.4 ACCESS TO EQUIPMENT

Equipment shall be installed in a location and manner that will allow convenient access for maintenance and inspection.

Working spaces shall be not less than specified in the National Electrical Code for voltages specified.

Where the ARCHITECT and OWNER determine that the Communications Integrator has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the ARCHITECT and OWNER, at no additional cost to the Owner. “Conveniently accessible” is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

3.5 CABLE TERMINATIONS AND DRESS

Installation of signal, video, communication and control conductors shall adhere to the following:

Cables shall be dressed, labeled and tie wrapped in cabinets, racks and/or at cross connect backboard to present a neat, logical and orderly installation. At the discretion of the Communications Integrator, cable duct with removable covers may be installed in equipment cabinets and control consoles to facilitate satisfying this requirement.

Cables shall be secured to equipment cabinet backboards, console members or to other system components using cable clamps and wraps. The Communications Integrator shall furnish and install cable support posts to facilitate system installation.

Cables and conductors shall be terminated with cable termination connectors compatible with the specific termination.

Metallic cables and conductors entering the facility from a point exterior to the building shall be equipped with lightning protection. Protector shall be located at the nearest point of cable entry in the building.

3.6 EXAMINATION

A. Examine pathway elements to receive cable. Check raceways, wire ways, cable trays and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Prior to the start of actual installation, the communications integrator shall review the exact

location of all cables, outlets, and equipment with the Owner, Construction Manager and the suppliers of related equipment.

C. The communications integrator shall coordinate the equipment installation with the installation of raceways, to eliminate potential damage to cables.

3.7 INSTALLATION

A. Wiring Method: Install wiring with J-Hooks (except where cable tray is available). Comply with ANSI/TIA-569-D for conduit sizing not indicated on Contract Drawings. Do not exceed the manufacturer's minimum bend radius. Comply with requirements listed in STELL DECKING specification (see related work section of this specification). The horizontal system cables shall be run using a star topology format from the MDF and/or IDFs rooms to the technology outlets as shown on the technology drawings. The length of each individual CAT 6A cable run between patch panels in the MDF and IDFs to each technology outlet or termination shall not exceed 300 ft. Cables may be routed through rooms and other spaces in the event that cable routing through main hallways negatively affects the requirement that the length of each individual cable run not to exceed 300 ft. (90m) (terminated end to terminated end). Cabling which deviates from the main pathways shall be identified on the floor plans by the communications integrator.

B. Install components as indicated, according to manufacturers' written instructions. Use techniques practices, and methods that are consistent with the Category 6A rating of the components and that assure Category 6A performance of completed and linked signal paths, end-to-end.

C. Install cable without damaging conductors, shield, or jacket.

D. Do not bend cable in handling or installation to smaller radii than minimums recommended by manufacturers. Maintain recommended manufacturer's minimum bend radii of all UTP and fiber optic cabling at all times.

E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously where more than one is being installed in the same raceway.

2. Use "thin film" pulling lubricants only. It has been shown that lubricants will affect testing as the cable needs several weeks to dry before attenuation levels recover.

3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

F. Install exposed raceway parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

G. Secure and support cable at intervals not exceeding 30 in. and not more than 6 in. from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

H. Wiring within Wiring Closets and Enclosures: Provide adequate length of conductors. Train the conductors to terminal points with 24 in. extra cable neatly looped and secured properly. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to radii smaller than allowed.

I. Separation of Wires: Comply with ANSI/TIA-569-D rules for separation of unshielded copper voice and data system cables from potential EMI sources, including electrical power lines and equipment and NEC Article 800-S2.

J. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

K. Cables for data and voice shall be installed and terminated exactly as shown or described in the manufacturer's instructions.

L. Standards for each type of cable are very specific. Cable length, the bending radius of each turn, cutting back the sheath, length of untwisting and termination of the individual wires, stripping of the insulation displacing connections to the push-on terminals shall be performed strictly per manufacturer's instructions and any applicable standards.

M. Work area communications outlets shall be installed as shown on walls, floor or ceilings.

N. Jacks shall be installed as depicted on technology detail plans. Questions or discrepancies shall be reported to the owner.

O. Devices installed in the school will be of the same "Type and Manufacture".

P. All cables shall be routed in large groupings, through main hallways, until cable can be distributed directly to the communication outlet. Route individual cables to the appropriate outlet locations in accordance with all standards described herein.

Q. In suspended ceilings and corridors cable shall be bundled by type using Velcro cables ties snug, but not deforming the cable geometry and be supported via approved "J" style hooks attached to the existing building structure at a maximum of 4 ft. intervals. Use of ceiling tiles, grid or hanger wires for support of cabling is prohibited. Use of plastic 'zip' ties are prohibited.

R. Do not install random or diagonal cable runs except for the reasons specified in item A above. Cable turns and bends shall be made at 90-degree angles whenever possible, but maintaining manufacturer's requirements for bending radius at all time.

S. All cables, which enter conduit stubs of technology outlets in fixed wall locations, shall be installed with a minimum of a 3 ft. service loop of cable secured above the ceiling where the cable enters the conduit at each outlet. A 3 ft. service loop of cable shall also be provided in the cable tray above the data patch panel racks. Provide a service loop of cabling for each cable installed above the ceiling

T. All cables which penetrate a steel stud or steel wall cap, wall section and where a cable enters a conduit shall be protected from damage with a "stud liner".

U. All cables entering power poles, surface mounted raceway, or other cable management systems shall be protected from damage.

V. Cabling shall be extended between floors utilizing inter-floor conduit provided under 26 00 00. See network riser drawing for cable pathways.

W. Conduit and sleeves provided as a means of routing cables between various rooms and floors, and those which remain (empty) as spare, shall be sealed with an approved fireproof, removable safing material. Sleeves, which pass vertically from floor to floor, shall be sealed in a similar manner using an approved re-enterable system. Additional penetrations through rated assemblies necessary for passage of wiring shall be made using an approved method, coordination with the General Contractor and permanently sealed after installation of cables.

X. Meet all requirements regarding use of cable in return air plenums (SEE 1.3.C. above) and in raised floor systems. Provide wiring that complies with all applicable state, local building codes, and the National Electrical Code. All cables run in raised floor systems with forced air-cooling shall meet the requirements of Article 645, “Electronic Computer Data Processing Equipment” of the NEC.

Y. Cables installed partially or fully within the MDF and IDFs are to be routed through and secured in the cable tray wherever possible. Cables placed in the cable tray are to be laced or tie wrapped with Velcro tie wraps frequently to keep them neatly bundled and not permitted to shift from one side of the tray to the other as they are routed in the tray.

Z. Provide one voice station cable (Cat6A) from the MDF (home run) to EACH elevator equipment room. Route cable to elevator control cable termination in elevator equipment room as noted on drawings. Leave 30 ft. of slack for connection by integrator responsible for the elevator phone connection. Terminate, label and crosswire elevator phone and connect cable to the line provided by Local Exchange Carrier. Verify proper room and location with elevator integrator.

AA. Secure all equipment racks with threaded rod to cable tray (if installed) above racks.

3.8 GROUNDING

A. Installation

1. The communications integrator of this section and the electrical integrator shall provide grounding and bonding in accordance with the requirements of NFPA 70, IEEE 142, EIA/TIA 568, EIA/TIA 607, state and local codes, and to requirements specified herein. Codes shall be complied with as a minimum requirement, with qualification standards prevailing when they are more stringent. See T2.40 for delineation of grounding work and for parts, equipment and materials required.

B. Bonding

1. Metallic conduits, wireways, metal enclosures of busways, cable boxes, equipment housings, all racks and all non-current carrying metallic parts of the installed communications services shall be grounded. The metallic conduit system shall be used for equipment and enclosure grounding but not as a system ground conductor. A code sized green insulated copper grounding conductor shall be included in nonmetallic conduits, and each end shall be terminated on suitable lug, bus, or bushing.

2. All conduit stub-ups shall be grounded, and where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.

3. Each metallic raceway, pipe, duct and other metal object entering the buildings shall be bonded together and all conduits entering the building shall be labeled. The communications integrator shall use #6 AWG copper conductors.

4. The communications integrator of this section shall bond communications equipment and busbars separately.

5. The electrical integrator shall install the main telecommunications grounding bus bar in

accordance with T2.40 details.

C. Signal Reference Grounding and Bonding

1. Each identified communications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:

a. Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of TIA 607-C. The communication ground shall not ground any other equipment or be connected to any potential high voltage source. All racks, frames, drain wires, and all installed communication equipment shall be grounded to this common reference ground only.

b. Communications integrator of this section must provide, as a minimum, a continuous #6 AWG green electrical conductor connected to a ¼ in. x 4 in. x 5.25 in. telecommunications grounding bus bar (TGB) 6 in. AFF on the plywood backboard of each IDF to terminate chassis, racks, and other equipment grounds, unless otherwise specified.

c. The ground wires from each individual IDF shall be routed directly to the main telecommunications ground bus bar in the MDF room, terminated and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum ¼ in. x 4 in. x 12 in. dimensions. This point of single reference for all closets in a building shall in turn be grounded with a minimum #0 ground conductor to an acceptable building ground of five ohms or less. An acceptable building ground for signal reference is the building service entrance ground. Electrical integrator must supply the grounding bus bar.

D. Riser / Tie Cabling Grounding

1. There shall be no bonding between the entry cable and the inside riser or distribution cable.

2. All riser and tie cable shields shall be bonded into a single continuous path end-to-end and grounded on each floor in which pairs leave the sheath. Cable shields shall be grounded to the signal reference ground provided in each telecommunication space.

E. Field Tests

1. As an exception to requirements that may be stated elsewhere in the agreement with the District, the Inspector shall be given five working days' notice prior to each test. The communications integrator of this section shall provide all test equipment and personnel and shall provide written copies of all test results.

2. Grounding and bonding system conductors and connections shall be inspected for tightness and proper installation.

3.9 CLEANING

During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by telecommunications work.

Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible

current carrying elements prior to being energized.

3.10 COMPLETION

General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Testing, start-up and cleaning work shall be complete.

Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.11 TESTING AND ACCEPTANCE CRITERIA

A. Fiber Optic Cabling

1. Scope of Certification Testing

a. Each fiber optic data cable and associated outlet/connector shall be 100% identified and tested. It is the responsibility of the communications integrator of this section to ensure the design/equipment provided/methods used provides acceptable total link loss to ensure a high performance 10GB backbone.

2. Certification Tests

a. At a minimum, provide the results from the following performance tests on all installed fiber optic data cabling as outlined in ANSI/TIA/EIA-568-B.3-2000, along with the respective addenda, ANSI/TIA/EIA 526-A and TIA 568-B.1. MM fiber shall be tested at 850nm and 1300nm in accordance with ANSI/TIA/EIA 526-14A method B and SM fiber shall be tested at 1310nm and 1550nm in accordance with ANSI/TIA/EIA 526-14A method A.1

b. Record all fibers length and total attenuation

c. Note that all of these tests are required for each strand of the fiber optic data cable.

d. In addition to these, any performance tests required by the cabling product vendor for issuing and honoring the required 15-year warranty must also be performed.

e. Approved accuracy testing equipment must be used for all tests.

B. UTP Cabling (Data/Voice/WAP/CCTV, Other)

1. If cable manufacturer requires field AXT testing for its Cat 6A solution/warranty, Communications Integrator is to test to the TIA-568-C.2 and TIA 568-C permanent link testing standards and the following requirements within this specification.

2. Test each Permanent Link cable drop for full Category 6A compliance with ANEXT exception as noted. Cabling systems shall meet or exceed the electrical and transmission characteristics of the systems specified.

3. Cable segments and links shall be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

4. The system shall not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.

5. After the installation is complete, in addition to any other required testing as described herein, and at such times as the Owner/Engineer directs, the communications integrator shall be present while the Owner conducts an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at the communications integrator's expense and the tests performed again.

6. After review of the completed test results, the Owner reserves the right to retest cables, utilizing the communications integrator's tester and the communications integrator's labor.

7. Alien Crosstalk Testing Preparation:

   a) Alien Crosstalk (AXT) testing measures the unwanted noise coupled to the cable being tested (called the "Victim" or "Disturbed") by six surrounding cables (called "Disturbers"). Two tests need to be performed: the Power Sum Alien Near-end Crosstalk (PSANEXT) test and the Power Sum Alien Attenuation-to-Crosstalk Ratio, Far-end (PSAACRF) test. Results for the remaining AXT tests are taken as part of these two, so although they are not directly provided, a "pass" result for PSANEXT and PSAACRF ensures passing results for AACRF, AFEXT, ANEXT, and PSAFEXT. A 2% sample of the installed cables is typically recommended: testing the longest cables in the installation will provide the most meaningful results.

   b) AXT testing requires special planning, equipment and training:

      1. AXT tests are time consuming. Budget AXT test time into the project bid.

      2. Handheld test instruments (field testers) require an adjunct AXT module.

         3. A laptop computer is also used with the field tester.

         4. The field tester's AXT application software must be loaded onto the laptop.

         5. Installation personnel will require training prior to performing AXT testing.

8. Field Testing Equipment: Submit during shop drawing review on the testing equipment to be utilized on this project. The communications integrator shall test all cables installed under this Section.

   a) Category 6A Testing Equipment:

      1. Testing shall be accomplished using a UL Level IV field tester capable of testing to 500 MHz. Ensure that the tester has any necessary hardware or software upgrades, including AXT testing capabilities for testing Cat 6A installations.

      2. Provide factory calibration report of field test equipment.

9. Testing Procedures:

   a) Testing shall conform to the TIA 568-C.2 standards.

   b) Testing will be to the Permanent Link Test Parameters.

c) For ANEXT A 2% sample of the installed cables is typically recommended: testing the longest cables in the installation will provide the most meaningful results.

d) Tests shall be based on each pair of conductors and not the aggregate multiple pair results.

e) Test cable segments end-to-end, from the telecommunications room horizontal patch panel/cross connect block panel to each work area outlet and from each telecommunications room backbone patch panel/cross-connect block panel to respective main cross connect, and from the work area outlet to the main cross-connect (through patch cables or cross- connect wiring) with a Signal Injector, Graphical Link Testing Meter and Time Domain Reflectometer (TDR) for compliance to latest TIA performance requirements.

f) Provide report indicating failures and what actions were taken to ensure a passing horizontal cable and its terminations. Any cable failing the certification test (Fail, Fail* or, Pass*) must have remedial work done to provide a full pass test result; Remediation may include re-termination or replacement of the cable, which fails. No cables passing within tolerance only (Conditional Pass*) will be accepted. Remedial work shall be at no cost to the Owner.

C. Test Plan

1. All test equipment, test procedures, and testing techniques shall be specified in the acceptance test plan and will require approval prior to execution. All test equipment shall indicate a current manufacturer calibration.

2. Tests shall be conducted by the communications integrator of this section in accordance with the approved Test Plan.

3. The purpose of this testing is to verify that the installed system meets all specified attenuation and bandwidth requirements and is capable of being used for its intended purpose.

4. Test results shall be submitted for approval. Manufactured or assembled products or equipment shall be tested as indicated, and the results submitted to the District's technical representative for approval, prior to shipment to the site.

5. The communications integrator of this section shall prepare a test plan which provides a detailed outline of all testing to be accomplished.

6. The test plan shall include, as a minimum, a schedule of when tests will be performed (relative to installation milestones), specific test procedure that will be used, a list of test equipment that will be used (manufacturer, model number, range, resolution accuracy) and shall conform to the specified requirements of other sections of this specification.

D. Test results:

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.

2. Test results saved by the tester shall be transferred into a Windows based database utility that

allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

3. Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).

4. Test Results shall include the following:

   a) Applicable room number of jack location (room number per Contract Documents)
   b) Applicable Telecommunications Room number
   c) Circuit I.D. number with corresponding jack identifier
   d) Wire Map – shall include the following:
      1. Continuity to the remote end
      2. Shorts between any two or more conductors
      3. Crossed pairs
      4. Reversed pairs
      5. Split pairs
      6. Any other miswiring
   e) Length
   f) Insertion Loss
   g) Near-end Crosstalk (NEXT) Loss
   h) PS-NEXT (Power Sum Near End Cross Talk)
   i) FEXT (Far End Crosstalk)
   j) ELFEXT (Equal Level Far End Cross Talk)
   k) PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)
   l) Propagation Delay
   m) Delay Skew
   n) Return loss
   o) PSFEXT (Power Sum Far End Crosstalk)
   p) PSACRF (Power Sum Attenuation to Crosstalk Ratio, Far End)
   q) AACRF (Alend Attenuation to Crosstalk ratio, Far End)
   r) AFEXT (Alien Far End Crosstalk)
   s) ANEXT (Alien Near End Crosstalk)
   t) PSANEXT (Power Sum Alien Near End Crosstalk)
   u) PSAACRF (Power Sum Alien Attenuation to Crosstalk Ratio, Far End)

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Section 27 40 00

AUDIO - VIDEO COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of a Contract, including conditions of the Contract and Division 1 of the Specifications, shall apply to the Work in this Section.

B. Drawings and general provisions of the Contract, including all portions of the Project Manual are hereby made a part of this Section. Refer to paragraph titled “Quality Assurance” in this section and to Division 1 for requirements for contractors. Throughout this and related Sections, “Integrator” shall not be limited to the singular and masculine and shall refer to one, or more than one, Communications Integrator. The Terms “Integrator” “Communications Integrator” and “Communications System Integrator “shall be used interchangeably and shall be understood to represent the communications integrator contractor responsible for the furnishing, configuring, testing, programming, warranting and for ensuring all work is performed in accordance with manufacturer’s requirements and recommendations for the work identified in this SECTION.

C. Any qualifications or certificates required in this specification may be requested by the Architect as part of the post-bid qualifications review. Such review shall commence subsequent to the bid submission, as none of this information is required as part of the bid submission. In the event that the Architect requests qualification or certification documentation such documentation shall be provided within three business days.

1.2 SUMMARY

A. Work Included. The scope of work of this Section consists of the installation, and programming of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances and services necessary and/or incidental to properly complete all work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Architect and Owner, as being required and in general, is as follows:
   1. Classroom 75 in. interactive flat panel display, with OPS PC board and wireless options. All wall mounted interactive displays shall have a height adjustable wall mount. The top height shall be 6 ft.-6 in. above finished floor (aff), with display moving down from that maximum height until the top of the display is at 5’-3” aff.
   2. Conference rooms and Media Center (multiple Media Center locations): interactive flat panel displays with adjustable wall mounts, OPS boards and wireless options.
   3. Presentation cameras in classrooms if Alternate 8 is selected. Otherwise, no presentation cameras are to be provided.

4. The following faceplate (See T2.10) cabling, terminations and installation responsibilities are part of this section: TCVL, V1, V2, V3, S3, and all E1 & E2 blank faceplates as detailed on the drawings, A (attenuator in room 410 and hallway C400A detailed below) and any other faceplate and cabling reasonable inferred to be for audio or video signals.
5. Various cabling termination for systems to include low voltage wire for complete and functional systems.
6. HDMI and USB over twisted pair transmitters and receivers where specified (V3 locations), and HDMI and USB active cables where specified (V1 locations). HDMI transmitter and receiver and cabling where specified (V2 locations). All HDMI/USB & HDMI transmitters shall be powered from the receiver end.
7. All low voltage cable shall be one continuous run. No splices are permitted. All twisted pair cabling for transmitters and receivers shall be shielded.
8. T2.10, T2.20, & T2.60 equipment, related work, cabling and other equipment/components required for design intent unless noted otherwise on those drawings.
9. All ceilings on RCPs that are to be black shall have the speakers provided in this section black.
10. Any exposed ceilings where system components are installed require back boxes to surface mount the components or speakers.
11. Coordination with 271000 and electrical contractor and general contractor to develop elevations for back box locations and heights behind displays, clearly showing mounts. Coordinate with general contractor for blocking required for display mounts in all locations. Approval by the architect is required when proposed back box locations and blocking type and size are determined.
12. Any cabling traversing above or between open and above open grid type ceilings, shall be fully wrapped in black nylon wrap (or a color matching the exposed ceiling in the area), covering the cable color.
13. Two 75 in. interactive display on carts with OPS PC and wireless options for Gym use.
14. Wavecast unit in fitness center for owner provided displays audio to be presented on wifi.
15. Amplifier, attenuators and speakers for distributing sound from 310 to the hallway on floor 4 and room 410.

B. Actual control room and rack layouts will be based upon the specific equipment submitted by the communications integrators. Needs for audio processing equipment, specific speakers, and other equipment will be dependent on actual product manufacturers and communications integrator's submittals. Communications integrators shall coordinate room layout, actual speaker and equipment placement, programming options, and control panel screens with architect prior to installation.
C. Provide and install:
   1. Assembly and setup of the systems for normal operation, testing, and training of operators and users.
   2. All sound system speakers shall include brackets, T-bars, and rigging hardware necessary to mount speakers in their specific applications.
   3. All labor, programming, tuning, cabling, terminations, and system configuration.

1.3 RELATED WORK SPECIFIED ELSEWHERE
A. All Sections of Division 27.
B. SECTION 05 31 00 – STEEL DECKING See section for restrictions concerning the hanging of material, cable tray, mounts, brackets, hooks, and other items from the roof or decking.
C. The following related work or material shall be provided under the designated trades

and under the listed SECTION:

1. SECTION 11 52 13 - PROJECTION SCREENS
2. SECTION 12 30 00 - MODULAR CASEWORK
3. SECTION 26 00 00 - ELECTRICAL All electrical work related to items in this Section
4. SECTION 11 61 00 – THEATER EQUIPMENT For sound systems and presentation equipment in auditorium, gym, band, chorus, and student commons.

1.4 SYSTEM DESCRIPTIONS

A. Basis of Design Equipment: Currently established systems within the district at various school locations are shown below, and drawings and specifications have been based on the following products:

Manufacturer:	Item:	Part Number:
Lightspeed	TOPCAT Voicelift System	TCN
Lightspeed	Media Connector	MCN
OkioLabs	Presentation Camera	OkioCam T Plus
Promethean	Interactive Displays	ActivPanel Nickel

B. Classrooms - Typical: Classrooms locations shall be equipped with 75 in. interactive flat panel display equipment, and a voice lift system with media connector. System includes height adjustable wall mounted 75 in. interactive flat panel display and ceiling mounted Topcat base station. Band and Chorus rooms shall also have a 75” interactive displays and voice lift system with media connector. Desktop and laptop computers will be provided by owner prior to system acceptance.

C. Interactive Conference Rooms and other small group spaces- Typical: Interactive Conference Room locations shall be equipped with a 65 in. (or 75 in. interactive flat panel if noted or shown on the schedule) interactive display. Desktop and laptop computer will be provided by owner prior to system acceptance.

D. Media Commons: Media Commons 213, 313 and 415, shall be equipped with 75 in. interactive flat panel displays. Room 415 shall also have a voice lift system, and media connector.

E. Fitness Center Wavecast device

F. Audio distribution from 310 to 4th floor hallway and room 410.

G. Voicelift audio output in Band and Chorus to the room’s theater system audio input.

H. Coordination: Coordinate device locations with furnishings and equipment.

1.5 SUBMITTALS

A. Architect may require submittal submission within 90 days of bid award. Submit the following as part of the submittals.
   1. A list describing at least five installations comparable in scope and nature as specified. Include the name, current position, address, and telephone number of a representative of each installation owner.
   2. Provide a listing of test equipment including a list showing procedures and service contacts.
   3. A complete list of quantities, including materials, components, devices, and equipment required for the Work. Tabulate the list of quantities for the components of each system as specified, and provide the following information for each item listed:
      a. Quantity.
      b. Description.
      c. Manufacturer’s name and model number.
      d. Corresponding specification section and article number.

Non-tabulated and indexed submittals shall be returned without action.

4. Corrected items as applicable for resubmitted, as specified above.
5. Complete, comprehensive, single-line diagrams in computer aided drafting (CAD) format including equipment, devices, connectors, wiring, and wire numbering completely identified. Include label designations and locations. One-Line signal flow drawings shall be submitted with specific equipment bid.
6. Complete, scaled (1 in. = 1 ft. minimum) in CAD format, equipment rack elevation drawings, including equipment designation, manufacturer's name, model number, rack location, and rack designation, and sample touch screen layouts for the integrated control systems.
7. Complete catalog cut sheets and manufacturer's literature.
8. Elevation drawing clearly showing teaching wall interactive display, mount, and blocking requirements. This will be used to determine back box locations behind the displays. Clearly show voicelift medica connector wall mounted behind display footprint, positioned to allow the use of the front buttons on the media connector while standing to the side of the display

B. Closeout Submittals:
1. Copy of FCC license for Hearing Assistance System FM transmitters.
2. Copy of certificate of cables complying with fire retardant requirements.
3. Closeout Submittals: Submit as-built drawings to the Architect.
4. Owners/Operations manuals for all installed equipment. Provide on a USB drive.
5. Updated one line system flow diagrams.

1.6 QUALITY ASSURANCE

A. Manufacturers' Requirements:
1. Manufacturer's products shall have been satisfactorily used in similar service for a minimum of three years.

B. Integrator Qualifications:
1. A firm with a minimum of five years successful installation experience similar in scope with this project.
2. Integrator shall be primarily engaged in the procurement, design, installation, and maintenance of commercial duty audio and video systems. Integrator must be certified by the manufacturer to procure, install, configure, program and warrant the equipment.
3. Integrator must hold a valid CTS-D Certification from the International Communications Industries Association.
4. Integrator installing technicians must hold a valid CTS-I Certification from the International Communications Industries Association.
5. Integrator installing technician shall be certified by the video and audio control system manufacturer if programming of control equipment is required.
6. Integrator must provide a CTS Certified project manager that provides weekly progress reports to owner on installation progress, attends job meetings, and visits the site at least weekly during equipment installation.
7. In order to ensure the Integrator can provide the Owner with readily available and qualified service through the installation and three-year warranty period, the Integrator must maintain CTS Project Managers, CTS-I technicians, and CTS-D technicians as full time employees of the bidder.

C. Code Compliance: Comply with national, state, and local electrical and structural codes as applicable to installation and construction of the sound reinforcement system.
D. Provide equipment listed and labeled by Underwriters Laboratories (UL).
E. All wiring shall be in conduits.

1.7 WARRANTY

A. Communications integrator shall warrant all work free from defects in materials and labor for 36 months from the date of owner acceptance of the systems, not from the date of substantial completion. Provide minimum three year parts and labor warranty for all systems/components.
B. The manufacturer or communications integrator shall repair or replace malfunctioning products at no expense to the Owner, except failures caused by damage or unreasonable use.
C. Communications integrator shall maintain regular service facilities and provide a qualified technician familiar with the work at the site within 24 hours of receipt of a notice of malfunction, excluding weekends and holidays.
    1. Provide material, devices, equipment, and personnel necessary for repairs.
    2. Provide accepted temporary, alternate equipment, if required by the Owner, complete and operational within 48 hours after notification of malfunction, at no additional cost during the first year of warranty.
D. Communications integrator shall conduct warranty repairs and service at the project site unless prohibited by manufacturer's warranty. If the latter, communications integrator shall provide substitute systems, equipment, and devices acceptable to the Owner for the duration of the off-site repairs. Replace items out of service more than 10 days with new equipment during the warranty period.
E. Communications integrator shall transport warranty equipment, substitute systems, test systems, equipment, devices, materials, parts, and personnel to and from the project site at no additional cost to the Owner.

1.8 DELIVERY, STORAGE AND HANDLING
A. Handle equipment components carefully to prevent breakage, denting, and scoring the finish.
B. Do not install damaged equipment. Replace and return damaged units to equipment manufacturer.
C. Store equipment in a clean, dry space, in original cartons and protect from dirt, physical damage, weather, and construction traffic. Protect electronic components from dust debris and water.

1.9 OWNER'S INSTRUCTION
A. Provide on-site training to the Owners personnel and technical staff on the use of the audio/visual systems. Training shall be broken down in one or two hour sessions. Coordinate each training sessions and the length with owner. 16 hours minimum for interactive and voicelift equipment.
B. All training shall be video recorded by the communication integrator of this section and provided to the owner on USB drives.
C. Provide digital copy of the manual service books. Provide a full parts list of all equipment delivered.

1.10 MAINTENANCE
A. Manual: Prepare and submit, before acceptance testing, copies of an operations and maintenance manual, neatly bound, indexed, and tabulated. Provide three copies for the Owner's use. Manual shall include:
    1. Basic power on/off and operational procedures.
    2. Manufacturer's service literature for each major system component.
    3. A copy of the verification test report.

PART 2 - PRODUCTS

2.0 Basis of Design Equipment

A. Currently established systems within the district at various school locations are shown below. Drawings and specifications have been based on the Promethean interactive display products, the Lightspeed products and OkioLabs products listed below:

Manufacturer:	Item:	Part Number:	Quantity
Lightspeed	TOPCAT VoiceLift	TCN	See T2.60
Lightspeed	Media Connector	MCN	See T2.60
OkioLabs	Presentation Camera	OkioCam T Plus	See T2.60
Promethean	Interactive Display	ActivPanel Nickel	See T2.60

2.1 Interactive Locations (See T2.60 Schedule for quantities of equipment specified below). Furnish and install equipment listed below:

A. General:
1. Refer to riser diagrams and schedules on technology drawings. Communications integrator must provide all cabling cross connections unless noted otherwise on the drawings.
2. This specification is designed to define the desired operating criteria and suggested equipment. Communications integrator shall provide a fully operational system including labor, materials, and equipment.

B. Capabilities: The system shall provide the following capabilities:
1. An interactive flat panel display that is mounted on the teaching wall of the classroom or space, which can interact with the teacher's laptop connected to an HDMI and USB face plate near the teaching location within the room. The laptop computer is not part of this specification. Furnish and install a height adjustable wall mount at each location. Display shall adjust from a top of display at 6 ft.-6 in. to top of display at 5ft. - 3in.

C. Products:
1. 65 in. Interactive flat panel displays & 75 in. Interactive flat panel displays (two 75" are on carts for the gym, see below). Furnish and install with height adjustable wall mount, at D3/E2 locations in each room listed on T2.60).
   a. Provide and install an interactive flat panel display, to include height adjustable wall mount.
   b. Provide all necessary mounting hardware for all wall surfaces.
   c. Panel shall be physically aligned square and plumb on the wall. All other manufacturer's installation parameters shall be met.
   d. Furnish and install cables to connect display LAN port (Blue Cat6A patch cords) to D3 faceplate behind panel.
   e. Provide programming of IP addresses for LAN interface and wireless module in panel. Coordinate with owner.
   f. Communications integrator of this section shall register each panel with manufacturer on behalf of the owner (this does not release the communications integrator of this section from the 36 month warranty specified above).
   g. Furnish and install in every panel an OPS-M PC board. Every panel shall include a wireless module.
   h. Panel shall be the Promethean Nickle series or equal. All displays shall include a height adjustable wall mount, wireless module and OPS-M PC Board. Furnish and install two manufacturer recommended carts for two of the 75" displays listed on T2.60 for gym use.
2. V1 faceplate, USB Active cable, HDMI active cable. See T2.60 for quantities. Provide each at every V1 location.
   a. USB Active cable shall be installed in V1 faceplate, routed through conduit connecting V1 to E2, and connected to interactive input of interactive

displays. USB type B behind display, type B at V1 faceplate.
b. HDMI active cable shall be installed in V1 faceplate, and routed through the same conduit. Connect to interactive display input.
c. USB 39 ft. center boost cable part number 38998 by Cables to Go
d. Pass through wall plate for V1: part number 39874 by Cables to Go
e. HDMI active cable, 35 ft., high speed with Ethernet, 4k, in wall CL2-rated part number 50634 by Cables to Go

3. Empty back box behind panel- furnish and install at each E2 location a dual decora brushed pass through face plate on the back box provided by electrical integrator. Similarly, at each E1 back box furnish and install a single decora style brushed faceplate.
4. At V3 locations (see T2.60 for quantity), furnish and install a DigitaLinx HDMI HDBaseT wall plate extension Set with USB part number DL-1H1A1U1C-WPKT-W by Liberty AV Solutions, . Furnish and install Cat6 F/UTP (foil shielded) cabling between transmitter in wall box and receiver at display. Velcro receiver to back of display bracket. All extra cabling shall be pulled up into the ceiling. Coordinate floor box size required for solution with electrical integrator.
5. Cabling at each location – See technology drawings. Provide and install:
   a. All HDMI cabling required.
   b. Audio cable from interactive panel audio output to voicelift input behind display. If amplifier is also included behind display, furnish and install audio output from voicelift to amplifier input. In Band and Chorus rooms, furnish and install 3.5mm audio output from voicelift to theater rack audio input in room.
   c. Blue Cat6A patch cords from Interactive flat panel and OPS-M to D3.
   d. Any other cabling required for a complete and operational system

2.2 V2 Faceplate and Cable. See T2.60 for quantity. Furnish and install at each location the listed items below:

A. For the wall plate, furnish and install Decora faceplate and a Crestron (or equal) HD-TX-4KZ-101-1G-W. Use shielded Cat6 cable from unit to receiver at display (see below).

B. The receiver shall be installed on the wall behind the display. The receiver shall power the faceplate transmitter. Power will not be provided or installed at the transmitter. Furnish and install (including HDMI cable to display) a Crestron (or equal) HD-RX-4K-210-C-E. This unit shall power the faceplate transmitter. Cat 6 shielded twisted pair shall be LANmark-6 FTP Plenum by Berk-Tek or equal.

2.3 Green Screen Touch Display– provide the following commercial 4k touch display at the location shown in corridor C103. Connect display and PC board to D2 behind display location.

A. Furnish and install 55 in. touch display, 4K UHD native resolution commercial grade part number M551-PT by NEC or equal. Include Raspberry Pi Compute Module 4. Provide and install low profile wall mount. Provide and install blue Cat6A patch cords to data outlet behind display for the display jack and Raspberry module. Display shall be rated for 24/7 operation, include 3 year manufacturer warranty, and have a minimum brightness of 500cd/m2.

B. Display must have hotel mode or provide Ethernet or RS-232 cabling and devices to lock out front panel buttons. Display must allow speakers in displays to be turned off. Display requires security latching mechanism to prevent the intentional or accidental removal of the display from the mount.

2.4 TOPCAT Voicelift Systems. Furnish and install at locations shown on T2.60 the following equipment: TCN ceiling mounted TOPCAT unit, a Flexmic, a Sharemic, and an MCN Media Connector (mounted to wall behind display. Furnish and install an audio cable to connect

audio output of display to MCN).

A. In addition to the equipment above, in room 310 also furnish and install an ATLONA AT-Gain-60, on the wall behind the display. Furnish and install audio cable to connect audio output of Media Connector (also mounted behind display) to this amplifier and connect speakers and volume controls shown on T2.20 to amplifier outputs. Furnish and install three speakers, JBL part number CSS8018 tapped at 10w. Install one speaker at S3 location in C400A. Furnish and install AT-35 volume attenuator at A location in corridor overlooking room 310 to individually control the volume at this speaker. Furnish and install the remaining two speakers in room 410. Furnish and install another AT-35 volume attenuator at A location to individually control the volume to this pair of speakers. Intent is for audio in room 310 to be heard and the volume adjusted in C400A and room 410.

B. Install page over ride cabling to all TOPCAT units. Electrical contractor shall install hard wired power to all units. Coordinate page override signal with 27 50 00 communications integrator. 275000 integrator shall provide signal and cable to TOPCAT system.

2.5 Furnish and install a Wavecast WF T8 unit and 1RU wall mount bracket in fitness center. Install unit in 1RU wall mounted bracket behind owner provided 75” display footprint. Cable each 75” owner provided display audio output in fitness center to the Wavecast unit such that each display is a channel on the WiFi audio in the room. Label wifi streams accordingly after displays are labeled and numbered. Connect Wavecast to data jack behind display. Furnish and install Cat6A blue patch cord to Wavecast unit. Leave audio cables coiled 6’ at owner display locations.

2.6 Audio Visual Cabling

A. General:

1. The following types of signal cables shall be used on this project:
   a. #24 AWG Audio Microphone Cable
   b. Audio Wire / Speaker Cabling #14 AWG for Speakers
   c. 4-Pair Cat 6 for equipment controls and video transmission – Gray

2. TERMINATION HARDWARE: The following types of connectors shall be used on this project
   a. XLR Connectors- 3 Pin (microphones, if required)
   b. Category 6 Data Jacks, (must be Gray) Panduit Mini-Com series, Siemon,
   c. F Type Connectors (if required)
   d. 3.5mm Connectors
   e. USB connectors (if required)
   f. HDMI connectors and pass thru keystone connectors

B. Category 6 Cable 4-Pairs- Equipment Controls

1. The Category 6 cable shall use the color code indicated below:
   a. All Category 6 cable for Equipment Control shall be Gray.
   b. Colored tape may not be used to re-identify jacket color.
2. The cable shall be composed of 23-gauge bare solid copper conductors bonded pairs, ripcord. Cable shall be insulated with a marked (every 2 ft) polyethylene vinyl chloride jacket. There shall be no shield required in the sheath.
3. Each sheath shall contain 4 unshielded copper twisted pairs. Each pair shall have a different twist ratio per foot ranging from 12 to 24 twists per foot.
4. All Category 6 cables shall meet or exceed the following criteria:
   a. Testing shall be in accordance with procedures in the 271000 section referenced standards unless otherwise stated.
   b. All cables shall meet, as a minimum, the requirements of:
      1) CSA
      2) NEC

3) UL444
4) ANSI/TIA/EIA-568-B Category 6
5) ISO/IEC 11801 Category 6

c. Factory splices of the insulated wire are not allowed in any portion of the cable, Butt-welded conductors prior to insulating are permitted.

5. HDBase-T - The cable shall meet the manufacturer of the HDBase-T equipment minimum standards. Use manufacturers recommended cabling where appropriate, plenum rated, and shielded.

2.7 Termination Hardware

A. Modular 8 position modules: (Equipment control)

1. Termination hardware shall be designed with an integral locking mechanism, which upon insertion of a modular plug provides maximum pullout strength at the plug/jack interface.
2. All modular 8-position jacks shall be RJ-45, T 568B wired.
3. The jacks shall meet or exceed the following standards:
   a. ANSI/TIA/EIA-568-B.2-1 Commercial Building Telecommunications Cabling
   b. Standards, Category 6
   c. IEC 60603-7
   d. FCC Part 68, Subpart F
4. The modular jacks shall meet the following electrical performance and certification requirements:
   a. The modular jacks shall meet all ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standards and ANSI/TIA/EIA-568-B.2
   b. Near End Crosstalk (NEXT) and Attenuation measurements shall be made per ANSI/TIA/EIA-568-B.2-1 and ANSI/TIA/EIA-568-B.2.
5. The modular jacks shall meet the following requirements:
   a. Connector-insulation displacement connectors shall be capable of accepting 24 gauge AWG solid conductor wire.
   b. Terminated in accordance with EIA-568B specifications.
   c. Data and Voice jacks shall be RJ45 (must be gray).
   d. In addition to complying with the above listed standards, all Category 6 termination hardware shall meet or exceed the following criteria: ANSI/TIA/EIA-568B.2-1,ISO/IEC 11801, IEC 60603-7, FCC Part 68 Subpart F
6. The jack shall be approved to work in all applications up to 100 Mb/sec, including, but not limited to 100 Mb/sec TP-PMD (100 meters over UTP, per ANSI X3T9.5), proposed 155 Mb/sec ATM, 16 Mb/sec token ring, 10 Base T and 4Mb/sec token ring.
7. The modular jacks shall use the color code indicated below:
   a. Data- Blue
   b. Voice- White
   c. Control- Gray
8. The manufacturer of modular jacks is Panduit, mini-com series #CJ688TP .

B. All Audio connectors in and out of sound systems for aux input and output shall be 3.5mm stereo.

2.8 Alternate 8 – Presentation Cameras

A. Furnish and install OkioCam Plus T document cameras or equal. Install one document camera at locations shown on T2.60 if Alternate 8 is selected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.
B. Notify Architect and Owner of any site problems preventing installation.

3.2 INSTALLATION

A. Verify exact locations of equipment with the architect and owner before installation and other trades necessary to provide a complete and operational system. Immediately notify the Owner and architect of any discrepancies.
B. Coordinate all work and service with the electrical integrator.
C. Coordinate final connection of power and ground wiring to equipment with electrical integrator. Power and ground wiring shall terminate inside sound rack and provide for interconnection to the building's electrical system.
D. Equipment and enclosures shall be plumb and square. Permanently attach equipment, except portable equipment, firmly in place to the structure. Supports shall be adequate to support their loads at a safety factor of at least three.
E. Prevent and guard against electromagnetic and electrostatic hum.
F. Make connections with accepted connectors and terminal blocks equal to Cinch 140-142 or TRW 142 series. If a device has screw terminal connections in addition to other types of receptacles, terminate cables to screw terminals using accepted spade lug type terminals. Tin all conductors at screw terminals of low level equipment.
G. According to IEC-268 standard, XLR connectors at equipment shall be wired pin 2 hot (high), pin 3 low, pin 1 shield. Drop shields at the outputs and connect at the respective equipment inputs to maintain ground integrity. Connections and signal hookup to low and medium level equipment shall be done in a balanced configuration. Unbalanced wiring without interfaces to balance signal with respect to ground is not allowed.
H. Provide visible termination resistors and not concealed within connector housings or inside devices being terminated.
I. Provide polarity at loudspeaker connections and use the same wire color code for speaker wiring throughout the project. Make joints and connections with rosin-core solder or with mechanical connectors or with terminal strips accepted by the A/E.
J. Pre-wire racks before delivery to project site. Wiring shall be according to standard broadcast practices.
K. Avoid damage to the cables and to the equipment. Isolate cables carrying signals at different levels and separate to restrict channel bleed through and feedback oscillation in any amplifier section. Keep the following wiring separated in groups of conduit:
    1. Microphone level circuits (level below -20dbm).
    2. Line level circuits (up to +30dbm).
    3. Loudspeaker circuits (above +30dbm).
    4. Power circuits.
L. Use insulating "spaghetti" and heat shrink tubing at each connection throughout system with an exposed drain wire or any other exposed shield. Use insulating collars consisting of heat shrink on rack terminations. Positively bond multiple racks together. Bond the racks to the isolated ground buss as applicable.
M. Insulate audio wiring and equipment racks from the building conduit system where applicable.
N. Grounding shall comply with isolated ground conventions described in:
    1. "Establishing A Clean Ground" in Sound and Video Contractor, July, August, and December 1988 issues.
    2. Sound System Engineering by Don and Carolyn Davis, Book Two.
    3. Audio Cyclopedia published by Howard & Sams.
    4. Sound Systems Design by Howard Giddings.
O. Mount XLR connectors to their plates using Phillips oval head screws having a matching finish to the custom panel.

P. Mount equipment to racks using black Phillips screws and black anti-scuff washers.
Q. Engrave provided panels and paint fill.
R. Conceal wiring unless absolutely impossible within the public spaces. Perform installation of wire, conduit, junction boxes, or other fittings in a professional manner consistent with these specifications and Owner's requirements.
S. If any conflicts or omissions occur as a result of the communications integrator's unsuccessful coordination of the above-mentioned work, it shall be the communications integrator's responsibility to correct and to furnish and install any additional material that may be required at no additional cost to the Owner.

3.3 FIELD QUALITY CONTROL

A. Conduct preliminary checks and testing before performance testing and after completion of related or adjacent work of other trades. Verify safe and proper operation of components, devices or equipment, nominal signal levels within the systems, and the absence of extraneous or degrading signals.
B. Perform the following verification and testing procedures:
    1. Provide proper grounding of devices and equipment per manufacturer's recommendation.
    2. Integrity of insulation, shield terminations, and connections.
    3. Proper provisions of power to devices and equipment.
    4. Integrity of soldered connections.
    5. Absence of solder splatter, solder bridges, debris of any kind or tools.
    6. Proper routing and dressing of wire and cable.
    7. "Wire checking" of circuitry, including phase and continuity, concerning cable designations on run sheets, field and shop drawings.
    8. Determine the proper sequence of energizing systems to minimize the risk of damage.
    9. Measure and record impedance of loudspeaker lines terminating at equipment racks at 1000 Hz, with loudspeakers connected to their respective lines at "full on".
    10. Measure and record overall system hum and noise level of each input channel with controls set so that -50dbm microphone input or +4dbm input would drive the system to full amplifier output. Terminate inputs with resistors (150 or 600 ohms) for this test.
    11. Measure and record electrical frequency response for each input channel through the power amplifier. Required is flat response with permissible deviation of + 2db within the range of 60Hz to 15Khz.
    12. Check polarity of loudspeakers by applying music program or constant power per octave (pink) noise to the system and walking through the transition areas of coverage from one loudspeaker to the next.
        a. Transition shall be smooth with no apparent shift in source from one speaker to the next. This test will be performed by the Owner at final inspection.
        b. Apply sine wave signal sweeping from 60Hz to 5000Hz and at a level of 10db below full output, and listen for rattles or objectionable noises. Correct if apparent.
    13. Drive system with broadband, constant power per octave (pink) noise, and measure the SPL at the 4Khz octave band.
        a. Adjust noise level until the meter readings are between 80 and 90db.
        b. Take readings at seated ear height.
        c. Perform listening tests and readjust system for a pleasing overall sound.
        d. Use parametric equalizer and "ring out" system to eliminate the major portions of feedback from foldback speakers.
        e. Demonstrate to Owner's operator the adjustment of speakers as necessary to achieve minimum deviation over entire area covered by this system.

14. Check system to assure freedom from oscillations or stray RF pickup.
    a. Check inputs with no signal and 100Hz sine wave signal driving system to full output.
    b. Detect unwanted signals on oscilloscope at rack termination and at loudspeaker connected at farthest distance from rack for each loudspeaker line.
15. After successfully energizing the systems, make preliminary adjustments and document the setting of controls, parameters of corrective networks, voltages at key system interconnection points, and gains and losses, as applicable.
    a. Tabulate data along with an inventory of test equipment, a description of testing conditions, and a list of test personnel as itemized below.
    b. Copies of preliminary test data shall accompany copies of performance testing data as part of the final submittal.
16. Verify the performance parameters of the individual system following established professional procedures, in addition to those specified.
17. Document acceptance testing, calibration, and correction procedures as specified with the following information:
    a. Performance date of the given procedure.
    b. Condition of performance of procedure.
    c. Type of procedure and description.
    d. Parameters measured and their values, including values measured before calibration or correction, if applicable.
    e. Parameters associated with calibration or corrective networks, components, or devices.
    f. The names of personnel conducting the procedure.
    g. The equipment used to conduct the procedure.
    h. Provide permanent labels on controls, as applies, to indicate correct setting after performance testing and adjustment procedures have been successfully completed.
    i. Provide documented voltage settings, hum and noise measurements, final elevations, and angle information for racks and loudspeakers as applicable.
18. Equalize system to provide full range operation and for commission foldback speakers. The final system response shall be set flat from 100Hz to 2kHz, +2dB, and then rolling off 3dB per octave to 10kHz. Average SPL response shall be 80 to 90 dB, “A” weighted and loss of consonants shall be less than 12 percent.
19. Check system to be free from rattles, buzzes, and objectionable distortion. Correct objectionable distortions and retest.
20. Provide operator support at first 2 uses of system after work is completed and accepted per this specification. Support limited to 8 hours of time on site. Provide emergency contact procedures in case of system trouble.

C. Upon completion of the Work and compliance with requirements, the Owner’s representative will verify test data as part of the acceptance procedure. Provide personnel and equipment, at the Owner’s representative convenience, to demonstrate any aspect or parameter of performance and to assist with such tests.

D. Failure of any component or system to meet specifications shall require immediate remedial action. In the event that material, device, equipment, system, or manual skills are found unacceptable as late as 15 days before the substantial completion date, Installer shall provide the temporary installation of operational components or systems satisfactory to the Owner until acceptance of the Work.

3.4 Testing and Acceptance Criteria

A. UTP Cabling

1. At a minimum, provide the results from the following performance tests on all installed UTP data cabling as outlined in ANSI/TIA/EIA-568-B.1, ANSI/TIA/EIA-

568-B.2 Communications integrator will measure and report (in hard paper copies and electronic format) the following link parameters for the permanent link and channel test configurations as defined in TIA/EIA-586-B.1

a. Wire Map including shield connection if present
b. Length
c. NEXT loss, pair-to-pair, measured from local end
d. NEXT loss, pair-to-pair, measured from far-end
e. NEXT loss, power sum, measured from local end
f. NEXT loss, power sum, measured from far-end
g. EFLEXT, pair-to-pair
h. ELFEXT, power sum
i. Return loss, measured from local end
j. Return loss, measured from far-end
k. Propagation delay
l. Delay Skew

2. In addition to these, any performance tests required by the cabling product vendor for issuing and honoring the required 15-year warranty must also be performed.
3. Approved Level II minimum accuracy testing equipment must be used for all tests.
4. Furnish all personnel, labor, meters, instruments, cable, connections, equipment and apparatus necessary for making all tests.

B. Test Plan
1. All test equipment, test procedures, and testing techniques shall be specified in the acceptance test plan and will require approval prior to execution.
2. Tests shall be conducted by the communications integrator in accordance with the approved Test Plan.
3. The purpose of this testing is to verify that the installed system meets all specified attenuation and bandwidth requirements and is capable of being used for its intended purpose.
4. Test results shall be submitted for approval. Manufactured or assembled products or equipment shall be tested as indicated, and the results submitted to the District's technical representative for approval, prior to shipment to the site.
5. The communications integrator shall prepare a test plan which provides a detailed outline of all testing to be accomplished.
6. The test plan shall include, as a minimum, a schedule of when tests will be performed (relative to installation milestones) , specific test procedure that will be used, a list of test equipment that will be used (manufacturer, model number, range, resolution accuracy) and shall conform to the specified requirements of other sections of this specification.

C. Test Results
1. Each test sheet shall have a sign-off blank for the communications integrator, as well as the District's technical representative. Copies of the completed test forms or test results shall be delivered according to the shop drawing procedures.
2. The communications integrator shall maintain an accurate test record during all field tests. Samples will be provided to the awarded vendor. Any communications integrator developed format for recording test data shall be submitted for approval as part of the test plan.

3.5 CLOSEOUT

A. Perform remedial work to correct inadequate or unacceptable conditions of, or relating to any portion of the Work, as determined by the Architect or Owner, at no expense to Owner.
B. Present, review, and clarify materials to the Owner, Owner's representative and

operating personnel and fully demonstrate the operation and maintenance of the systems, equipment, and devices as specified.

C. Check, inspect, and if necessary adjust systems, equipment, devices, and components specified, at the Owner's convenience, approximately 60 days after the Owner Acceptance of this work.

D. Further adjustments or if additional work becomes evident during acceptance of the system, the communications integrator will continue his Work until system is acceptable at no additional cost to the Owner. If approval is delayed because of defective equipment, failure of equipment, or installation to meet the requirements of these specifications, the communications integrator shall pay Owner expenses for additional time during any extension of the testing and acceptance period.

3.6 DEMONSTRATION

A. Provide on-site training to the facility's personnel (faculty and staff) on how to set-up, operate, and test systems for proper function.

END OF SECTION

Section 27 50 00

DISTRIBUTED COMMUNICATIONS AND MONITORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of a Contract, including conditions of the Contract and Division 1 of the Specifications, shall apply to the Work in this Section.

B. Drawings and general provisions of the Contract, including all portions of the Project Manual are hereby made a part of this Section. Refer to paragraph titled “Quality Assurance” in this section and to Division 1 for requirements for contractors. Throughout this and related Sections, “Integrator” shall not be limited to the singular and masculine and shall refer to one, or more than one, Communications Integrator. The Terms “Integrator” “Communications Integrator” and “Communications System Integrator “shall be used interchangeably and shall be understood to represent the communications integrator responsible for the furnishing, configuring, testing, programming, warranting and for ensuring all work is performed in accordance with manufacturer’s requirements and recommendations for the work identified in this SECTION.

C. Any qualifications or certificates required in this specification may be requested by the Architect as part of the post-bid qualifications review. Such review shall commence subsequent to the bid submission, as none of this information is required as part of the bid submission. In the event that the Architect requests qualification or certification documentation such documentation shall be provided within three business days.

1.2 SUMMARY – BASIS OF DESIGN EQUIPMENT – ATLAS IED AND RELATED COMPONETS

A. Work Included. Any and all cabling mentioned herein, to include data cabling, terminations, faceplates, patch panels, and patch cords to local IDFs and MDF for devices, and required to complete the work of this section shall be provided by the integrator of this section unless coordinated with the communication integrator of Section 27 10 00, thereby provided and installed by the Structured Cabling communication integrator of Section 27 10 00, so long as it does not void any manufacturer warranty. The communication integrator of this section is responsible for any cabling required by the manufacturer to ensure manufacturer’s warranty. The scope of work of this Section consists of the installation, and programming of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances and services necessary and/or incidental to properly complete all work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Architect and Owner, as being required and in general, is as follows:

1. Atlas IED Public Address System, including but not limited to:

a. Public address system amplifiers, zone controls, back boxes, and all equipment, cabling and support required to interface the Public Address

System to the Owner's Telephone System (Phone System not included in this contract - coordinate with Owner) to ensure a complete and functional system

b. Public Address System Speakers, flush and surface horn ceiling mounted interior, flush horn wall mounted, exterior. Provide and install override signal in coordination with 27 40 00 communication integrator to mute the sound systems in those sections.

c. Cabling and PoE switches to support the Public Address System (NOTE: any category 6 cable must be black).

d. Equipment rack in MDF for amplifiers and devices is provided by 27 10 00. Power above this rack is 120V30amp service, L5-30 twist lock receptacles. Two UPS devices will be provided in this rack by 27 10 00. Furnish and install PDUs if required for all equipment in rack. In IDFs, PA eq shall be in the voice/cctv racks. Half of this rack is provided for PA equipment and switches. If more space is required, it must be wall mounted. Communications integrator of this section is responsible for providing additional plywood back board for equipment if required, in coordination with the General Contractor.

e. NTP synchronized Master and Secondary Clock System, clocks and cabling.

f. PA integration with access control and intrusion detection system. Coordinate and program event (coordinate event and message with Owner) in PA system to be triggered by a Lockdown condition from intrusion detection system relay closure. Furnish and install cabling to intrusion detection system and access control system.

g. Provide PA administrative consoles (one at each A3 and A4 location. Coordinate cable required and jacks for termination with 27 10 00 or provide and terminate cable and jacks in A3 and A4 faceplates).

h. PA System shall be independent from the phone system and shall not rely upon a phone system to function; however, the PA system shall be integrated with the phone system to allow the phone system to initiate pages to zones or the whole building using codes. Owner shall supply a SIP trunk for this purpose.

i. Program paging zones in accordance with owner direction. Coordinate with owner. At a minimum, each grade, each interior floor, the whole interior, the exterior, Gym, Student Dining areas, and the auditorium, shall each be an independent zone.

j. All sound systems, including classrooms, require an input from the PA system to mute the audio of the sound system. Provide input in coordination with 27 40 00 communications integrator and 11 61 00 Theater Equipment integrator for sound systems (contact closure, voice signal, or similar)

k. Where noted on the drawings (FS/HS), provide a dedicated amplifier to provide 7.5w minimum to each PA speaker (HS and FS symbols) in the space. See Gym, Student Dining, Media Center, Auditorium and similar large group spaces. Provide an amplifier for each location. None of the HS or FS speakers shall be used for talk back. For exterior horn speakers, (ES symbol) provide amplifiers for up to 15w per speaker.

l. Technology drawings symbols to be provided under this section, as shown on T2.10 are: S1, S2, S4, ES, FS, HS, C1, C2, B1, B2, B3, A3, A4 locations for PA Admin Phone and Jack, and any other symbol reasonably determined to be part of the PA system.

m. All equipment described in this Section shall be provided, configured, tested, programmed and warranted by a manufacturer certified

communications integrator. Communications integrator shall provide proof of manufacturer certification. Coordinate programming and zones with the Owner.

n. Provide every required part of system complete in detail and operable in unison with all other sections of this specification, resulting in a complete Distributed Communications system.
o. All speakers in all locations (ceilings, walls, exterior) are required to be painted by the integrator of this section. This includes trim plates, exposed back boxes and speaker grills. Coordinate colors required with architect.
p. Provide programming and integration with owner provided phone system (VoIP/Digital/Analog hybrid system) to allow a call placed from off site, or from cell phone, to call into the PA system (or phone system), enter a code, hear a tone, and place an emergency page on the PA system.
q. Furnish and install in admin area a PA microphone or similar connected to the PA system to provide the capability to simply key the microphone and make announcements to the entire building. Provide all related equipment and cabling for functionality specified above.
r. Any terminations of cabling for the system that are to be rack mounted in the MDF or IDF cable racks shall be terminated on angled patch panels in the PA rack location in the MDF, and in the cable racks in IDF. Coordinate location of cable terminations in rack with 27 10 00 integrator and architect.
s. All clocks and wall mounted speakers shall be flush to the walls. No back boxes or devices shall extend into the room spaces, and no back boxes shall be surface mounted.
t. All network switches required for the PA system components and devices shall be furnished and installed by the integrator of this section. Note that all switches require a fiber GBIC/transceiver to interconnect all closets for the PA network. A fiber pair from MDF to each IDF is available (provided by 271000)
u. All data cabling and other cabling shall be furnished and installed by the integrator of this section unless the integrator of this section coordinates with the 27 10 00 integrator to furnish and install the cabling required.
v. Wireless clocks are not acceptable.
w. At S4 location, furnish and install 3.5mm audio jack, cabled to an aux input of the PA system to allow a personal music device to play music over the PA system.
x. The speaker output level of all areas shall meet the requirements of The Owner. Volume level changes shall be made to the Owner’s satisfaction.
y. Integrator shall provide all system programming for configuration and interfaces.
z. Components of the Unified Mass Communication System (UMCS) shall provide a complete network system solution including fully functioning Intercom System (IC), Public Address System (PAS), Emergency Notification System (ENS) and Master Clock System (MCS).
aa. System shall include General Purpose Input and Output (GPIO) trigger points for interfacing with other systems including Emergency and Security Systems to provide event driven system configuration scenarios.
bb. Each classroom shall be a zone on the system capable of individual intercom use or as part of a zone group or all call group during PAS use.
cc. Classroom IP endpoint device shall be a PoE+ device attached to the PA system network (furnished and installed by the integrator of this section, to include PoE+ switches).
dd. Classroom shall be capable of initiating an intercom call and an emergency call of different priority levels with full duplex operation from IP endpoint to network phone or network phone to IP endpoint operation.

ee. System shall be Common Alerting Protocol (CAP) compliant to provide automated warning notifications for subscription alerts such as Weather and Amber alerts as directed by the Owner's Representative.
ff. All common area loudspeakers shall operate on a 70-volt distributed system. The loudspeakers shall be grouped in modular zones allowing maximum flexibility for paging area assignment.

B. Actual control room and rack layouts will be based upon the specific equipment submitted by the communication integrators. Needs for equipment, specific speakers, and other equipment will be dependent on actual product. Communication integrators shall coordinate room layout, actual speaker and equipment placement and programming options with owner prior to installation.
C. There are no air plenum spaces in the building. No cabling is required to be plenum rated.

1.3 RELATED SECTIONS

A. Field Painting: DIVISION "FINISHES"
B. SECTION 01 23 00 - ALTERNATES
C. Electrical: DIVISION 26 00 00
D. All Communication Sections, 27 and 28. Mute overrides of all classroom amplification systems.
E. SECTION 05 31 00 – STEEL DECKING See for restrictions concerning the hanging of material, cable tray, mounts, brackets, hooks, and other items from the roof or decking
F. SECTION 11 61 00 – THEATER EQUIPMENT Mute overrides of all sound systems in section 11 61 00.

1.4 SECTION INCLUDES

A. Cabling, terminations, patch cords, and PoE switches

B. Administrative consoles (at A3 and A4 locations on the drawings. Coordinate connector in A3 and A4 faceplate and cable to Network/Telecom room or as per system requirements for locations with 27 10 00 communications integrator)

C. Digital Message Clocks with flasher (C1 symbol) with seconds displayed

E. Web based Bell/Class change signaling system.

F. Public Address/intercom System

G. Controls, Amplifiers, and Terminal Equipment

H. Power Supplies

I. Battery Backup for System Programming

J. Program Distribution System.

K. Master Clock & Messaging System

L. Telephone controlled intercom system

M. Web interface required for bell schedules

N. Programmable, individual control of inputs and outputs

O. Ceiling/Wall Mounted loudspeaker assemblies

P. Clock and loudspeaker back boxes and baffles

Q. Accessories

R. Wiring

S. Interior and Exterior Enclosed Horn Type PA Speakers

T. PA system shall not rely on a phone system to fully function.

U. Dedicated amplifiers for PA horn speakers (FS, HS, ES symbols).

V. Sound system muting signals. Coordinate with 274000 Section and 11 61 00 Theater Section.

W. Digital message clocks with integrated talk back speaker and flasher at C2 locations.

1.5 SUBMITTALS

A. Architect may require submittal submission within 45 days of bid award. Submit the following under provisions of Section 01 33 00- SUBMITTAL PROCEDURES:

B. Product Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder. Ensure submittal is tabulated with index referencing the specification sections. Non-tabulated and indexed submittal shall be returned without action.

C. Shop drawings, detailing the communications network system including, but not limited to, the following:

1. Device locations and wiring (PA speakers, administrative consoles, attenuators, clocks)

2. Interconnections (access control inputs, sound system mute outputs)

D. Provide a riser diagram for the system showing in technically accurate detail all connections, interconnections, and all provisions available and made for adaptability of all specified future functions and including all calculations, charts, and test data necessary to demonstrate that all systems and system components deliver the specified signals, grades, and levels at all required points and locations.

E. Manufacturer Certificate and Certified Training Certificates of communication integrator who will be providing, programming and warranting the equipment.

F. Closeout Submittals:

1. As-Built Drawings: Update Shop Drawings to create final As-Built Drawings. Submit copy digitally in PDF format.

2. Operation Data: Include PDF copy of the software Administrator and Operator Manuals.

3. Maintenance Data: Include PDF copies of product data, maintenance and repair procedures. PDF of product data and O&M manuals shall contain bookmarks for every section and item submitted.

4. Digital copies of all training materials on USB and videos of all training provided on USB. Communications integrator shall provide recording of training provided.

5. 3 year warranty certificate with contact numbers with appropriate start and stop dates

6. PDF of product data and O&M manuals shall contain bookmarks for every section and item submitted.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.7 QUALITY ASSURANCE

A. Manufacturers: Manufacturer shall be a single-source manufacturer for the system, that specializes in PA systems with a minimum of five years in the industry.
B. Communication integrator: Company specializing in Distributed Communications and Monitoring Systems, with a minimum of five years experience on systems of similar size and scope. Communications integrators working on project must have been certified by the manufacturers on the hardware and software used for this project. Provide valid current proof of manufacturer's certification.

1.8 REGULATORY REQUIREMENTS

A. The entire installation shall comply with all applicable and safety codes. All central equipment and additional applicable equipment shall be Listed by Underwriters' Laboratories, per US requirements.

B. All equipment with digital apparatus (microprocessors) that generate and use timing signals at a rate in excess of 9,000 pulses per second to compute and operate must be Federal Communications Commission (FCC) and DOC CSA standards C108.8 (Electromagnetic Emissions) compliant. Any non-compliant equipment supplied or installed shall not be accepted and shall nullify the contract. Note: Provide documents supporting and verifying compliance.

C. Systems shall be considered non-compliant unless they completely meet the criteria as outlined in this section. All supporting documentation shall be included as part of the initial submittal package. Letters regarding "future approval" or "approval pending" shall not be considered.

1.9 WARRANTY AND SERVICE AGREEMENT

A. All equipment, materials, travel and labor shall be warrantied for a period of 36 months from the date of final acceptance by the Owner. Warranty shall begin at this time, not the date of substantial completion or installation. Systems must be fully operational and accepted by the owner after training before the warranty is to begin.

B. The manufacturer or communications integrator shall repair or replace malfunctioning products at no expense to the Owner, except failures caused by damage or

unreasonable use.

C. Communications integrator shall maintain regular service facilities and a help desk. Provide qualified technicians that are experts on the System, and who are familiar with the work at the site, within 24 hours of receipt of a notice of malfunction, excluding weekends and holidays.

1. Provide material, devices, equipment, and personnel necessary for repairs.

D. Provide accepted temporary, alternate equipment, if required by the Owner, complete and operational within 48 hours after notification of malfunction, at no additional cost during the first year of warranty.

E. Communications integrator shall conduct warranty repairs and service at the project site unless prohibited by manufacturer's warranty. If the latter, communications integrator shall provide substitute systems, equipment, and devices acceptable to the Owner for the duration of the off-site repairs. Replace items out of service more than 10 days with new equipment during the warranty period.

F. Communications integrator shall transport warranty equipment, substitute systems, test systems, equipment, devices, materials, parts, and personnel to and from the project site at no additional cost to the Owner.

G. Provide any software maintenance updates (software assurance) or upgrades to all systems at no additional cost to the Owner for this 36 month period. Furnish and install firmware (for all hardware) and software updates (for all software) withing 30 days as firmware and software updates are released by the manufacturers during the 36 month warranty at no additional cot to the owner.

H. Response Times - Normal business hours shall be 7 AM to 5 PM Monday through Friday. Calls for service before noon shall be responded to on-site before the end of the day. Calls after noon shall be responded to on-site by noon the following business day.

I. Provide extra costs for time outside of normal business hours if the Owner requires emergency service.

J. Service Calls: Provide 24 hours of service calls on system for the school after final acceptance to make any adjustments necessary to keep system at peak operating condition. Warranty work is not included in the service call time.

1.10 MANUFACTURERS

A. Atlas IED
B. Telecor eSeries

PART 2 – PRODUCTS

2.1 GENERAL DESCRIPTION OF NETWORK INTERNAL COMMUNICATION SYSTEM

A. Supply and install a complete network based intercom system. Field wiring shall be CAT 6 cable, manufacturer recommended control wiring for power distributions and other cabling runs, and utilize a fiber backbone (when distances exceed normal Ethernet limitations). Fiber back bone between technology closets and MDF is provided under 27 10 00. One pair of single mode or multimode fiber is available for the PA network. All station equipment shall utilize standard RJ-45 modular connections. All

remote devices utilizing standard structured cabling shall be capable of PoE (Power over Ethernet). Wiring shall be capable of either being installed in conduit or cable trays, where shown on the plans. All PA data cabling shall be Cat6, black, and all RJ45 jacks shall be Cat6, black. All PA system Cat6 cabling shall be furnished and installed by the integrator of this section unless coordinated otherwise by the integrator of this section.

B. The system shall be capable of interconnecting with the building LAN (Local Area Network). This connection shall be minimal and utilize only one Ethernet 100 Mbps (or optionally 1 Gb) connection per station to accomplish all intercom operations. Ethernet ports and associated network switches that are required to connect any intercom devices will be provided by the integrator of this section.

C. Provide a separate channel for each room and administrative office so each room, speaker, amplifier, and emergency messaging display/clock can be individually addressed.

D. Overall intercom communications network shall utilize Ethernet or IP communications between all major components: administrative consoles, intercom stations, amplifiers and individual paging speakers, and network switches. Systems not utilizing Ethernet or IP communications protocol to each end-point device will not be acceptable. Systems not capable of supervising all networked devices including network amplifiers, network speakers, call button switches, and emergency messaging display/clocks will not be acceptable.

E. The network shall support a VLAN configuration to separate activity in the intercom system from other in building LAN traffic. In locations where the supervised network communications system will be considered as part of the facilities life safety systems, a dedicated and isolated network shall be required.

F. The system shall interface to the facilities iPBX via SIP trunk connectivity as well as allow the digital/analog phones on the Owner's VOIP/hybrid system to initiate and make pages to the building or zones.

G. The Internal Communications System shall include master clock support and synchronization of digital and analog secondary clocks, event scheduling, and messaging software allowing the facility to configure multiple schedules per school, multi zone time tone signaling for class changes, and message notification.

2.2 DESCRIPTION OF NETWORK INTERCOM / PA / MESSAGING FEATURES

A. The system specified is based on the Atlas IED Network based Communications System providing at least the features and functions outlined below. It shall be installed and programmed by a local authorized and certified manufacturer's dealer.

B. All station devices shall receive power and data through a Power-Over-Ethernet switch (provided by integrator of this section)

C. Each Intercom Station, Loudspeaker, clock/message display, shall be assignable to all or any combination of Unlimited Paging, Program Distribution or Time Zones in the system.

D. Each Classroom shall be provided with two Call Buttons located where shown on the drawings (B1, B2, and B3). One call switch (B1) shall normally page the front office. The second call switch (B2) shall generate an Emergency level call to the front office. The B2 shall have a protective flip up cover labeled "EMERGENCY PAGE".

E. Speech shall be transmitted in the frequency range from 50 Hz to 7 kHz and shall use a maximum of 128 kbps of bandwidth during a call. In order to assure maximum intelligibility, all system audio shall be at a minimum HD Audio as defined in Intel(TM)

High Definition Audio Specifications, June 17, 2010.

F. Intercom communications between consoles and system devices shall be non-blocking with no channel restrictions or limitations (other than network capacity) to the number of simultaneous conversations at any time between pairs of intercom stations, intercom station to console, console to console, console to speaker or zone of speakers, program source to a speaker or zone of speakers, or bell tones to a speaker or zone of speakers regardless of number of stations or consoles.

G. Any and all devices shall have the ability to have its programming downloaded, individually or simultaneously via the network. Programming shall be downloadable in a series of human readable, industry standard comma-separated values (CSV) files that can be saved and edited using common spreadsheet applications. Consoles, intercom stations, clocks, displays, and speakers residing on a network shall have the ability to update their programming, simultaneously from a CSV file. Furthermore, all devices shall also have the capability to be configured directly, such that device numbers, names, zones, and call-in destinations can be altered in real time without the uploading or downloading of their programming. System shall be capable of uploading firmware updates to all device classes simultaneously, via the network, without the requirement of tools, by authorized technician or qualified facility technician or representatives.

H. Audio communications between all devices shall be accomplished with latency values of a maximum of 0.1 seconds and connection times of 0.01s for 1 to 500 speakers.

I. The system shall support a minimum of 50 channels of simultaneous duplex communication paths on the intercom system LAN, plus a minimum of 10 simultaneous duplex channels for PBX integration.

J. The system shall be capable of routing calls from the Public Switched Telephone Network (PSTN) into any classroom, zone or the entire school via the District's SIP enabled Telephone System. This shall allow for remote monitoring and two-way voice communications from outside the facility to classrooms as well as paging into areas of the school. Additional features shall include:

    a. The ability to place call-ins from classroom call stations to SIP Telephones

    b. The ability to initiate calls from SIP Telephones to Classroom Speakers.

    c. The ability to initiate zone and all call paging announcements from SIP Telephones to Speakers throughout the facility.

    d. The ability to make outside calls from Administrative Consoles to the PSTN via the Districts Phone System.

    e. The ability to page the building or zones from digital/analog handsets connected to the owner's VOIP/hybrid phone system.

K. The System shall allow users to configure multiple schedules per school, with an unlimited number of programmable events in each schedule. Each Event shall sound a user selectable tone, play a user provided audio file or an external audio source. In addition, a textual message shall be able to be programmed to be displayed at associated message displays throughout the school. All scheduling assignments shall be performed via a simple to use, Graphical User Interface (GUI) from a non-dedicated PC, residing in the School. Programming shall also be accomplished from a non-dedicated PC at the District Office. The following features and functions shall be provided. Systems that cannot provide these shall not be acceptable.

    a. The system schedules shall facilitate the requirements of combined facilities (e.g. elementary and middle schools in a common building) where multiple schedules running concurrently would be required.

b. Each event shall play any of the available tones, audio files or audio sources provided. Events shall be directed to any one or more Time Zones in the systems.

c. Events shall include textual messages to clock/message displays. These shall be formatted as fixed, flashing or scrolling displays that can include up to 200 characters in length.

d. Time Tones may be manually activated from Administrative Consoles or selected SIP phones residing on the schools IP PBX.

e. An integral Master Clock shall provide time synchronization to all secondary digital clock / Message Displays throughout the school. The communications shall be capable of obtaining it's time synch signal from any NTP time server.

f. A web interface shall be used for creating, adjusting, and changing bell schedules. Having to use remote software (such as LogMeIn or Team Viewer) to a PC hosting the bell schedule does not constitute a bell schedule web interface. The PA system shall host a web page allowing any authorized device (MAC, Android or Windows based) in the building to access, create, adjust and change bell schedules.

L. The System shall be capable of automatically distribute SMS and email notifications to relevant staff members when an emergency event is occurring the facility. Notifications shall be distributed to user alert devices such as mobile phones and smart devices. Mobile phones shall receive the notifications as SMS messages while smart devices shall receive email messages. Emergency events include:

a. The activation of emergency-themed element icons on a PC GUI (e.g., Lockdown, Evacuate)

b. Emergency Calls placed from Call Stations located room locations.

M. The system shall automatically distribute SMS and email notifications to appropriate technical support staff in the event that the system is experiencing a fault.

2.3 NETWORKED ADMINISTRATIVE CONTROL CONSOLE (A3 and A4 locations)

A. The Network Administrative Control Console (subsequently referred to as Console) shall be a IP-CONSOLE-GH by Atlas IED or equal. The Console shall allow the operator to establish two-way communications with an intercom station, talkback speaker, clock or another Console using the handset or speakerphone. VOX functioning shall be automatically enabled when the handset is used.

B. Incoming calls to a Console shall show the originating station dial number and name on the Console display. Calls shall be displayed in the order they are received. The operator shall be able to scroll through the list of calls and answer them out of sequence. Emergency call-ins shall be distinctly annunciated both visually and audibly.

C. The Console shall allow call-ins to be forwarded to another Console, or for calls to be put on hold or transferred to another Console location. Additionally, call-ins or calls shall be forward/transfer-able to PBX telephone extensions via a SIP trunk interface.

D. The Console shall be able select a tone or a pre-recorded announcement and broadcast the tone or announcement to all facility speakers or to select areas, such as a speaker zone or a selection of speakers.

E. The Console shall be equipped with digital volume control that shall allow for the separate adjustment of the speaker listen and handset listen volumes. The levels for

intercom listen, tones, and program distributions shall be independently adjusted and stored in memory.

F. The system shall allow user programming of alphanumeric architectural room names and numbers. The Console shall be capable of using 1 to 7 digit sequences for dial out and call-in identification, and shall display station numbering, station name, and call-in priority.

G. The end-user shall be allowed to choose and determine the number and location of Consoles. The end-user shall not be limited by pre-set manufacturer limitations of the number of Consoles required by this project; allowing for unrestricted future expansion. Consoles may be added at any time. Consoles added by the end-user that exceed the engineered design for this project shall be at owner's expense. Communication between consoles or consoles and intercom stations or rooms shall not be inhibited by channel number restrictions.

H. The Console shall be capable of displaying room statuses such as Privacy and Do Not Disturb and shall have the ability to override any status limiting communication between the Console and a station with Privacy or Do Not Disturb status activated. Temporary override shall not interfere with continued activation of Privacy and Do Not Disturb after communication has been established and electively terminated.

I. Consoles shall have an attached microphone to simplify paging.

2.4 CLASSROOM ANALOG SPEAKER (S1 locations)

A. The classroom analog speaker shall be the C803A connected to the classroom clock, the IP-DMF. Furnish and install all back boxes, baffles and cabling required to recess mount the speaker in the middle of the classrooms.

B. All speakers in all locations (ceilings, walls, exterior) are required to be painted by the integrator of this section. This includes trim plates, exposed back boxes and speaker grills. Coordinate colors required with architect.

C. No external volume controls shall be part of or protrude from, the speaker grill.

D. In classrooms with secondary rooms that show an S2 speaker location, add a second speaker to the message clock if possible, part number IP-SA such that the page to the room will also announce in the secondary room. Examples of these types of rooms are the prep rooms for science classrooms.

2.5 IP MESSAGE DISPLAY/CLOCK AND CALL BUTTONS (C1, C2 locations)

A. The Emergency Display/Clock (subsequently referred to as Message Display) shall be a flush mounted IP-DMF with IP-FEC-DM back box for C1 locations. The IP-SDMF with IP-FEST-SD back box shall be installed at C2 locations. The IP-SDH and IP-FEST-SD back box shall be installed at C3 locations. The IP-FEST-SD dimensions are 13.13" high by 11.63" (18.63" with wings attached) wide by 4" deep. The Message Display shall simultaneously display the time and date. The time shall be displayed in hours, minutes, and seconds. Hours and minutes shall be displayed in large min 2.25" digits. The seconds shall be slightly smaller for easy distinction. Loss of communication to the Message Display shall result in an immediate indication of communication loss with the device and annunciated at the designated locations.

B. The Message Display shall receive power and data over a RJ45 connect CAT 6 cable from a single Power-Over-Ethernet switch.

C. The Message Display shall by default show the time and date which shall be

synchronized to all other Message Display. If time signal communication to the Message Display is lost, it shall maintain the time independently, and remain synchronized to other Message Displays connected on the local area network. Once communication is restored, the Message Display shall resynchronize with the time server and shall be automatically updated to current data communication provided at time of restoral.

D. The Message Display shall provide a dry contact output that can be activated remotely from a station or console, such as may be required in a door release application.

E. The Message Display shall be capable of supporting notification devices and shall have a call-in roll-over feature where if a call-in to the primary call destination is not answered after a pre-set amount of time, the call shall be automatically escalated to a secondary call destination. If both the primary and secondary call destinations are unavailable, the call shall be redirected to a back-up station or console.

F. The Message Display shall have the capability to be configured as a member of 1 or more paging zones.

G. The Message Display shall optionally activate strobe and siren signals in conjunction with emergency call-ins. Siren shall be automatically suspended upon an audio connection. Strobe shall be maintained until call completion.

H. The Message Display shall automatically activate and maintain strobe signals in conjunction with emergency pages, programs, tones, announcements, and/or textual messages.

I. A message display/clock wire guard shall be furnished and installed over all clocks in the gym and locker rooms. The guards shall be constructed from sturdy, heavy gauge steel and include a Plexiglas window that shall provide both protection and optimum visibility of the display. These also be furnished and installed in other locations if noted on the drawings. Guard by American Time, part number G2093.

J. Connect both call buttons (B1 and B2, part number WPD-SWM, labeled accordingly as noted above) to message display/clock.

K. Over the emergency call button, furnish and install a cover by STI. Part number STI-13010CW by Universal Stopper, without horn, or equal. The cover shall have the label applied, to read “EMERGENCY PAGE” for the B2 locations. The B1 will not have a cover.

L. Both clocks will have a flasher for emergency notifications, and both will scroll messages for different scenarios.

2.6 NETWORK INTERCOM STATIONS WITH SPEAKER (B3 SYMBOL)

A. The Network Intercom Station with integral speaker (subsequently referred to as Intercom Station) shall be the IPS_VOI. The Station shall be used to establish communication between specific areas of a facility, providing for two-way communications as well as call-in capabilities.

B. The Station shall receive power and data through a Power-Over-Ethernet switch.

C. The Station shall be wall-mounted in a manufacturer recommended backbox. Mounting hardware shall be tamper-proof. The intercom station shall be designed to withstand physical damage and everyday wear-and-tear. The buttons shall be tamper-proof and the overall assembly shall be designed to be vandal-proof. The intercom station shall be suitable for outdoor use and be weather proof.

2.7 HALLWAY AND NON-TALK BACK SPEAKERS (S2 locations)

A. Speakers shall be part number SD72W, with up to 24 speakers on a PA60G amplifier (or less to create appropriate zones the facility).

B. Furnish and install an IP to analog gateway device for all amplifiers, part number IP-ZCM.

C. Horn Speakers: Indoor/Outdoor: External Building PA Speakers (as shown on technology drawings ES (recessed, enclosed), and internal PA Speakers FS and HS, recessed/flush mounted (FS) and HS surface mounted with back boxes).

ES, FS and HS type:

a. Aluminum re-entrant type: flush mount installation, surface mount box.

b. Frequency Response: 600 to 12kHz nominal.

c. Power Handling: 15 Watts RMS.

d. Variable screw taps, 70/25 V transformer (25:.48/.94/1.8/7.5/15w; 70v:.9/1.8/3.8/7.5/15W)

e. Sound Pressure Level: 105 dB at 1 meter with 1-watt input, dispersion 80 degrees.

f. Lowell Unihorn LUH-15TA Horn Speaker with LUH-TBAR tile bridge were required (in ACT), and LUH-BOX at ES, HS and FS locations.

g. Provide LUH-TP trim plates and LUH-VRG grills on all ES, FS and HS locations. Paint trim plates, grills, and exposed boxes as per architect's direction. Coordinate required color with architect.

h. Furnish and install IP to analog gateways for each amplifier to drive these speakers. Amplifiers shall be the DPA in amounts required to properly zone the building and amplify the speakers.

i. Every ES back box shall have every seam, slot, hole and conduit connection sealed by the 27 50 00 integrator. Vapor barrier shall be sealed to the box.

2.8 INTERACTIVE GRAPHICAL USER INTERFACE

A. The system shall include an Interactive Graphical User Interface (subsequently referred to as IGUI). Furnish and install Informcast and Singlewire software. Furnish and install PC in the main office if required. Include a UPS device for this PC. Furnish and install a call platform if the Owner's phone system cannot provide a SIP trunk for integration purposes with the PA system.

B. The IGUI shall utilize an easy-to-use Graphical User Interface for quick and easy graphically aided navigation to access functionality for all intercom stations, paging zones, and program distribution sources. Emergency operations shall be simplified through the IGUI allowing stored audio files and alphanumeric messages for message displays to be activated from the IGUI. The IGUI shall allow common operations such as daily announcements to become simplified into single touch activated icons; removing multi-step console set ups and dial strings.

C. The voice device used to originate voice communication for the IGUI to selected locations shall be an administrative console with microphone or telephone handset. The voice device shall remain functional and accessible regardless of the operational state of a computer supporting the IGUI.

D. The IGUI shall allow the creation of a custom operating screen(s) based on the floor plans of the facilities. Icons representing intercom stations, zones used for paging, tone distribution, textual Message distribution, and audio program distribution shall be

incorporated onto the floor plans. The IGUI software shall provide:

a. Simple routine call processing, including: hold, transfer, and forward
b. Activation of remote station auxiliary relays for applications such as door lock or release
c. Emergency functions
d. Paging
e. Audio program distribution
f. Customizable page elements
g. Customizable operating screen
h. Element library for emergency event icons
i. Initiation of emergency and non-emergency messaging, textual and audible
j. Remote station volume adjustment
k. Remote activation of do not disturb status and/or message waiting status
l. Remote station trouble indication
m. Remote station background music channel selection
n. Dynamic zone management for interactive on-the-fly console specific zones
o. Single touch emergency response (supporting both actual emergencies and drills) including but not limited to all or any combination of the following:

- Live voice notification
- Pre-recorded audio message
- Digital plain text messaging with simultaneous numerically coded message capability
- Remote system activation, i.e., access control systems, CCTV systems, door release systems.

E. The IGUI must provide an efficient and reliable method of notifying the occupants within the facility of critical situations. A variety of emergency tone signals that reside within the intercom/paging system shall be activated by clicking on pre-programmed buttons on the IGUI screen, initiating the transmission of tone signals to speakers, and alphanumeric messages to message displays/digital clocks. A “lockdown” icon shall be designed as per Owner direction, with Owner selecting the appropriate tone. Whole building macros for emergency or off-normal response shall be built into the internal communication system as directed by the Owner. Each macro shall be capable of being activated by the console, the IGUI as indicated on plans or as directed by the Owner or AHJ. It shall be possible to activate a WAV file message or Owner selected tone coinciding with multi-language textual messages for distributions to zones as directed by the Owner, all from a single activation icon located on the IGUI. Other single action macros shall be activated in similar fashion via the IGUI and a custom labeled icon. Plain language labeling of all icons on the IGUI shall be user changeable. All Mass Notification Events (if an MNS system is provided under Section 26 00 00) shall be mimicked in the PA system, to send the event name (or other message as defined by the owner) to the digital clocks manually when an MNS event occurs. Provide programming to place events on the GUI, and training to edit these clock messages for MNS events. Training shall also include how to clear messages (returning the clocks back to the time display) and how to easily create custom clock messages, ready for a moments notice to easily be sent to the clocks.

2.9 MASTER CLOCK

A. Include a master clock to synchronize all clocks in the facility. Synch master clock to an NTP time source to continually update time. Include a web based time and bell scheduler. An unlimited number of operations shall be managed for activation by

schedules or use. The application shall be web-based and secured via HTTPS certification. It shall be preconfigured with a variety of default operations, schedules, audio, and icons for quick customization. Users shall log into the application from any desktop computer or mobile smart device using a supported web-browser. Supported web browsers shall include Microsoft Edge, Mozilla Firefox, Google Chrome, and Apple Safari.

B. The web based event scheduler shall manage an unlimited number of calendar-based schedules, which are collections of operations intended to be performed frequently, periodically, or on specific dates and times. For example, a schedule may be a series of bell tones that consistently indicate class changes. Users shall set schedules so that the operations they contain will activate accordingly.

C. Schedules shall be viewed, enabled, or disabled in a calendar. The calendar shall display schedules on a daily, weekly, monthly, or yearly basis. The scheduler shall support scheduling operations up to 10 years into the future.

D. An unlimited number of holidays shall be specified and marked on the calendar. This shall indicate days where disabling all schedules may be appropriate.

E. Operations shall include several components, including: pre-announce tones, pre-recorded audio, scrolling textual messages, and coded messages. If desired, specific details of the components shall be customized. Customization shall include: the number of times the pre-announce tone plays, the message scroll speed, and the delay before pre-recorded audio repeats. Depending on the operation type, user-activated operations shall be distributed immediately or queued for later distribution.

F. The Home page shall provide a quick overview of managed operations. This shall include the next scheduled operation, the schedules that are currently active, and the next scheduled school drill.

G. The Live page shall show currently active and upcoming operations. A history of recently performed operations shall confirm operations occurred as intended. Also, users shall easily initiate on-the-fly operations on the Live page by configuring and activating them on demand.

H. Routine operations shall include an unlimited number of pre-configured common audio distributions. Examples shall include announcements for special assemblies, bus arrivals, staff meetings, and festive events.

I. Audio files shall be used for tones or announcements while images shall be used as icons throughout the GUI to represent different operations or schedules. Audio file formats shall include (WAV and MP3) and images to support operations.

J. Access shall be user-account controlled. An unlimited number of users shall be supported with a high level of individual customization. Users shall be given access to only the pages and operations relevant to their intended roles. For each page, users shall be granted permissions to activate or configure operations and schedules from a desktop or, for certain users, from mobile devices. An administrator account shall have full access to view and make configuration changes on all pages, while an operator account shall be limited to activating routine or emergency operations and enabling or disabling schedules.

K. Users with administrative privileges shall have the ability to configure the site name, time, time zone, test zone, and import and export databases. To aid installers with initial configuration, a test mode shall be provided as well as a database import/export feature. Test mode shall redirect all activated operations to a test zone (that only the installer occupies) to prevent disrupting other people during configuration and testing. Database import/export shall allow the configuration to be exported for backup

purposes or to copy to other installations.

L. The system shall be configured for an unlimited number of dedicated emergency response operations. A corresponding drill operation shall be automatically created for each emergency situation. Users shall be able to activate emergency response operations from facility PCs or remote mobile devices.

2.10 POWER

A. Power for the rack equipment in the MDF shall be two 120V30Amp L5-30 twist lock outlets above a four post rack set aside for the PA equipment in the MDF. Power in the IDFs will be 120V30Amp L5-30 twist lock outlet. Two UPS devices (provided in the 4 post rack in the MDF and all two post racks) will be installed by 271000.
B. Half of the voice/cctv rack in every IDF is available for PA system terminations and equipment. If more space is needed, all additional equipment shall be wall mounted by the integrator of this section. Coordinate plywood (if additional plywood is required) with General Contractor. Costs associated for this shall, if required, be the responsibility of the integrator of this section.

2.11 INPUTS/OUTPUTS

A. Access control will have 10 outputs to the PA system. Provide 10 inputs for various conditions. One of these outputs shall be an all clear.

B. Intrusion detection shall have two inputs to the PA system. Provide 2 inputs for Intrusion relay triggers. One shall be for a lockdown event. One shall be for an all clear, returning the PA to the condition it was in prior to the lockdown event.

2.12 LOCKDOWN EVENT

A. Upon a lockdown signal from the intrusion system, the following programming shall be provided to trigger the PA system to:

1. Immediately play an audio announcement (provided by the integrator) that announces “LOCKDOWN, LOCKDOWN, LOCKDOWN” twice. After this announcement the PA system may be used for emergency input throughout the school.

2. The clocks shall all present a scrolling message of LOCKDOWN repeatedly scrolling until the all clear signal is received from intrusion or access control.

3. Clock flashers shall repeatedly flash until the event is cleared.

PART 3—EXECUTION

3.1 INSTALLATION

A. General

1. Execute work in accordance with state and local codes, regulations, and ordinances.
2. Install work neatly, plumb, and square and in a manner consistent with standard industry practice. Coordinate on-site installation with the Owner and carefully protect work from dust, paint and moisture as dictated by Owner requirements. The integrator will be fully responsible for protection of his work during the

construction phase up until final acceptance by the Owner.

3. Install equipment according to manufacturer's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by manufacturer for correct assembly and installation.
4. Secure equipment firmly in place, including speakers, shelves, cables, etc.
   a. All supports, mounts, fasteners, attachments, and attachment points shall support their loads with a safety factor of at least 5:1 for static loads.
   b. Do not impose the weight of equipment or fixtures on supports provided for other systems.
   c. Any suspended equipment or associated hardware must be certified by the manufacturer for overhead suspension.
   d. The integrator is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, shelves, fasteners and attachments.
5. Locate overhead ceiling-mounted speakers as shown on drawings, with minor changes not to exceed 12" in any direction for hard ceiling or one tile space for drop ceiling spaces.
   a. Mount and adjust as needed to securely support speaker assembly.
   b. Speaker back boxes shall be completely filled with fiberglass insulation or as recommended by the manufacturer.
   c. Seal cone speakers to their enclosures to prevent air passing from one side of the speaker to the other.
6. Painting is required for any exposed work such as exposed back boxes, plates, panels, speakers, speaker baffles, and trim plates. Color shall be approved by the architect and match the wall or ceiling color the devices are installed in. All exterior back boxes shall be sealed at every slot, seam, conduit entrance, and at unused screw holes. Trim plates and baffles shall be sealed to the building with color matching sealant by the integrator of this section
7. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommeted holes in size and quantity necessary for a proper install. Do not allow cable to leave or enter boxes without cover plates installed.
8. Mount all equipment in telecommunications rooms on the T-series drawings. Coordinate equipment installation with other trades and other equipment in rooms.

B. Cabling Practice

1. Execute all cabling in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
2. Do not splice cabling anywhere along the entire length of the run.
3. Make sure cables are fully insulated from each other and from the raceway for the entire length of the run.
4. Do not pull cable through any enclosure where a change of raceway alignment or direction occurs. Do not bend cables to less than radius recommended by manufacturer.
5. Replace the entire length of the run of any cable that is damaged or abraded

during installation. There are no acceptable methods of repairing damaged or abraded cabling.

6. Use cable pulling lubricants and pulling tensions as recommended by the manufacturer.
7. Use grommets around cut-outs and knockouts where conduit or chase nipples are not installed.
8. Do not use tape-based or glue-based cable anchors.
9. Provide ample service loops at harness breakouts and at plates, panels and equipment. Loops should be sufficient to allow removal of plates, panels and equipment for service and inspection.
10. Utilize permanent strain relief for any cable with an outside diameter of 1-inch or greater.
11. All PA system cabling shall be routed in the building maintaining 6” clearance from any electrical cables.
12. Protect all cabling from paint and paint overspray. Any cabling found painted shall be removed and replaced at no expense to the Owner.
13. Cabling shall be neat and bundled. Plastic ‘zip’ ties are not permitted. Use Velcro ties to bundle all cable, every 3’ to 4’ All cablig shall be supported every 3’-4’ with J-hooks.

C. Dress non-UTP cables as follows:

1. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing. Inspect for and remove any solder splatter.

D. Labeling

a. Clearly, consistently, logically, and permanently mark cables, connectors, and electronics and other equipment.
b. For backboard/shelf-mounted equipment, use engraved Lamacoid labels with white 1/8” (minimum) high lettering on black background.
c. Where multiple pieces of equipment reside in the same group, clearly and logically label each indicating to which room, channel, and receptacle location they correspond.
d. Permanently label cables at each end, including intra-room connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used. All labels shall be level, plumb and square.
e. Integrator’s name shall appear no more than once within a given equipment room. The integrator’s name shall not appear on wall plates, emergency phones or speakers.

3.2 TEST EQUIPMENT

A. The integrator shall furnish all test and computer equipment required for all testing and adjustments as well as any site visits by the integrator.

3.3 TEST AND MEASUREMENTS

A. Required audio system tests and measurements:
   1. Impedance measurements of all speaker lines at 50hz, 500Hz, and 5KHz with speakers installed and operating in their specified configuration.
   2. Polarity testing of all speaker lines.
   3. Overall hum & noise testing of each audio reinforcement system. Perform sweep frequency testing of speakers to check for rattles, buzzing, and/or functional problems. Sweeps shall not exceed the manufacturers rated bandwidth or one-quarter rated power for the device under test.
   4. Verification testing to ensure that systems are free from spurious oscillation, Radio Frequency Interference (RFI) or Electromagnetic Interference (EMI).
   5. Tests for audible clicks or pops caused by normal operation.

3.4 INSTRUCTION

A. Integrator shall provide a qualified individual to provide a minimum of 16 hours of instruction to the Owner regarding the design, features and proper operation of the systems. Provide this training in block increments as per Owner direction.
B. All training shall be video recorded by the integrator and provided to the Owner on USB drives.

3.5 FINAL CLEANING

A. At completion of work, remove all rubbish, tools, scaffolding, and surplus materials from the site. Site shall meet Owner's requirements for cleanliness.
B. At completion of work, thoroughly vacuum floors and flat surfaces such as shelves, counters and windowsills in the areas affected by the work.
C. Coordinate removal or storage of packing materials with the Owner. Integrator shall remove all packing materials from the site unless otherwise directed.
D. In the event the integrator fails to perform final cleaning, the Owner may do so and charge any associated costs back to the integrator.

3.6 PROJECT CLOSE-OUT

A. Punch list:

   1. Once notice of Substantial Completion is received, the integrator shall visit the site to review the work, and shall prepare a punch list of items determined to be incomplete, deficient or otherwise not in compliance with the intent of the Contract Documents.
      a. During the review of the work, if the architect finds that the known exceptions/deviations list provided by the integrator was insufficiently thorough, that the work is not substantially complete, or that deficiencies in the work are excessive, the architect will cease review and inform the integrator that the work is not substantially complete. The integrator shall be responsible for fees incurred by the architect for this partial review.

   2. The integrator shall perform corrective action for each item noted in the punch list. When complete, the integrator shall submit the original punch list with each item initialed attesting to the fact that the item was corrected.

a. If necessary, the architect will perform a subsequent review after receipt of the integrator initialed punch list.

3. Should additional reviews beyond the original punch list review be required of the architect due to the integrator's failure to correct all incomplete, deficient, or non-compliant work, the integrator shall be responsible for fees incurred by the architect for the additional reviews.

3.7 FOLLOW UP

A. After the system(s) and facility have been placed in operation and are in use by the Owner, provide technical assistance for the first two weeks of operation on a standby basis for troubleshooting, education, and problem solving.

END OF SECTION

SECTION 28 00 00

ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of a Contract, including conditions of the Contract and Division 1 of the Specifications, shall apply to the Work in this Section.

B. Drawings and general provisions of the Contract, including all portions of the Project Manual are hereby made a part of this Section. Refer to paragraph titled “Quality Assurance” in this section and to Division 1 for requirements for contractors. Throughout this and related Sections, “Integrator” shall not be limited to the singular and masculine and shall refer to one, or more than one, Communications Integrator. The Terms “Integrator” “Communications Integrator” and “Communications System Integrator “shall be used interchangeably and shall be understood to represent the communications integrator contractor responsible for the furnishing, configuring, testing, programming, warranting and for ensuring all work is performed in accordance with manufacturer’s requirements and recommendations for the work identified in this SECTION.

C. Any qualifications or certificates required in this specification may be requested by the Architect as part of the post-bid qualifications review. Such review shall commence subsequent to the bid submission, as none of this information is required as part of the bid submission. In the event that the Architect requests qualification or certification documentation such documentation shall be provided within three business days.

1.2 SUMMARY

A. Any and all cabling mentioned herein and required to complete the work of this section shall be coordinated with and by the communications integrator of this section and provided and installed by the Structured Cabling communications integrator of section 27 10 00 so long as it does not void any manufacturer warranty in this section. Failure of the integrator of this section to coordinate with the 271000 integrator for cabling pre bid shall result in the integrator of this section being responsible to furnish and install all cabling required in this section for a complete and functional system. The communications integrator of this section is responsible for any cabling required by the manufacturer to ensure the manufacturer’s warranty. The scope of work of this Section consists of the installation of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances and services necessary and/or incidental to properly complete all cabling work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Owner, as being required and in general, is as follows: all access control, intrusion detection and video surveillance cabling, parts and equipment specified below, integration between all systems and the PA system, and programming of equipment and devices to complete installation and testing of the systems to be used as complete access control, intrusion detection, PA notification for lockdown and video surveillance systems. The electrical contractor and integrator of this section is responsible for coordinating the cabling responsibility between this section and Section 27 10 00. Integration programming between all systems will be determined at a later date between the owner and architect. Every effort will be made to have the required infrastructure included in the

specification and drawings. Integrator of this section will provide programming when final details are determined for system integrations.

1. The PA (public address) System (hereafter referred to as the PA System) is provided by the 27 50 00 integrator. Access control shall send a relay output to the PA system for an automatic lockdown message to be broadcast upon access control lockdown triggers. Integrator of this section is responsible for all programming required to accomplish this functional requirement. Coordinate with 27 50 00 and 26 00 00 integrators.
2. Elevators have card readers with keypads, inside the elevators and outside the elevator on every floor. Coordinate and provide programming and cabling to accomplish access control requirements as detailed in future meetings between the integrator of this section, the owner, and the architect. A valid card read is required to activate the call button unless a PIN code or key override is used. A valid card read, PIN code or key is required to access each floor. User classes can be restricted by floor or time of day. Upon a lockdown, elevators will be parked on the floor the owner chooses during programming. Coordinate with owner.

1.3 SECURITY SYSTEMS

B. PROPRIETARY Access Control System is Identicard PremiSys by PDC, including, but not limited to, the following:
1. Wall cabinets with batteries
2. Batteries for cabinets and components
3. Multi-technology card readers, mobile enabled
4. Multi-technology card readers with PIN keypads for elevator use
5. Input and output relay boards and modules
6. Power supplies with inline surge suppressors for all cabinets
7. 13.56MHz smart cards, printable on both sides
8. Door contacts (DPDT door contacts provided in door hardware), overhead door and roof hatch contacts, (all DPDT), installation, wiring, and integration to both access control and intrusion detection systems.
9. Request to Exit (REX) devices will be included in door hardware. Wire and connect REX to access control. A REX shall not shunt the door contact, access control will shunt the door contact. This will allow the Owner to decide if a door should ignore a REX request. REX devices will be provided at every door with a door contact, not just access controlled card reader doors. REX signaling shall not unlock a door. Double doors each have request to exit signaling to be integrated into access control.
10. Panic button (hereafter referred to as PB) input devices at locations shown as PB (under desk type) on the drawings to initiate immediate lock down of the access control system as defined by the Owner. Each PB shall be a different input to intrusion detection system, allowing different configurations dependent on PB locations. Panic buttons shall be wired to the intrusion detection system. Access control has inputs from and outputs to Intrusion and outputs to the PA system.
11. Integrate all motion detectors noted on the drawings for access control use (inside and outside stairwells, outside elevators, and in hallways (where noted) and any other locations noted) into access control if there is integration with intrusion to share motion detection when the intrusion system is in a disarmed state. Motion detected shall only report an alarm in access control after normal use hours of the building. If integration does not exist between access control and intrusion, add a motion at the locations noted on the drawings for access control use after hours.
12. Any other hardware/software/licenses required to ensure a fully functional access control security system, intrusion detection system, and CCTV system not specifically listed in this specification.
13. The work of this section is shown on Technology Drawings designated by a T.
14. No corridors or spaces are air plenums. No cabling needs to be plenum rated.

15. All equipment and materials used shall be standard components, regularly manufactured, and regularly utilized in the manufacturer's system.
16. Provide in addition to all relays and interfaces required for a fully functional system, a wall cabinet in the MDF and each IDF, (unless room exists to add in the installed wall cabinets), one input and one output blade, unused, for future use. None of the relays in these wall cabinets shall be in use on opening day unless approved during construction by change order.
17. Provide all licenses, and all integration licenses between access control, intrusion, and video surveillance. All licenses, and support agreements (hardware and software upgrades) initial and if recurring, shall be provided for 3 years.
18. Drawing symbols for this section: DC, RH, E, OH, CR, CK, CO, RX, LM, MB, PB, KP, MO, VCS, VES, PS, SW, FACP, C#### (for location of cameras), SR (Door Sirens), KS (key switch). At all E locations in bathroom ceilings, install blank steel faceplate.
19. Electrical contractor shall provide and install inline surge suppressors to hardwired electrical feeds to all access control panels and intrusion panels not protected by a UPS.
20. Furnish and install yellow Cat6A patch cords from VES faceplate jacks and camera faceplate jacks to VES and camera devices, and red Cat6A patch cords from A4 faceplates to VCS devices.
21. Every door shown on the drawings with a PS symbol, and every door noted on the door schedule with a PS require access control integration for all leaves in the doorway. Some leaves do not have a card reader, but access control shall be able to schedule these non-card reader leaves locked or unlocked.
22. All doors/leaves with door contacts shall be monitored in the access control system (as well as the intrusion system).
23. Integrator is responsible for all data entry of users, card enrollments, and user access level groups and assignments to users in the access control system.
24. LM – latch monitoring (LM on drawings) will be provided at these doors in door hardware. Access control subcontractor/integrator shall wire and integrate this signal into access control for latch monitoring alarms. Coordinate alarm time out with owner to signal a latch held in doorway. At double door locations, each leaf shall be wired and monitored in access control.
25. Integrate system into district system for a single user to manage all systems in the district. Coordinate with Owner.
26. All programming of access control in coordination with the owner and architect shall be provided by the integrator of this section. This includes new users added to the system, new credentials, new authorization levels and assignments, door scheduling, lockdown programming, notifications (emails and texts) of events for lockdown, and other scenarios, event programming (such as shelter in place, lock in or lock out), system state programming for after hours use and normal use, panic button lockdown integration with intrusion detection, and so on.

B. Intrusion Detection System –

1. DMP is basis of design. Provided system shall be able to integrate with DMP district systems. Every wired contact and motion shall be individually ID reportable. Communications integrator of this section shall provide laminated color coded floor maps for each building section no smaller than 21"x15" of the building, which clearly shows all door contacts by door number and contact ID, motions by ID, room numbers, hallway numbers, building 'zones', and keypad locations with ID.
2. All motions shall be placed to minimize false alarms

3. Integrator of this section is responsible for all intrusion system programming and integrations, to include user data input, user group creation, if any, code creation and user assignment of codes, and partitioning of the system.
4. Motions installed in the gym require wire guards. Furnish and install wire guards over security devices.
5. Panic buttons and medical buttons shall be wired to intrusion system for immediate central monitoring station reporting.
6. All programming shall be provided for all scenarios, such as lockdown via the panic buttons and integration with access control, integration with PA system, medical emergency button integrations between system and central monitoring, and programming for different events coordinated with the owner and architect such as lock out, lock in, shelter in place, evacuate, and so on. All user programming and user additions, access levels and user codes shall be provided by the integrator of this section in coordination with the owner. Other zones will be required; coordinate with owner and provide programming as required.

C. Video Surveillance System – Avigilon Control Center is basis of design

1. IP based video surveillance system. System shall be Enterprise class, expandable to provide video surveillance for other buildings within the district/town. Provide enterprise and active directory integration licensing (licensing for VMS, NVRs and all cameras).
2. Category 6A permanent link cabling for each camera is provided and installed under section 271000.
3. Provide yellow Cat6a patch cords from the CCTV faceplate jack (permanent link) to the cameras.
4. Communications Integrator must work with owner to define a specific sequence of operations for the camera control system, software client, camera groups and PTZ manual controls. Operations will include camera tours, camera groups, camera group tours, sequence for alarm management, if applicable, or loss of signal. Camera controls shall be programmed with macros and programming sequences to provide camera tours, quick call up of individual cameras and by groups, by building partitioning/ Program loss of service notification to administrative staff. All programming and sequencing is included in the bid. All programming for system integrations (Intrusion, Access Control) is included in the bid.
5. Provide snapshots of every camera, and review with the owner and adjust views of each camera as necessary for final view approval of the owner. If views are not correct, readjust camera views until desired views are approved by owner.
6. Program, name and group cameras as per owner direction. Owner shall provide every camera name before equipment submittal is sent to architect for approval. Coordinate with architect.
7. Change default passwords of all cameras and the recording system. Coordinate passwords with owner.
8. Set camera time to network time source. Set recorder time to a network time source.
9. H.265 shall be used for the record stream, if available, otherwise H.264 shall be used. Cameras shall be set to record on motion.
10. Program PTZ tours as per owner direction. PTZs shall record 24/7.
11. Power over Ethernet switches for cameras shall be provided by the owner. HPOE injectors required for multi sensor cameras and the PTZ camera shall be furnished and installed by the integrator of this section.
12. Camera viewing and stored video shall be accessible from a PC on the network and on mobile devices via an app.
13. Viewing and monitoring of the recorded video will take place remotely over the Owner's

network using existing computers.

14. Mounting Brackets and lenses: Mounting brackets and lenses have been specified on the drawings and in the specification below to indicate the style of mounting for interior and exterior cameras and the types of lenses to be used. Communications Integrator is responsible for ensuring that the correct mounts and lenses for the distance requirements are used for the camera system specified.
15. The specifications provided are to provide a general description of the operating criteria of the system. Communications Integrator is responsible for providing a fully operational system.
16. Coordinate camera labeling on the submittals and as-builts with owner. No submittal shall be reviewed until the floor plans reflect the owners camera label scheme.
17. Equal cameras submitted must, at a minimum, meet the minimum lens focal capabilities specified in each camera paragraph.
18. Develop and populate software maps with every camera on the map. Simply clicking a camera will bring up a live view of the camera. If capable, after hours cameras that detect motion shall present a halo effect to visually notify a user of camera motion. In MDF, connect camera to an intrusion output for lockdown alarm. When in lockdown, all cameras with motion shall present halo effect on the software maps when detecting motion.
19. All camera manufacturers that are currently banned by the US Government for use by government agencies are not acceptable for use on this project. This includes but is not limited to equipment and services provided by the following:
    a. Telecommunications equipment produced by Huawai Technologies Company or ZTE Corporation, or subsidiaries or affiliates.
    b. Video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, Dahua Technology Company, or subsidiaries or affiliates.
    c. Telecommunications or video surveillance equipment or services reasonably believed to be owned, controlled by, or otherwise connected to the government of a covered foreign country, such as The People’s Republic of China
    d. Any equipment from the above manufacturers rebranded by other manufacturers is prohibited.
    e. Any other manufacturer’s equipment or models added to the banned list.

D. The below naming of two or more distinct and different manufacturers or model numbers is for the purpose of establishing a standard of quality, design, functionality, and appearance and is not intended to establish these manufacturers and/or products as the only acceptable products, nor is it intended to limit the submittal of substitute products and/or manufacturers which are equal to the established standards. Equal products may be submitted (except where proprietary equipment is noted in the specification) and will be reviewed for their equivalency in meeting the established standard.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. All Sections of Division 27.

B. The following related work or material shall be provided under the designated trades and under the listed SECTION:

1. SECTION 26 00 00- ELECTRICAL All electrical work related to items in this Section.
2. SECTION 27 10 00- STRUCTURED CABLING
3. SECTION 27 40 00 – AUDIO - VIDEO COMMUNICATIONS
4. SECTION 27 50 00- DISTRIBUTED COMMUNICATIONS AND MONITORING

5. SECTION 14 22 00 – COMPACT TRACTION ELEVATORS
   a. Coordinate cameras and card readers (provided in this section) and programming and installation with elevator contractor.
6. SECTION 05 31 00 – STEEL DECKING See for restrictions concerning the hanging of material, cable tray, mounts, brackets, hooks, and other items from the roof or decking
7. SECTION 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY
8. SECTION 08 71 00 – DOOR HARDWARE
9. ARCHITECTURAL DRAWINGS - DOOR SCHEDULE A6.00A and A6.00B
10. SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES
11. SECTION 21 00 00 FIRE PROTECTION
12. SECTION 08 35 23 ACCORDION FOLDING DOORS

1.5 REFERENCES

A NFPA 70 - National Electrical Code.

1. UL294 - Standard for Access Control Systems.
2. NFPA 72 - National Fire Alarm Code.
3. NFPA 101 - Life Safety Code.

1.6 REGULATORY REQUIREMENTS

A Systems shall be UL-Listed.

1.7 SYSTEM DESCRIPTIONS

A. Proprietary Equipment: Specified Manufacturer: To conform and integrate with currently established systems within the district at various school locations, drawings and specifications have been based on the Identicard Premisys access control system by PDC.

Manufacturer:	Item:	Part Number:
PDC	IDENTICARD PREMISYS	VARIOUS
DMP	INTRUSION SECURITY PANEL	XR550

B. Basis of Design Equipment: The district is currently using the following equipment at various school locations. Drawings and specifications have been based on the DMP intrusion system, and Avigilon Video Management System and Network Recorders.

Manufacturer:	Item:	Part Number:
AVIGILON	VIDEO MANAGEMENT SYSTEM	LATEST VERSION
AVIGILON	RECORDER	NVR5-PRM-224TB-S19

1.8 SUBMITTALS

A. Architect may require submittal submission within 45 days of bid award. Submit under provisions of Section 01300. Tabulate and index all pages. Show reference to specification

section in index. Any submittals received non-tabulated or indexed shall be returned without action.

B. Manufacturer's Data:
   1. Submit five copies of:
      a. Product Data Sheets.
      b. Installation Instructions.
   2. Authorized Dealer Certificate and Certified Training Certificates of communications integrator who will be installing equipment.

C. Shop Drawings:
   1. Submit digital copies in AutoCAD 2013 or later format, on USB, shop drawings, including:
      a. Layout of all equipment and locations supplied AutoCAD drawings, include labeled wiring risers.
      b. Field Controller equipment location wall layouts, including size requirements.
      c. Detailed wiring diagrams of Field Controllers, Door Details, and head-end devices.

D. As-Built Drawings: Update Shop Drawings to create final As-Built Drawings as construction progresses. Submit copy digitally in AutoCAD 2013 or later format on a USB drive.

E. Operation Data: Include on USB drive a copy of the software Administrator and Operator Manuals.

F. Maintenance Data: Include on USB drive a copy of the maintenance and repair procedures.

1.9 QUALITY ASSURANCE

A. Manufacturer: Each system (access control, intrusion detection, video surveillance) shall be from a single-source manufacturers that specializes in each system with a minimum of 5 years experience.

B. Communications integrator: Company specializing in intrusion detection, video surveillance and access control systems with a minimum of three years experience on systems of similar size and scope. Companies and technicians working on project must be certified by the manufacturer of the hardware and software being installed on the project.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store equipment in a secure, dry, locked storage area under this scope of work.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.11 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.12 WARRANTY AND SERVICE AGREEMENT

A. All equipment, materials, and labor shall be guaranteed for a period of 36 months from the date of final acceptance by the Owner. For support agreements from a manufacturer that are in 2 year increments, provide 4 years warranty and software maintenance/subscription for those systems if a 3 year term cannot be provided.

B. Provide any licensing, software maintenance updates or upgrades at no additional cost to the Owner for this period.

C. Perform two (2) scheduled preventative maintenance site visits per year during the warranty period.

D. Response Times - Normal business hours shall be 7 AM to 5 PM Monday through Friday. Calls for service before noon shall be responded to on-site before the end of the day. Calls after noon shall be responded to on-site by noon the following business day.

E. Provide extra costs for time outside of normal business hours if the Owner requires emergency service.

F. Submit normal and after hours labor costs and typical costs for equipment for items not covered under the Warranty, like: Acts of God, vandalism, misuse.

G. Owner's current monitoring company shall monitor the intrusion detection system. Coordinate with owner and owner's monitoring company to add the high school intrusion system monitoring system. Program notifications, responses and call backs with the owner and owner's monitoring company.

H. Communications integrator shall conduct warranty repairs on site unless prohibited by the manufacturer's warranty. If the latter, communications integrator shall provide substitute systems, equipment, and devices acceptable to the Owner for the duration of the off-site repairs. Replace items out of service more than 10 days with new equipment during the warranty period.

I. Communications integrator shall transport warranty equipment, substitute systems, test systems, equipment, devices, materials, parts, and personnel to and from the project site at no additional cost to the Owner.

J. All licenses for equipment and devices provided shall be for 3 years (unless 3 years cannot be obtained, in which case provide 4 years of licensing). Include costs in the bid.

1.13 EXTRA MATERIALS

A. Provide one (1) each of the following components to serve as system spares:
   1. Card reader
   2. Card reader with keypad
   3. Access control board
   4. Access control input board
   5. Access control output board

PART 2 PRODUCTS

2.0 Proprietary Equipment: Specified Manufacturer: To conform and integrate with currently established systems within the district at various school locations, drawings and specifications have been based on the Identicard Premisys access control system by PDC.

Manufacturer:	Item:	Part Number:
PDC	IDENTICARD PREMISYS	VARIOUS
DMP	INTRUSION SECURITY PANEL	XR550

C. Basis of Design Equipment: The district is currently using the following equipment at various school locations. Drawings and specifications have been based on the DMP intrusion system, and Avigilon Video Management System and Network Video Recorders.

Manufacturer:	Item:	Part Number:
AVIGILON	VIDEO MANAGEMENT SYSTEM	LATEST VERSION
AVIGILON	RECORDER	NVR5-PRM-224TB-S19

2.1 ACCESS CONTROL (2.1 - 2.29)

A. PROPRIETARY Identicard Premisys by PDC.

2.2 LOCATION

A. The 4 post security rack in the MDF (which contains the access control server, VMS server and VMS NVRs) is provided under SECTION 27 10 00. Security rack is identified in the MDF on the floor plans. Power above the rack is two 120v30amp L5-30 twist lock receptacles. Two UPS devices shall be provided in the rack by 27 10 00. All equipment in wall mounted units shall have batteries. Power to these wall cabinets shall be hard wired to the power circuit on the plywood back board in the room by the electrical subcontractor and shall have inline surge suppressors install on all power feeds to cabinets.

2.3 OVERALL SYSTEM CAPABILITY

A. The Identicard PremiSys Access Control Equipment shall monitor and control facility access, and shall perform alarm monitoring, and communications loss monitoring. The system shall also maintain a database of system activity, personnel access control information, and system user passwords and user role permissions. The system shall provide email and/or text message alerts for all alarm conditions and threats. Any other system submitted for approval shall be compatible with the existing enrollment station in the district.

B. The Identicard system shall provide the following Access Control capabilities:

1. Integrated photo ID creation capability with video verification.
2. User interface secured access under encrypted password control.
3. System-wide timed anti-passback function.
4. Regional anti-passback with mustering and roll call functions.
5. “First-in-unlock” rule enforcement.
6. Multiple access levels and cards per person.
7. Card support for Weigand card readers.

8. Detailed time specifications.
9. Simultaneous support for multiple card data formats.
10. Elevator control.
11. Access privileges variable by threat level.
12. Scheduled portal unlock by time and threat level.
13. Activation/expiration date/time by person with one minute resolution.
14. Access level disable upon immediate lockdown.
15. Multiple holiday schedules.
16. Timed unlock schedules.
17. Scheduled actions for arming inputs, activating outputs, and locking and unlocking portals.
18. Card enrollment reader support.
19. Wiegand Reader support.
20. Wiegand keypad PIN support for 4-digit or 6-digit PINs.

C. The system shall provide the following Monitoring capabilities:
1. Support for the creation of custom sets of alarm event actions.
2. Provides the ability to assign threat levels to various alarms according to severity.
3. Support for electronic supervision of alarm inputs.
4. Support for the use of output relays for enabling circuits under alarm event control.
5. System user permissions to grant whole or partial access to system resources, commands, and personal data.
6. Secure access to the user interface under encrypted password control
7. Delivery of alerts via browsers, email, and text messages.

D. The system shall provide the following Security Database capabilities:
1. Maintain data of system activity, personnel access control information, system user passwords and custom user role permissions for whole or partial access to system resources and data.
2. Ethernet port with AES-256bit encryption
3. Embedded secure HTTPS web server
4. Autodetect hardware modules
5. Automatically create unique encrypted authentication keys per site and per credential

E. Furnish and install wall cabinets, wiring troughs, controllers, input boards, output boards and access control boards for a fully functional system to include access control of all doors with card readers and all doors without card readers that have power supplies. A door with electrified hardware (see 08 71 00 Section) without a reader (such as a second doorway at an entry or a second leaf in a double door) will be controlled locked/unlocked by access control if it has a power supply (PS symbol) shown on the drawings.

2.4 HARDWARE PACKAGING REQUIREMENTS

A. The System shall utilize wall enclosures for the various components of the access control system. The wall-mount enclosures shall have a lock requiring a key, and a cabinet door tamper switch. Individual cards shall not have tamper switches enabled. Integrate tamper switches for cabinets with access control to send alarm events to owner.

B. Furnish and install batteries in cabinet or in cabinet beneath component cabinets, with conduits connecting the cabinets.

C. All power shall be hard wired, and have inline surge suppression installed

D. Any additional plywood required for wall mounting of troughs or cabinets will be the responsibility of the integtrator of this section.

2.5 CARD READERS

A. Card Readers:
1. CK symbol – furnish and install Black Multi-technology Card Reader with keypad and mounting plate if required at every elevator door on every floor, and inside each elevator. Multi-technology reader with keypad required. Schlage MTK15 or equal by HID.
2. CR & CO symbols- furnish and install a black multi-technology proximity reader (Schlage MTB15 or equal by HID) with mounting plate if required. Furnish and install mullion mounted slimline reader (Schlage MTB11 or equal by HID) where required.
3. All card readers shall function without a beep for card reads. Only a visual indication of a valid or denied card read will be programmed.
4. Credentials with authorized exits at interior CO readers at a door with a siren shall momentarily disable the local door alarm siren in access control. Similarly, the CR outside the doorway shall also shunt the siren from sounding on an authorized entry. An authorized card presented at the local door outside CR or inside CO reader shall also reset the door siren if the siren is alarming. The key switch near the siren shall also reset/arm/disable the siren function at the doorway.

2.6 BACK BOXES. Backboxes for all security devices in quantities necessary for design intent. Provide backboxes and deliver to electrical contractor for installation.

2.7 POWER SUPPLIES. Power supplies in quantities necessary for design intent, by Altronix .

2.8 DOOR CONTACTS. Wire and integrate DPDT door contacts for all door leafs as shown on the drawings (designated as DC). Door contacts are furnished in door hardware (Section 08 71 00). Note that all door contacts shall be wired to both access control and intrusion systems.

2.9 OVERHEAD DOOR CONTACTS. Provide and install/wire overhead door contacts, for all overhead doors as shown on drawings (designated as OH), Sentrol Model 2507AD. Note that all door contacts shall be wired to both access control and intrusion systems.

2.10 ROOF HATCH CONTACTS. Provide and install/wire Roof hatch door contacts as shown on the drawings for all roof hatches (designated as RH). Sentrol Model 2507A. Note that all door contacts shall be wired to both access control and intrusion systems.

2.11 REQUEST TO EXIT DEVICES. Cable door hardware REX devices (provided in door hardware, see Section 08 71 00) to access control system. A Rex device shall not shunt a door contact, the access control system shall shunt the door contact. All doors with door contacts, regardless of access control card readers on the doors, require rex device cable and installation into access control. The owner shall decide which doors will be programmed to ignore the rex function, thereby sending an alarm if the portal is opened from either side. See door hardware and door schedules for rex devices and notes. Furnish and install cabling to every portal that is shown on the drawings with DC symbols, whether the rex device is included in the door hardware or not. Doors annotated on the drawings as Exit Only shall be initially programmed for REX ignore to alarm in access control for the door opening from either side. SR (sirens) are to be provided on noted doors. Siren shall sound when the door is

open without a valid card read. Card out readers are to be provided as noted on the drawings. A valid card read from a card reader on the exterior side of the door shall also disable the siren to allow entry into the building. Sirens are to be reset by either access control, a valid card read, or a key switch. A key switch set to disable and left on disable shall shunt the siren from alarming when the door is opened, but access control shall still report an alarm that the door was opened.

2.12 SMART CARDS. Photo-badge Smart Cards, 13.56MHz, lifetime warranty with labels. Coordinate part number, fac code and starting number with owner. Provide 500.

2.13 INPUT/OUTPUTS

A. Provide for 10 inputs from intrusion detection panel to allow access control to integrate with the intrusion detection system. These do not count as 'spare'.
   1. One input from intrusion is for a lockdown event. This shall trigger the lockdown programming of the access control system.
   2. One input from intrusion shall be for a lockdown all clear signal.
   3. One input from intrusion shall be to set access control back to normal programming if access control is in an afterhours use level/program. This indicates the school is unoccupied and the intrusion system is armed.

B. Provide 10 outputs from access control to the intrusion detection system. These do not count as 'spare'.
   1. One output to intrusion shall be to initiate a lockdown event in intrusion when triggered in access control.
   2. One output shall be for a lockdown event all clear to intrusion, clearing the lockdown event.

C. Provide 5 access control input relays, cabled from the Fire Alarm Control Panel (FACP). Cable these relays to the FACP and leave coiled 10' above panels in ceiling. Label all cables with input relay identifiers.
   1. One input from the FACP shall be for smoke detection and/or water flow detection in the fire alarm system. Upon this condition, interior doors into the building from stairwells shall be unlocked if in a lockdown event.

D. Provide 5 access control outputs to FACP. Cable these relays to the FACP panel and leave coiled 10' in the ceiling. Label all cables with relay identifiers.
   1. One output to FACP is to drop doors off mag holders during after hours use of the building.
   2. One output to FACP shall be to re-energize the mag holders when the after hours use condition in access control is cleared.

E. Provide 10 outputs from access control to the PA system for various non lockdown event triggers. These shall trigger announcements if desired, and clock messages for the events. One output shall be all clear.

F. Provide in addition to all required inputs and outputs above, one input board and one output board in each IDF and the MDF, unused, on opening day of school.

2.14 VIDEO ENTRY SYSTEM

A. General
   1. Furnish and install a complete video/audio entry intercom system with independent door release mechanisms according to the following specifications. Manufacturer's names and part numbers used herein establish the required type, quality and operating characteristics. Provided system shall have at a minimum the following functional capabilities: System shall be IP based, PoE powered and allow remote door release on an iOS or Android app using WiFi connection.

B. Door stations and indoor room stations shall be complete with handsets, 7 in. color desktop mounted video monitor receivers, door release buttons and desk stands. Provide and install:
1. Six Aiphone 7 in. color master control stations, part number IX-MV7-HW-JP . Three VCS are in the admin area (these control door C102A-01, 124-06, 130-01, and 122A-01). The fourth is at the kitchen desk, area 124, the fifth is in the kitchen office, 124D. The two kitchen VCS only control door 124-06. The sixth is at the Custodian office, 233B. This control station shall only unlock door 130-01.
2. Furnish IXGW-GW series mobile app gateway, eight user. The doors shall be able to be unlocked remotely. Provide licensing for control of doors from the IX-MV7-HW-JP handsets.
3. Furnish and install desk stands.
4. The video door stations shall have vandal resistant hardware. Provide and install: four Aiphone video entry door stations. One outside main entryway door (C102A-01), one outside kitchen door (124-06), one outside 130-01 door, and one outside café door 122A-01. All are shown by as a VES symbol. Station shall have tamper proof surface mounted stainless steel housing. Aiphone part number IX-DVF with surface mount box . Coordinate back box location and installation with electrical contractor. Cameras in door station shall be added to the VMS system and be recorded. Provide licenses to add these cameras to the VMS system.
5. Provide all programming of buttons for desired functions.

2.15 DOOR RELEASE SWITCHES

A. Furnish and install, where shown with SW (four locations) in 120, four momentary switches. Two switches will unlock door 120-01 (one switch at each desk location) and the other two shall unlock door 120-02. Doors will be unlocked only while the buttons are depressed. Cable switches to nearest input relays for access control. Two switches can be consolidated, such that one faceplate has two switches at each desk location. A faceplate with a switch for each door. Switches will be disabled upon lockdown. Switch shall be UB-1 push button by STI or equal. Clearly label each switch for the door it unlocks.

2.16 THIN CLIENTS - Furnish and install 15 thin clients (if required) on owner devices.

2.17 LATCH MONITORING - Integrate door hardware latch monitoring at all exterior doors and interior doors as labeled LM on the door schedule drawings into access control. Latch monitoring function provided by door hardware. Cable door hardware signals to access control inputs. Coordinate latch monitoring time out before an alarm is generated with owner.

2.18 Furnish access control relay trigger to FACP system to allow an after hours use of building and another relay trigger to initiate a lockdown event. Both triggers shall drop all mag hold open doors, and lock specific doors in the building to partition the building for after hours use (or all electrified doors for a lockdown) of the building. Furnish input to access control from intrusion system to clear this after hours partitioned state when the intrusion system is armed (unlock all doors that were locked to partition building for afterhours use). Doors will return to the normally scheduled status.

2.19 DOOR SIRENS

A. Furnish, wire, integrate, program and install local door sirens/alarms above the doors as designated on the drawings with an SR symbol.

B. Siren shall sound local alarm upon unauthorized ingress or egress. Siren shall be reset via the access control system (programming) or key switch (see below) or authorized card read at the doorway (either exterior reader at the doorway or interior reader at the door way). Sirens shall

also be allowed to be reset by a pin code on the intrusion system keypad. Program one output from intrusion system to the access control system to allow this functionality.

C. Provide part number 335 by DMP and power supplies. Power supplies shall be in the local IDFs on the plywood back board. Connect to Security power circuit.

D. Battery powered sirens are not acceptable.

E. Furnish and install wire cage to protect sirens in gym.

2.20 KEY SWITCHES

A. Furnish, wire, integrate, install, and program with access control local door key switches at all KS symbols.

B. Ensure key switch is of the appropriate type to allow staff to reset the door siren alarm in access control once the door is secure.

C. Key switch shall reset access control to shut off the siren when turned to disable then enable. When left in disable, siren will be muted upon door opening, but access control shall still report an alarm when door is opened from either side. Program access control accordingly. Key switch: MCK-6-4 by Assa Abloy or equal with mortise cylinder CY-1A by Assa Abloy or equal. All switches shall be keyed the same and have red and green LEDs to designate door alarmed (green) and door disarmed (red).

2.21-2.29 NOT USED

2.30 INTRUSION DETECTION SYSTEM (2.31 – 2.60)

2.31 PROPRIETARY EQUIPMENT DMP XR550 Security Control Panel

A. The base panel shall have the following minimum capacities: up to 574 zones. expandable using 8-zone expansion modules. 10 on board zones, up to 16 supervised keypads, 506 outputs, 32 areas, 32 character names for users, zones and area names, 10,000 user codes, 99 profiles, and 12,000 event buffer. Furnish and install the XR550 by DMP or equal in the high school, and integrate in to the district XR150 schema used in the district.

B. All zones shall be fully supervised and programmable. Panel shall be complete with integral power supply and supervised battery charger, auxiliary power for powering security detection devices, programmable switched auxiliary power supply for 4-wire smoke detectors, integral supervised digital alarm communicator, supervised bell/siren output, and two general purpose programmable outputs which can be programmed as general purpose outputs or as the system's addressable loops.

C. Provide and install inline surge suppressors to hardwired electrical feeds. Furnish and install batteries in all panels. All panes shall be hard wired to power.

2.32 System Keypads (Symbol KP on drawings)

A. The system shall accommodate up to 16 LCD keypads which are powered from the base panel communications bus.

B. LCD keypads shall have a display capacity of at least 32 alphanumeric characters

D. Keys shall be backlit for low light ease of use. Keypads shall include individual "Armed", "Ready" and "Trouble" indicators, three keypad-activated alarm keys, and five programmable function keys.

E. Furnish and install at all KP locations. Aqualite 7000A or equal.

2.33 Central Station Reporting

A. Panel shall have onboard dialer

B. The system shall also allow communication to a pager. The telephone numbers shall be programmable for backup dialing should the primary number fail.

C. The system shall be programmable for split reporting so that alarms/restorals, openings/closing and miscellaneous events can be sent to different telephone numbers.

D. The system shall report a separate account code for each partition and for non-partition (system) events.

E. The system shall provide opening/closing scheduled suppression to prevent opens and closes from being reported to the central station.

F. The system shall be capable of reporting all alarms, troubles, and system status information by combinations of all communication methods installed including: digital dialer communicator, TCP/IP and Cellular.

G. Current district monitoring company shall monitor intrusion detection system. Coordinate monitoring company with owner and program system accordingly.

H. Furnish and install plug-in LTE cellular communications option. Coordinate carrier with owner.

2.34 TCP/IP LAN/WAN Communications

A. Panel shall have onboard 10/100 network communication. The system shall be able to communicate all alarm signals via the network.

B. Communication shall be via a LAN or WAN, compatible with 10BaseT and 100BaseT Ethernet TCP/IP communications.

2.35 Motion Detectors (Symbol MO in a hex on the drawings)

A. Ceiling mounted 360 degree detection area for a min 32ft coverage area. Provide wall mounted motion detectors where shown on the floor plans, min 32 ft. coverage area side to side. Furnish and install second motion where noted on drawings for access control input.

2.36 Addressable Modules

A. Addressable device to monitor alarm, tamper and trouble conditions.

2.37 Input/Output.

A. Provide for 10 intrusion outputs to the access control system to allow intrusion panel to integrate with access control (these are not counted as ‘spare’).
   1. One of these outputs shall be for access control to set the doors in the building for an ‘intrusion armed’ condition.
   2. One output for a lockdown event (panic button)
   3. One output for lockdown all clear

B. Provide for 10 intrusion inputs from access control panel to integrate access control with intrusion panel (these are not counted as ‘spare’).
   1. One of these inputs shall be for a lock down event.
   2. One input shall be for a lockdown all clear

C. Provide 5 intrusion inputs from FACP (Fire Alarm Control Panel). Program response as per owner direction. Cable these relays to the FACP and leave coiled and labeled 10' above each panel.
D. Provide two outputs to fire alarm control panel, leave wire coiled 30' above fire panel. Coordinate lockdown integration with fire alarm integrator and owner.
   1. One output shall be for lockdown event (drop doors off mags)
   2. One output shall be for all clear, (re-energize mags)
E. Provide relay output (2 total) from intrusion to the Public Address system for when a lockdown is initiated. Leave 25' coiled at PA system head end for integration by PA integrator.
   1. One output shall be for PA to trigger PA announcement, flashers and clock message.
   2. One output shall be for reset/all clear returning PA to non-lockdown state
F. Provide a relay out during a lockdown event to the alarm input of the camera in the MDF. Reset this relay when lockdown is cleared.
G. Provide 10 spare intrusion inputs and intrusion outputs.

2.38 Door Contacts
A. All DPDT door contacts (provided in door hardware Section 08 71 00) shall have the second set of contacts on all doors with door contacts wired to intrusion detection system.

2.39 Zones. Program intrusion system into zones. Coordinated with the owner. A PIN shall be required to disarm all zones and a different PIN shall be is required to arm/disarm the system

2.40 Furnish relay trigger to access control for intrusion alarm activation. Upon intrusion arming, access control shall return doors that were locked during after hours use to their normally scheduled state in access control.

2.41 See access control section for other relays required for integration with access control.

2.42 PANIC BUTTONS. Furnish and install 'panic button' devices (contact closure button) in locations marked as PB on the drawings to allow the owner to immediately initiate a lock down of the various security systems as per owner's direction. Provide plunger type hold up button. Each PB shall have its own input to the intrusion detection system. Furnish and install cable from each panic button to the intrusion system. Provide 5 additional reset keys. Intrusion shall notify central monitoring station of lockdown alert to make call notifications as appropriate. Relay closure to access control shall signal access control to notify administration, police and fire by email and text and to initiate lockdown programming in access control. Relay closure from intrusion to PA system shall trigger lockdown programming of PA system. Keypad shall display location of panic button pressed. Central monitoring shall be notified of panic button location pressed.

2.43 WALL MOUNTED MEDICAL EMERGENCY BUTTONS - Furnish and install STI SS2489EM-EN at all MB locations. Furnish power supply for horn and illumination in local IDF. Cable relay button to intrusion panel. Intrusion shall report medical condition with button location to central monitoring station. Program Intrusion response as per owner direction. Relay closure to access control shall trigger access control medical condition response. Siren shall sound when the cover is lifted. Twisting button shall reset relay and reset intrusion for the MB input. Alarm condition shall notify off site EMS personnel by call, email and text by central monitoring station, and notify onsite personnel by email and text. Keypad shall display location of medical button pressed. Cover label shall read "911 MEDICAL EMERGENCY"

2.44 Program all clear code for use at keypads to clear a lockdown event.

2.45– 2.60 NOT USED

2.61 VIDEO SURVEILLANCE SYSTEM (2.61 – 2.81)

2.62 GENERAL

A. Acceptable manufacturers:
1. Video cameras:
a. 4k outdoor:
by Avigilon 8.0C-H6A-D02-IR or equal by Bosch or Axis. See below for other cameras.
b. All Cameras submitted must be compatible with submitted VMS and be able to record on motion.
c. Cameras that do not record to network video recorders on premises shall not be acceptable. Cloud only recording cameras shall not be acceptable.
2. Video Management Software and Recorders – Basis of Design by Avigilon
a. VMS shall support full resolution of the cameras approved and analytics as detailed below.

B. Coordinate camera labeling on the submittals and as-builts with owner. No submittal shall be reviewed until the floor plans reflect the owners camera label scheme.

2.63 SOFTWARE

A. The Communications Integrator shall supply the licenses per camera integrated into the CCTV system as necessary, (to include all of the video entry systems cameras) and any licensing required for server/software/remote clients (min 20 remote clients) and mobile clients (min 20).
B. Software shall provide the following camera analytics for searches and alarm events: people search, object enters area, object loitering, objects crossing line, object appears, object not present in area, objects leave area, object stops in area, direction violated, and tamper detection. Classified object types: vehicle (car, truck, bike, bus); person.
C. Install and program Focus of Attention application in Avigilon software. Train users on the use of camera alerts for alarms/analytic reporting, motion reporting, and event reporting, to simply see the alert and click a camera for its view.

2.64 NVRs: Furnish and install two 244TB servers, part number NVR5-PRM-244TB-S19 by Avigilon or equal. Note that an equal will require the cameras be submitted to the NVR manufacturer for recalculated storage requirements that may increase the number of NVRs: required for 60 days of recording, all cameras (except PTZ) at 1fps 24/7 (ptz at 15fps 24/7 recording) with an increase to 15fps upon motion, for an estimated 10 hours of motion per day. Any increase in costs shall be at no expense to the owner post bid. Include licenses for all cameras – Servers shall be Enterprise class, include rack rails, 4x1GbE RJ45 ports, 4x 10GbE SFP+ ports, 48GB DDR4, Intel 16 core Xeon CPU, redundant power supplies, OS (Windows Server 2019) on two SSD hard drives in RAID 1 array, RAID 60 for 244TB useable storage (288TB raw), 5 year warranty min. Furnish and install rack mounted sliding KVM solution for all 3 servers (two NVR, Access control server, 5 spare). NVR shall provide 60 days of recording.

2.65 FIXED NETWORK COLOR CAMERA, ELEVATOR CAR (Provide 2; (See C121 on T2.30 for details) The surface corner mounted vandal resistant mini dome color cameras in the elevators shall be an Avigilon Model 3.0C-H5A-CR2-IR-SS or equal. Housing shall be stainless steel, and lens shall be 2.3mm. Provide all media conversion equipment, power supplies, PoE injectors and coordinate all cabling with 27 10 00 communications integrator and elevator integrator to connect and integrate elevator cameras to the network and VMS system. Position in rear corner of car for view of occupants and of door.

2.66 FIXED NETWORK COLOR CAMERA 8MP Outdoor (Provide quantities listed for each camera type on T2.30. Avigilon 8.0C-H6A-D02-IR with 10.9mm to 29mm lens or equal- see C0458 (with pendant wall mount) & C0558 (with pendant pole mount) on T2.30. Typical mounted height on poles for cameras is 15' AFG, with additional cameras on the same pole just below each other. Any alternate cameras, (if domes, must include pendent mounts at no expense to the owner and have clear domes) must have a minimum focal length of 12mm-22mm to be considered an equal while meeting the rest of the characteristics of the camera above.

2.67 FIXED NETWORK COLOR CAMERA Avigilon 8.0C-H6A-D01-IR or equal 8MP resolution (Provide quantities listed on T2.30) at locations shown on T2.30. See C0448 on T2.30. Camera shall have clear dome. Min focal length 4.4mm to 9.3mm. Provide pendant wall arm.

2.68 FIXED NETWORK COLOR CAMERA Avigilon 6.0C-H6A-D01-IR 6MP or equal. Provide quantities shown on T2.30 for camera type C1146. Camera shall have clear dome. Min focal length 4.4mm to 9.3mm.

2.69 FIXED NETWORK COLOR CAMERA Avigilon 6.0-H6A-D01-IR 6MP or equal. Provide quantities shown on T2.30 for camera C1346. Provide recess mount in ceiling. Camera shall have clear dome. Min focal length 4.4mm to 9.3mm.

2.70 FIXED NETWORK COLOR CAMERA 8.0C-H6A-D01-IR 8MP or equal. See C1348 on T2.30 for quantities. Domes shall be clear. Provide recess mount in ceiling. Min focal length 4.4mm to 9.3mm

2.71 FIXED NETWORK COLOR CAMERA See C0629 on T2.30. Avigilon 15C-H5A-3MH 15MP (3 – 5MP imagers) multi imager camera or equal. See quantity listed on T2.30. Furnish and install optional IR ring (H4AMH-AD-IRIL1) and H5AMH-DO-COVR1. Provide corner mount (CRNMT-1001) and pendant mount (H5AMH-AD-PEND1) and wall mount (WLMT-1001) adapters and PoE injectors. Min focal length 3.3mm to 5.7mm

2.72 FIXED NETWORK COLOR CAMERA Avigilon 8.0C-H6A-D01-IR or equal 8MP resolution (Provide quantities listed on T2.30) at locations shown on T2.30. See C1448 on T2.30. Camera shall have clear dome. Min focal length 4.4mm to 9.3mm. Provide pendant wall arm.

2.73 PTZ CAMERA Furnish and install one I-PRO WV-X6533LN , for field surveillance. Include wall mount, shroud and mounting arm. See T2.30, camera C04Z for quantities. Min 40x optical zoom. Focal length min 4.25mm-170mm.

2.74 CAMERA Avigilon 8.0C-H6A-D01-IR or equal 8MP resolution (Provide quantities listed on T2.30) at locations shown on T2.30. See C0248 on T2.30. Camera shall have clear dome. Min focal length 4.4mm to 9.3mm.

2.75 FIXED NETWORK COLOR CAMERA FOR LPR RECORDING. Camera for LPR (on pole 5, focused on site entryway) shall be mounted at 9' AFG on pole. Symbol C0744 on T2.30. Include pole mount adapter PLMT-1001. Avigilon 4.0C-H6A-B01-IR or equal.

2.76 All cameras shall be compatible with VMS, and have support for server and camera side record on motion. All cameras that have H.265 shall use H.265 for the record stream if supported within the VMS. All cameras, interior and exterior shall be outdoor models, have IR illuminators, Wide Dynamic Range, True Day/Night and be white (or grey if white is not available) in color. All cameras shall be set to record 24/7 at 1fps and 15fps upon motion. PTZ shall record 24/7 at 15fps.

2.77 All camera directions shown on floor plans are diagrammatic. Coordinate with Architect for expected views before installation. Initial pointing shall be reviewed by the architects and adjustments made by

the integrator when an image or view is not considered appropriate for design intent. After adjustments, owner shall review images, and integrator may be required to make a final adjustment of each camera. Furnish and provide to architect images of each camera for initial views and then again after owner adjustments. If any camera views are deemed not properly adjusted according to architect or owner direction, further adjustments will be made by the integrator until the acceptable image is obtained.

2.78 Camera Pole Requirements. Furnish and install the following devices to power cameras at the poles and for data transmission of cameras to the network.

A. See T2.70. Furnish and install on poles (quantity 8) with cameras at 6' AFG a Netway SP4BTWP by Altronix. Electrical contractor shall connect unit to 120v circuit. Electrical contractor shall install in bottom of unit an elbow, fully sealed, exiting the box and entering the pole with flex conduit (flex conduit in pole by electrical contractor) running up the pole for the Cat6 patch outdoor grade cords. Fully seal all openings. 27 10 00 integrator shall furnish and install 2 pair armored outdoor OM4 multi-mode fiber and terminate both pairs with LC duplex terminations on both ends, with 3 foot service loop inside Netway enclosure. All outdoor grade Cat 6 patch cords from Netway device to the cameras are furnished and installed by the integrator of this section. Netway enclosure shall be pole mounted and have a lock. All locks shall be keyed the same. See T2.30 for details. Include pole mount kit for Netway device. Include 8 SFP P1MM fiber transceivers, one for each pole.

B. IDF 106 equipment.

1. In the IDF, furnish and install the following equipment: One Netway SP8A by Alronix . Include 8 SFP P1MM fiber transceivers, by Altronix , for 8 fiber pairs from poles. These fiber pairs are terminated in the IDF in the fiber enclosure at the top of the voice/cctv rack. Install Netway SP8A in the voice/cctv rack. Furnish and install a shelf for this device if rack mounted ears are not included or available. Furnish and install OM4 LC duplex fiber patch cords (furnished by 271000 integrator) from the fiber enclosure to the back of the Netway SP8A device. Do not connect spare fiber pairs from each pole. Furnish and install yellow Category 6A cables from the front of the Netway SP8A devices to the owners switch ports. Coordinate switch ports to be utilized with owner.

2.79 Integrate relay for lockdown from Intrusion panel into camera in MDF. Upon lockdown event, all cameras on software maps that detect motion shall show a halo effect on the camera icon. Simply clicking the camera icon will bring up a live view.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Coordinate with electrical contractor for door hardware/wiring

C. Install wiring for detection and signal circuit conductors in conduit. Use 22 AWG minimum size conductors.

D. Provide and install conduit and wiring and connections to door hardware devices. This includes the wiring and installation and integration of door contacts (connect to both systems, intrusion and access control), latch monitoring, and rex devices (both to access control) in door hardware. Furnish and install flex conduit and wiring and connections for all OH and RH contacts to both systems (access control and intrusion).

E. Power for access control power supplies will be provided by the Electrical contractor. Access control power supplies shall be connected and wired by the communication integrator of this section. Communication integrator of this section is responsible for installation and wiring of all key switches and sirens and to provide appropriate input to the access control system for desired functionality.Where FACP is indicated on the drawings, the door shall be unsecured during smoke/water flow detection of fire alarm system. Coordinate this requirement with the 26 00 00 communication integrator. Coordinate with Architect before final FACP connections to the door power supplies are made.

F. The communication integrator of this section is responsible for providing, wiring, installing, connecting and terminating all access control and intrusion devices to include door contacts, (2nd set of contacts for Intrusion Detection Section) request to exit devices, latch monitoring, card readers, power supplies, inputs from intrusion detection (motions), and outputs to intrusion detection. A request to exit signal shall only shunt the door contact, it shall not unlock a secured door.

1. The communication integrator of this section is responsible for coordinating with the 27 10 00 communication integrator for all Cat6A LAN drops required to support access control devices, intrusion devices/panels, and video surveillance components if not provided for on the drawings, or to provide and install the required cabling. Include in bid all work required if not shown on the drawings. Include all patch cables in IDFs and MDF to connect access control devices. The intent of this specification is for a complete and functional access control. Intrusion and video surveillance system.

2. Electrical contractor is responsible for providing hard power connections to all access control and intrusion panels from the corresponding emergency power panel servicing the MDF or IDF. Panels shall not be “plugged into” the wall.

G. Intrusion system and access control cabinets shall be provided with a battery to provide 8 hours of function with no utility power.

H. Install motions to provide largest coverage area possible. Do not install next to hot/cold air vents. Set motions to minimum sensitivity.

I. Adjust all devices to achieve proper operations.

J. All camera domes shall be clear

3.3 FIELD QUALITY CONTROL

A. Test in accordance with NFPA 72 - National Fire Alarm Code

B. Test in accordance with manufacturer testing procedures.

3.4 TRAINING All training to be video recorded by the communications integrator and given to the owner

A. Provide 8 hours training on video entry system, adjustments, configuration, programming and function. Install client software as directed by owner. Provide in 1 hour blocks

B. Provide 16 hours of training for VMS use. Provide in 1 hour blocks.

C. Provide Intrusion System demonstration and training, min 8 hours in 1 hour blocks.

D. Provide 16 hours training on access control system use, in 1 hour blocks.

3.5 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services for final system checkout and acceptance testing.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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Section 31 00 00
EARTHWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The General Documents, as listed in the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all drawings and all other Sections of the Specifications for the requirements therein affecting the work of this trade. Plans, surveys, measurements and dimensions, under which the work is to be performed are believed to be correct to the best of the Architect's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found herein. The contractor shall reconcile all drawings. Where there is a conflict between drawings, the interpretation that most in favor of the owner shall be adopted.

C. The Contractor shall become thoroughly familiar with the site, consult records and drawings of adjacent structures and of existing utilities and their connections, and note all conditions which may influence the work of this Section.

D. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

E. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure a steady progress of work under this Contract.

1.2 SCOPE OF WORK

A. The work of this section consists of all excavation, filling and grading and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

1. All materials, equipment, labor and services required for all Earth Moving work, including all items incidental thereto, as specified herein and as shown on the Drawings.
2. Excavation of all types, including but not limited to excavations for footings, slabs, foundations, retaining walls, new pavements, ramps, stairways, equipment pads, curbs, sidewalks, and utilities, to the lines and grades shown in the Drawings or the limits specified herein, whichever is deeper. Excavation shall include removal and legal offsite disposal of all materials that cannot be reused.
3. Excavating, filling, trenching, backfilling, compaction and concrete encasement of utility conduits, of all description, required for the construction of foundations, walls, building structures, retaining walls, new pavements, ramps, stairways, equipment pads, curbs, sidewalks, utility structures, lawn areas, athletic fields, and site improvements. Provide all additional fill materials as required and specified herein. Refer to Sections on Heating, Plumbing, Fire Protection, Electrical and Structural for other excavation.

4. Entirely removing topsoil, subsoil, tree stumps, root balls, buried organic soil, asphalt, concrete structures, demolition debris, below ground structures, existing fill, and other deleterious matter from within the proposed building footprint.
5. Entirely removing topsoil, subsoil, surficial organic material, tree stumps, root balls, asphalt, concrete and other deleterious material from within the proposed paved areas.
6. Removing topsoil, subsoil, root balls, tree stumps, and other deleterious material from within the proposed athletic fields where the grades are anticipated to be raised. The surficial organic material, asphalt, and concrete shall be removed from within the proposed athletic fields in accordance with the recommendation provided by the Landscape Architect.
7. Improving the existing fill under the subbase of paved areas and proposed athletic fields.
8. Screening and stockpiling the topsoil for reuse as directed by the Architect.
9. Performing test pits before start and during construction as required by the Geotechnical Engineer.
10. Removing and disposing of spoiled material not suitable for fill from the site. No burning on the site shall be permitted.
11. Rehandling, hauling and placing of stockpiled materials for use in refilling, filling, backfilling, grading and such other operations. Stockpiling shall include protection to maintain materials in a workable condition.
12. Furnishing, placing, and compacting fill materials.
13. Removing, hauling, stockpiling, rehandling, and placement of materials. Over-excavation to remove unsuitable materials.
14. Proofrolling of exposed subgrade for fill, footings, foundations, slabs, walks, pavements, lawns and grasses, and exterior plants.
15. Backfilling of excavations for foundations, footings, walls, utilities, pavements, sidewalks, and landscaped areas with specified on-site and imported materials.
16. Disposing off-site of excess or unsuitable materials.
17. Placing bedding, sub-base and base course layers.
18. Stabilizing/mitigating of saturated or otherwise disturbed materials.
19. Performing rough and final grading.
20. Filling slopes and site retaining walls.
21. Installing excavation support, shoring or bracing as necessary
22. Protecting existing buildings, utilities, roads, pavements, lawns, planting and other improvements from damage due to construction.
23. Performing coordination of material testing shall be the responsibility of the Contractor. All imported material tested shall be under ASTM D422 and shall be paid for by the Contractor.
24. Performing material testing, and field density testing as needed.
25. Performing dust control and cleanup.
26. Dewatering.

27. Installing fencing and safety devices or controls as specified and as necessary.
28. Notifying all affected utility companies and Dig Safe before the start of work.

B. The Work of this Section shall include performance of pre and post construction condition surveys.

1.3 CONTRACT REFERENCE

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections
1. Section 01 42 00, References
2. Section 01 45 00, Quality Control
3. Section 01 50 00, Temporary Facilities and Controls
4. Section 02 41 00, Site Demolition
5. Section 03 30 00, Cast-in-Place Concrete
6. Section 22 00 00, Plumbing
7. Section 31 10 00, Site Preparation and Clearing
8. Section 31 23 19, Dewatering and Drainage
9. Section 31 25 00, Erosion Control
10. Section 32 13 13, Site Concrete
11. Section 33 40 00 Storm Drainage Systems
12. Division 01 Section “Unit Prices”
13. Division 01 Section "Temporary Tree and Plant Protection”
14. Division 31 Section “Trench Excavation and Backfill”
15. Division 31 Section "Dewatering"
16. Division 32 Section "Turf and Grasses"
17. Appendix A, Geotechnical Report

1.4 DESCRIPTION

A. The Contractor shall furnish all labor, material, tools and equipment necessary to excavate materials; segregate, track, handle, sample, analyze, and test excavated materials, backfill, and re-grade as indicated on the Drawings.

B. The Contractor shall use suitable on-site soils and fill, and soil from off-site sources, as needed. Please note that most of the on-site materials will likely not be suitable for reuse, nor will all required material gradations be present on the site. The contractor shall avoid mixing the reusable soils with fine-grained and/or organic soils. Imported materials or blending of onsite materials with imported materials are anticipated for this project.

C. The Contractor shall make excavations in such a manner and to such widths that will provide suitable room for performing the Work and shall furnish and place all

sheeting, bracing, and supports, if necessary. Excavation support is anticipated for this project.

D. The Contractor shall provide labor and material for all pumping and draining, if necessary; and shall render the bottom of excavation firm and dry and in all respects acceptable. The Contractor shall collect and properly dispose of all discharge water from dewatering systems in accordance with local and State requirements and permits.

E. The Contractor shall raise the Site to final grades and compact the subgrade and intermediate layers to the required criteria set forth within this Section.

F. The contractor shall provide routine monitoring of in-place excavation support system.

G. Contractor shall protect and moisture condition all on site and imported materials for proper installation, compaction, and use. This includes covering, drying, and adding moisture in order to maintain suitable workability of the soil materials. Failure by the Contractor to follow this requirement shall not be cause for additional cost to the Owner.

1.5 INFORMATION

A. Information on the Drawings, Reference Drawings, Geotechnical Reports, and in the Specifications relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for information and is not guaranteed.

B. Site Information – Data on indicated subsurface conditions are not intended as representations or warrants of continuity of such conditions between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there by the Contractor. Data is made available for the convenience of the Contractor. The Owner, Architect and Engineer assume no responsibility for the accuracy of the data other than at the particular locations and at the time the explorations were made.

C. The Contractor, at his/her own expense, may conduct additional subsurface testing for his/her own information after approval by the Owner. The Owner assumes no responsibility for the Contractor's failure to make his own site investigation and makes no representation other than the soils reports regarding the character of the soil or subsurface conditions which may be encountered during the performance of the work. The Contractor shall refer to the Geotechnical Report. Failure by the Contractor to be aware of existing site conditions shall not be cause for additional cost to the Owner.

1.6 SUBSURFACE CONDITIONS AND SPECIAL SITE CONSIDERATIONS

A. Geotechnical testing including subsurface explorations have been made by qualified Contractors for this site. This information is provided in the attached Preliminary Geotechnical Report by Lahlaf Geotechnical Consulting, Inc., dated February 7, 2023 (“Geotechnical Report”). The Owner, the Architect, and the Geotechnical Engineer assume no responsibility for the accuracy of the data and for the Contractor's failure to make his own site investigation and make no representation other than the soils reports regarding the character of the soil or subsurface conditions which may be encountered during the performance of the

work. The Contractor shall refer to Section 00 31 32. Failure by the Contractor to be aware of existing site conditions shall not be cause for additional cost to the Owner.

1. Information on subsurface conditions is made available for the convenience of the Bidders. The Owner does not represent to the Contractor that the information is either an accurate or a comprehensive indication of subsurface conditions. Bidders are invited to review the information to apprise themselves of the information available, and also to make additional investigations at their own expense.
2. Interpretation of this data for purposes of construction is the responsibility of the Contractor. It is the Contractor's responsibility to make interpretations and draw conclusions with respect to the character of materials to be encountered and groundwater conditions at the site and their impact upon Contractor's work based on his expert knowledge of the area, construction dewatering methods, and support of excavation methods. Contractor may, at his own expense, conduct additional subsurface testing as required for his own information after approval by the Owner.
3. The Geotechnical Report indicates that the materials present at the site include fill, peat, organic soil, silt, and sand. The contractor is made aware of this condition and will not be eligible to receive additional compensation exceeding the Contractor's initial bid for imported material.
4. It is the responsibility of the Contractor under this Contract to do the necessary excavation, filling, grading and rough and final grading to bring the existing grades to subgrade and parallel to finished grades as specified herein and as shown on the Drawings for this Work. The Contractor shall visit the site prior to submitting a bid to become familiar with the extent of the work to be done under this Contract. The Contractor shall be responsible for determining the quantities of earth materials necessary to complete the work under this Section. All earth materials shall be included in the Contractor's base bid.
5. No claim for extra cost or extension of time resulting from reliance by the Contractor on information presented herein shall be allowed, except as provided in the Contract Documents.

B. Environmental investigation and testing, including subsurface explorations have been made by qualified Contractors for this site. This information is provided in the attached Phase I Environmental Site Assessment and Limited Subsurface Investigation by Sage Environmental, Inc., dated November 8, 2021.

1. Laboratory analytical results for select soil samples collected from the Site identified a number of semi volatile organic compounds (SVOCs), arsenic, lead, and total petroleum hydrocarbons (TPH) in excess of the RIDEM Method 1 Residential Direct Exposure Criteria (R-DEC).
2. No groundwater impacts were identified above RIDEM GB Groundwater Objectives at the Site.
3. Handing, reusing, and disposing of onsite soils in accordance with RIDEM regulations and requirements shall be included in the Contractor's base bid.

1.7 QUALITY CONTROL

A. The Owner may retain and pay for the services of an independent testing agency (Soils Representative) to monitor backfill operations, perform laboratory tests on soil samples, and to perform field density tests; and a Geotechnical Engineer to

periodically observe the earthwork operations, observe the preparation of the subgrade for footings, slabs, and paved areas, and to review laboratory and field test data. The geotechnical engineer may from time to time request that the contractor excavate tests pits ahead of excavation to confirm subsurface conditions. Test pits shall be performed at no additional cost to the Owner.

B. The services of the Soils representative may include, but are not limited to performing observations and testing during placement of fills within the proposed building, parking area, and controlled fill areas.

C. The Contractor shall make provisions for allowing safe and timely observations and testing of Contractor's Work by the Geotechnical Engineer and by Soils Representative. The presence of the Soils Representative and/or the Geotechnical Engineer does not include supervision or direction of the actual work of the Contractor, his employees or agents. Neither the presence of the Soils Representative and/or the Geotechnical Engineer, nor any observations and testing performed by them, nor failure to give notice of defects shall excuse the Contractor from defects discovered in his work.

D. Costs related to retesting due to unacceptable quality of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to Owner, and the costs thereof will be deducted by the Owner from the Contract Sum.

1. Testing frequency shall be as follows:

Material	Responsible Party	Situation	Test	Minimum Frequency
Structural Fill/ Ordinary Fill/ Gravel Borrow/ Common Borrow/ Bedding Material/ Crushed Stone / Pea Gravel	Contractor	Source Investigation	Grain Size through 0.002 mm	1 per source
			Moisture Density Relationship	1 per source
	Owner	During Placement	Grain Size through 0.002 mm	1 per 100 tons
			Moisture Density Relationship	1 per 100 tons
	Owner	As-Placed	Dry Density and As-Placed Moisture	2 per lift per location or activity and no less than 1 every 500 sf
Loam Borrow	Contractor	During Placement	PH, Nitrogen, Phosphorous, Potassium, and USDA Classification	2 per Acre
Riprap	Contractor	Source Investigation	Source Material Certification	1 per source
			Specific Gravity	1 per source
	Contractor	During Placement	Source Material Certification	1 per 500 tons
			Specific Gravity	1 per 500 tons

1.8 COORDINATION

A. Prior to start of earthwork, the Contractor shall arrange an onsite meeting with the Architect, Engineer, the Geotechnical Engineer, and the testing agency for the purpose of establishing the Contractor's schedule of operations, and scheduling observation and testing procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Geotechnical Engineer at least 2 days and the testing agency at least 24 hours

prior to the start of earthwork operations requiring observation and/or testing. This section also applies to instances when the General Contractor resumes earthwork operations after a period of pause in earthwork operations that require observations by the Geotechnical Engineer.

C. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to ensure the steady progress of all work of the Contract.

1.9 PERMITS, CODES AND SAFETY REQUIREMENTS

A. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926. Contractors shall be familiar with the requirements of these regulations.

B. The Contractor is responsible for the adequacy of the excavation support system and shall retain the services of a Professional Engineer registered in Rhode Island to design any required excavation support systems. The Contractor's Professional Engineer shall practice in a discipline applicable to excavation work, shall have experience in the design of excavation support systems and shall design in conformance with OSHA requirements. The Contractor's Professional Engineer shall provide sufficient on-site inspection and supervision to assure that the excavation support system is installed and functions in accordance with his design. Criteria listed herein defining the responsibilities of the Contractor's Professional Engineer are minimum requirements.

C. All work shall conform to the Drawings and Specifications and shall comply with applicable codes and regulations.

D. Comply with the rules, regulations, laws and ordinances of the City of Central Falls, of the State of Rhode Island, appropriate agencies of the State of Rhode Island and all other authorities having jurisdiction. Coordinate all work done within City and State rights of way with the appropriate agencies, including the RI Department of Transportation. Provide all required traffic control and safety measures, including uniformed police officers per City and State requirements. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.

E. Comply with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration (OSHA), United States Department of Labor whichever is more stringent.

F. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Drawings.

G. The Contractor shall not close or obstruct any street, sidewalk, or passageway unless authorized in writing by the Architect. The Contractor shall so conduct his operations as to interfere as little as possible with the use ordinarily made of roads, driveways, sidewalks or other facilities near enough to the work to be affected hereby. The Contractor shall comply with the time limits established by the terms for trucking onto and off the site.

H. Any apparent conflict between the Drawings and Specifications and the applicable codes and regulations shall be referred to the Architect in writing, for resolution before the work is started.

I. The Contractor shall comply with all excavation, trenching, and related sheeting and bracing requirements of Occupational Safety and Health Administration (OSHA) excavation safety standards, 29 CFR Part 1926.650 through 1926.652.

1.10 LAYOUTS AND GRADES

A. All line and grade work not presently established at the site shall be laid out by a survey team under the supervision of a Land Surveyor or Professional Engineer registered in the State of Rhode Island and employed by the Contractor in accordance with Drawings and Specifications. Basic layout for the project is shown on the drawings. The Contractor shall supply all additional layout and grade control as necessary to properly implement and construct the work. The Contractor shall establish permanent benchmarks and replace as directed any which are destroyed or disturbed. The Contractor shall employ and pay all costs for a registered Civil Engineer or Surveyor who is licensed within the jurisdiction of the project site to lay out all lines and grades in accordance with the Drawings and Specifications, and as necessary or required for the construction. The Contractor shall submit building layout drawings for approval, stamped by a Registered Surveyor.

B. The words “finished grades” as used herein shall mean final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas outside of the building shall be given uniform slopes between points for which finished grades are indicated or between such points and existing established grades.

C. The word “subgrade” as used herein, means the surface or elevation remaining after completing excavation or top surface of a fill or backfill required surface of subsoil, borrow fill or compacted fill. This surface is immediately beneath the site improvements, fill materials as dimensioned on the Drawings, or other proposed surface material.

D. The words “rough grading” shall mean excavating or filling to elevations indicated, and to the required depths herein. The permissible tolerance of rough grading within an area 100 sq. ft. shall not exceed plus or minus 2 in. The cost of placing fill material to refill areas having rough grades lower than designed shall be borne by the Contractor.

1.11 DISPOSITION OF EXISTING UTILITIES

A. All work shall be executed in such a manner as to prevent any damage to existing buildings, streets, curbs, paving, service utility lines, structures and adjoining property. Existing streets, sidewalks and curbs damaged during the project work shall be repaired or replaced to their condition prior to commencement of Earth Moving operations.

B. Locate and mark underground utilities to remain in service before beginning the work. Active utilities existing on the site and work areas shall be carefully protected from damage and relocated or removed as necessitated by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings as described in this Section and both Architect and Utility Owner notified in writing.

C. Inactive or abandoned utilities encountered during construction operations shall be removed and suitably backfilled if within the building area. Abandoned utilities outside the building area shall be removed, grouted, plugged or capped. The location of such utilities shall be noted on the record drawings and reported in writing to the Architect.

D. The Contractor shall notify “Dig Safe” and local utility companies prior to the start of construction. The “Dig Safe” number shall be submitted by the Contractor in writing to the Architect prior to construction.

E. Acceptance of any of the Contractor’s plans, design calculations and methods of construction by the Designer shall not relieve the Contractor of the responsibility for the adequacy of the excavation lateral support system; preventing damage to existing or new structures, utilities and streets adjacent to excavations; the safety of persons working within excavated areas and the public at large; and excavation dewatering.

1.12 SUPPORT OF EXCAVATION

A. Provide support of excavation (SOE) system, as necessary, in order to meet the requirements of OSHA and to assure complete safety against collapse of earth at sides of excavations. The contractor shall design and submit for review and upon approval install a temporary support of excavation (SOE) to protect the existing foundations during construction.

B. In selecting the type of SOE system, the Contractor shall take into consideration the possible presence of rock and the presence of boulders in the existing fill and in the natural soil.

C. If sufficient or proper supports have not been provided, additional supports shall be placed at the expense of the Contractor. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

D. All components of SOE system not ordered left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities or property whether public or private. All voids left after withdrawal of sheeting shall be immediately refilled with sand and rammed with tools especially adapted to that purpose or otherwise compacted as directed to achieve the required density.

E. The design and installation of SOE systems shall not constitute a condition for which an increase may be made in the contract price with the exception that if the Architect directs with writing that certain shoring or sheeting shall be left in place, the contract price will be adjusted in accordance with General Conditions.

F. SOE systems shall be designed to support the earth pressures, surcharge loads from stored material and construction equipment.

G. Shoring and bracing of trenches and other excavations shall, at a minimum, be in accordance with the latest requirements of the Department of Labor and Industries Bulletin No. 12, Section 10, and all subsequent amendments, and OSHA excavation safety standards.

H. SOE systems shall be designed by a Professional Engineer registered in the State of Rhode Island and hired by and paid for by the Contractor.

1.13 DRAINAGE AND GROUNDWATER CONTROL

A. The Contractor shall control the grading in areas under construction on the site so that the surface of the ground will properly slope to prevent accumulation of groundwater and surface water in excavated areas and adjacent properties.

B. The Contractor shall provide, at his own expense, adequate pumping and drainage facilities to maintain the excavated area sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. The flows of all water resulting from pumping shall be managed so as not to cause erosion, siltation of drainage systems, or damage to adjacent property.

C. The groundwater level shall me maintained at 12 inches beneath the bottom of excavation or deeper until the excavation is backfilled to at least 2 feet above the groundwater level.

D. Damage resulting from the failure of the dewatering operations of the Contractor, and damage resulting from the failure of the Contractor to maintain all the areas of work in a suitable dry condition, shall be repaired by the Contractor, as directed by the Engineer, at no additional expense to the Owner. The Contractor's pumping and dewatering operations shall be carried out in such a manner as to prevent damage to the Contract work and so that no loss of ground will result from these operations. Precautions shall be taken to protect new work from flooding during storms or from other causes. Pumping shall be continuous to protect the work and/or to maintain satisfactory progress.

E. All pipelines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected. Water from the trenches, excavations, and stormwater management operations shall be disposed of in such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress.

F. The Contractor shall excavate interceptor swales and ditches, as necessary, prior to the start of major earthmoving operations to reduce the potential for erosion and to keep areas as free from surface and ponded water as possible.

G. All piping exposed above ground surface for this use, shall be properly covered to allow foot traffic and vehicles to pass without obstruction.

H. Should surface, rain or groundwater be encountered during the operations, the Contractor shall furnish and operate pumps or other equipment, and provide all necessary piping to keep all excavations clear of water at all times and shall be responsible for any damage to work or adjacent properties for such water. All piping exposed above ground surface for this use, shall be properly covered to allow foot traffic and vehicles to pass without obstruction.

I. The presence of groundwater or stormwater in soil will not constitute a condition for which an increase in the contract price may be made. Under no circumstances place concrete fill, lay piping or install appurtenances in excavation containing free water. Keep utility trenches free of water until pipe joint material has hardened and backfilled to prevent flotation.

J. For further information refer to paragraphs on SPECIAL REQUIREMENTS FOR SEQUENCE OF CONSTRUCTION OPERATIONS AND DRAINAGE AND EROSION CONTROL as specified herein.

1.14 FROST PROTECTION / WORK IN FREEZING WEATHER

A. Protect excavation bottoms and sides against freezing. Provide protective insulating materials as necessary, including by means of heat blankets, and heating plant.

B. A layer of fill shall not be left in an uncompacted state at the close of a day's operation when there is the potential for that layer to freeze.

C. The Contractor shall not place any material on snow, ice, frozen soil, or soil that was permitted to freeze prior to compaction. Removal of these unsatisfactory materials will be at the Contractor's expense.

D. Do not excavate to full indicated depth when freezing temperatures may be expected, unless work can be completed to subgrade, the materials installed, and the excavation backfilled the same day. Protect the excavation from frost if placing of materials or backfilling is delayed.

E. The Contractor shall keep the operations under this Contract clear and free of accumulation of snow within the limits of Contract Lines as necessary to carry out the work.

F. No materials shall be installed on frozen ground. Fill materials shall be free of frost.

G. The subgrade of footings and slabs shall be protected from frost before placing concrete. The subgrade on the sides of the footings shall be protected from frost after the footings are constructed until sufficient fill is placed to protect the bottom of footings from frost induced heave. Uninsulated slabs shall be covered with heat blankets until the slab areas are heated. The cover shall extend at least 4 feet beyond the limits of the slabs.

1.15 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION

A. The Contractor shall take the necessary steps to avoid disturbance of subgrade and underlying natural soils/compacted fill during excavation and filling operations. Methods of excavation and filling operations shall be revised as necessary to avoid disturbance of the subgrade and underlying natural soils/compacted fill, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials. The Contractor shall coordinate with the Architect or Soils Representative to modify his operations as necessary to minimize disturbance and protect bearing soils, based on the Architect's or Soils Representative's observations.

B. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with compacted approved material in accordance with this Specifications. Fill that cannot be compacted within 48 hours because of its saturated condition shall be removed and replaced with compacted approved material in accordance with this Specifications. Costs of removal of disturbed material and replacement with approved material shall be borne by the Contractor.

C. If requested by the Architect or Geotechnical Engineer, the Contractor shall place a six-inch layer of Crushed Stone or 12-inch layer of Granular Fill/Structural Fill over natural underlying soil to stabilize areas disturbed during construction.

1. The placement of the Crushed Stone layer or Granular Fill/Structural Fill as well as material costs shall be borne by the Contractor. A geotextile fabric shall be used to separate the crushed stone from the natural soil and from the overlying fill when directed by the Geotechnical Engineer at no additional cost to the owner at no extra cost to the owner.

D. Material that is above or below optimum moisture for compaction of the particular material in place as determined by the Architect or the Soils Representative and is disturbed by the Contractor during construction operations so that proper compaction cannot be reached shall be classified as unsuitable bearing materials. This material shall be removed and replaced with lean concrete, suitable/approved backfill material, or crushed stone as directed by the Geotechnical Engineer or Soils Representative at no additional cost to the Owner.

1.16 SPECIAL REQUIREMENTS FOR SEQUENCE OF CONSTRUCTION OPERATIONS AND DRAINAGE AND EROSION CONTROL

A. An initial procedure for sequencing of construction operations is specified under Section 31 25 00, Erosion and Sedimentation Controls. This procedure shall be extended through earthwork operations as follows:

1. Perform initial procedures as specified under Section 31 25 00, Erosion and Sedimentation Controls – Initial Sequence of Construction Activities and Preliminary Drainage Control.
2. Repair any broken or damaged Sections of the haybales or siltation fencing installed during site preparation and install any additional Sections necessary for proper erosion control.
3. Throughout earthwork operations, in addition to drainage swales, check dams, siltation sumps, and other items shown on the Drawings, the Contractor shall take other necessary precautions, including installation of temporary drainage swales, siltation sumps, check dams, haybales, silt fencing and temporary pipe to direct and control drainage from disturbed areas on the site so that erosion and siltation is minimal. In addition, no erosion or discharge of silt or larger particles shall occur in water bodies or wetland areas to remain undisturbed or onto adjacent properties.
4. Damaged or loose haybales and siltation fence shall be replaced as necessary to maintain their function of controlled erosion and siltation. Damaged or broken down check dams and filtration dams shall be replaced immediately.
5. Throughout construction, remove any accumulation of silt or soil build-up behind haybales, silt fences, check dams and filtration dams as it occurs. Remove accumulations of silt and build-up from the siltation pumps and silt traps when it is approximately 18 inches deep, or when it adversely affects the performance of the system. Remove silt sacks in catch basins when they have become clogged and replace to maintain their function.
6. Replace the crushed stone on the inside of all siltation sumps as necessary to permit adequate flow through the media and to maintain their function as a filter of silt and larger particles. Excavate silt and other material from the basins of all siltation sumps as it accumulates.

7. Remove temporary drainage swales, check dams, siltation sumps, haybales and other temporary drainage, erosion and siltation control measures when permanent drainage control measures have been installed, and grass is established in drainage areas and lawn areas. Do not remove the above items without approval of the Architect. If, in the Architect's opinion, these measures are still necessary, they shall stay in place.

1.17 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the grade and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill. Imported fill shall meet the gradation requirements set forth in PART 2 - PRODUCTS.

E. Building Area: The area defined by the projection of a line from two foot outside of the edge of the footing extending upward and outward at a slope of 1.5H: 1V. (If over-excavation is required below the footing the building area will be redefined from the bottom of over-excavation).

F. Compaction: The tamping and rolling of all backfill placed in uniform horizontal layers not exceeding a defined uncompacted lift thickness.

G. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

H. Deleterious Material: Trash, debris, clay, topsoil, roots, organic material friable, glass, material that has become soft and saturated, even if previously compacted, material defined in section 1.17.X, or otherwise degradable materials that compromise the strength and properties of soils.

I. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated. Excavation is unclassified.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

J. Fill: Soil materials used to raise existing grades or meet proposed grades.

K. Frost Zone: The area within 4 feet of finished grade.

L. Influence Zone/Area: The area below a footing defined by the projection of a line from two feet outside of either edge of the footing extending downward and outward at a slope of 1V:1H.

M. “In-the-dry”: In-situ soil moisture content of no more than two percentage points above the optimum moisture content for that soil.

N. Optimum Moisture Content: Determined by the ASTM standard specified to determine the maximum dry density for relative compaction.

O. Prepared Ground Surface: The ground surface after clearing, grubbing, stripping, excavation, and scarification and/or compaction.

P. Proof-rolling: The tamping and rolling of all subgrades including running a loaded rubber tire truck over the subgrade when requested by the Geotechnical Engineer.

Q. Relative Density: As defined by ASTM D4253 or D4254.

R. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D1557. Corrections for oversized material shall be applied to maximum dry density.

S. State Standards: RI Department of Transportation Standard Specifications for Highways and Bridges.

T. Structures: Buildings, footings, foundations of any type, retaining walls, buildings and equipment slabs, ramps, stairs, tanks, curbs, sidewalks, mechanical and electrical appurtenances, retaining walls, or other man-made stationary features constructed above or below the ground surface.

U. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

V. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

W. Unclassified Excavation: The nature of materials to be encountered has not been identified or described herein.

X. Unsuitable material shall be material having at least one of the following properties:

1. Material with a maximum unit dry weight per cubic foot less than 110 lbs., as determined by ASTM D1557.
2. Material containing greater than 2% organic matter by weight, topsoil, organic silt, peat, construction debris, roots and stumps.
3. Material which has a Liquid Limit greater than 55 when tested in accordance with ASTM D 4318.
4. Materials that do not meet one of the gradation specifications in this section.
5. Wet material which cannot be compacted due to moisture contents outside of the limits of ±2 percentage points of optimum moisture content.
6. Material classified as unsuitable by the Geotechnical Engineer.
7. Unsuitable material shall be disposed of off-site as directed by the Architect.

8. Material processed onsite that is not well graded or contains excess stones and exhibits honeycombing when placed in lifts.
9. Materials that are unstable as a result of inadequate construction dewatering, excessive subgrade disturbance, or other means and methods used by the Contractor are not considered unsuitable materials This include materials that were stable and that have become unstable.

Y. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

Z. Trench: An excavation of any length where the width is less than twice the depth and where the shortest distance between payment lines does not exceed ten (10') feet. All other excavations shall be defined as open excavations.

AA. Architect: Where architect is referenced it shall mean the Architect or the Architect's representative.

BB. Geotechnical Engineer: Where Geotechnical Engineer is referenced it shall mean the Geotechnical Engineer or its representative.

CC. The base layer of athletic fields shall mean the surface layer(s) required for the grass and/or athletic fields as designed by the project Civil Engineer or Landscape Architect.

1.18 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements govern.

B. American Society for Testing and Materials (ASTM):
1. ASTM D1556, Density of Soil In Place by the Sand-Cone Method.
2. ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
3. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
4. ASTM D422, Particle Size Analysis of Soils.

C. State of Rhode Island:
1. Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction.
2. The Rhode Island State Building Code.
3. Rhode Island Stormwater Design and Installation Manual.
4. Rhode Island Erosion and Sediment Control Handbook.

D. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T-11, Standard Method of Test for Amount of Material Finer than 0.075 mm sieve in aggregate.
2. AASHTO T-27, Standard Method of test for sieve analysis of fine and coarse aggregates.

E. Occupational Safety and Health Act of 1970 (Public Law 91-596 of the United States, 29 USC Section 651 et seq.).

1.19 SUBMITTALS

A. Product Data: For the following:
   1. Each type of plastic warning tape.
   2. Geotextile – The contractor shall submit a 12” by 12” sample of geotextiles.
   3. Controlled low-strength material, including design mixture.

B. Submit a detailed construction sequence plan for project excavation indicating temporary stockpile areas, side slopes of excavations, limits of required temporary excavation support and sequence and procedures for subgrade protection, excavation, concrete placement, moisture conditioning of on-site excavated soils used as fill, filling, backfill, and compaction.

C. The Contractor shall submit, the name of imported material suppliers. Change of source suppliers shall require approval from the Architect.

D. Grain-size distribution analysis test data shall be delivered with the samples. The analysis shall be performed in accordance with ASTM D 422. The data shall include a plot of the gradation and the envelope of the specified material. A material shall be considered meeting the specifications when its gradation curve fits entirely within the specified envelope. Borrow soil materials with grain-size distribution curves that do not fall entirely within the specified envelope shall be deemed unacceptable.

E. The Contractor shall submit to the Architect, under provisions of Section 01 33 00, manufacturer’s literature, and data on proposed compaction equipment.

F. The Contractor shall provide to the Architect, on a daily basis, copies of field records documenting the location of stockpiled material, and stockpile identification data.

G. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

H. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each onsite and borrow soil material proposed for fill and backfill.
   2. Recent (less than one month old) Gradation Curve (ASTM-D422) and Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

I. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins

J. Excavation and Excavation Support Plan: Submit at least 10 calendar days prior to the start of the work a detailed plan for the sequence of excavation, and methods to be used for excavation support and dewatering of excavations if required.

Submit engineering calculation stamped by a Rhode Island Registered Professional Engineer and shop drawings for earth support systems to be used.

K. Dewatering plan shall be submitted at least 10 days before the start of construction. Dewatering and groundwater control systems shall be designed to keep excavations free of water and to avoid disturbance of the subgrade in accordance with Section 1.13 of these Specifications. The dewatering submittal shall include locations, depth, and size of deep sump pumps.

1.20 SAMPLING AND TESTING

A. The contractor shall submit 50-lbs samples of each type of fill material, in air-tight containers, proposed for use on-site in accordance with PART 2 - PRODUCTS, to the Owner's Geotechnical Engineer (Geotechnical Consultant) for **preliminary compliance testing** at least two (2) weeks prior to use. No fill material shall be delivered to the site or placed until the material has been approved. The final review of the material will be based on the re-tested sample by the owner's testing agency upon delivery of the material to the site. The gradation curves shall fit entirely within the envelopes defined by the limits specified herein for the material to be approved for use at the site.

1. Samples shall be delivered to the office of the Architect or as directed.
2. Samples required in connection with compaction tests will be taken and transported by the Soils Representative.
3. Additional tests, including grain-size analyses and laboratory compaction tests shall be performed on the material after it is delivered to the site.
4. For on-site materials, submit representative samples, collected from each stockpile of excavated on-site material to be used, directly to the Owner's Geotechnical Consultant's office at least two (2) weeks in advance of use of these materials.

B. Product Data: Submit location of pits for borrow material. Samples shall include name of source, name of material, sampling date, and intended use.

C. Samples shall be representative of the source pit. If materials are found to vary once construction begins, the Contractor will be required to submit additional representative samples at his own cost.

D. Compaction tests:

1. Compaction tests shall be performed at all bench and other site fixture pads.
2. Compaction tests shall be performed on each lift of placed and compacted material. Accordingly, it is the responsibility of the Contractor to provide ample notice to the testing agency to provide a field representative to perform field density tests.

E. Materials imported to the site by the Contractor for on-site use shall not contain oil, hazardous waste, or deleterious materials.

1. The Contractor shall be responsible for all costs incurred by the Owner as a result of the Contractor's action to import materials containing concentrations of oil and/or hazardous materials to the site.
2. In the event that site characterization of off-site borrow sources indicates that soils are acceptable to the Architect or Engineer for use, then chemical testing

will not be required. It is anticipated that chemical testing would not normally be required for material from customarily utilized commercial borrow sources No fill material from “urban areas” will be accepted for fill at the site, even if chemical testing indicates no exceedances of “Reportable Concentrations”.

If requested by the Owner or Engineer, based on review of the borrow site characterization, the Contractor shall conduct testing on proposed fill material and submit results prior to delivery to the site, at no additional cost to the Owner. Testing shall be conducted by a Rhode Island certified testing laboratory and shall include, at a minimum, the following analytical test data.

a. Total Petroleum Hydrocarbons (EPA Method 418.1) every 100 yards
b. Volatile Organic Compounds (EPA Method 8420) every 500 yards
c. PCB and Pesticides (EPA Method 8080) every 500 yards
d. Total RCRA Metals (EPA Method 6000-7000 series) every 500 yards
e. Polynuclear Aromatic Hydrocarbons (EPA Method 8270) every 500 yards
f. TCLP for those total parameters which exceed twenty times the TCP criteria every 500 yards
g. Total cyanide (EPA 9020)

3. Testing parameters and testing frequencies may be reduced, as directed by the Soils Representative.
4. All sieve analyses for conformance of on-site and off-site fill materials to be used in the work shall be done by means of a mechanical wet sieve analysis and in accordance with ASTM D 422.

1.21 QUALITY ASSURANCE

A. The Engineer’s duties do not include the supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Engineer nor any observation and testing by the Engineer shall excuse the contractor from defects discovered in his Work at that time or subsequent to the testing.

B. Subgrades shall be observed and approved by the geotechnical engineer before placing fill. The compaction and material composition shall be approved by the geotechnical engineer before placement. The by the Architect and/or Geotechnical Engineer prior to placing subsequent lifts. If inspections indicate subgrade does not meet specified requirements, the unsuitable subgrade shall be excavated, the unsuitable material shall be removed, and replaced with approved backfill material and compacted at no additional cost to the owner or architect. The work shall be done in accordance with this specification.

C. Costs related to retesting due to unacceptable quality of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to Owner, and the costs thereof will be deducted by the Owner from the Contract Sum.

a. The Soils Representative’s presence or the Geotechnical Engineer does not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Soils Representative, nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse the Contractor from defects discovered in his work.

b. The Owner reserves the right to modify the services of the Soils Representative or Geotechnical engineer.

A. The contractor shall make provisions for allowing safe and timely observations and testing of Contractor's Work by the Geotechnical Engineer and by the Soils Representative. The presence of the independent testing agency and/or the Geotechnical Engineer does not include supervision or direction of the actual work of the Contractor, his employees or agents. Neither the presence of the Soils Representative and/or the Geotechnical Engineer, nor any observations and testing performed by them, nor failure to give notice of defects shall excuse the Contractor from defects discovered in his work.

B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Before commencing earthwork, meet with representatives of the governing authorities, Owner, Architect, Engineer, consultants, Soils Representative, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

C. Testing: Compaction tests will be required by the Owner and will be paid for by the owner. No specific testing schedule has been established at this time. If tests indicate that density requirement have not been achieved, the contractor continue compacting the tested material. All retesting is these areas shall be paid for by the contractor.

D. The Owner's Testing Agency will perform water content, gradation tests on onsite and processed materials, and compaction tests at a frequency and at locations as required. The results of these tests will be submitted to the Architect, and a copy submitted to the Contractor, on a timely basis so that the Contractor can take such action as is required to remedy the indicated deficiencies.

E. Contractor shall notify Architect when excavations have reached required subgrade and provide a minimum notice of 24 hours prior to placement of backfill on exposed subgrade. Density and Compaction Testing: The contractor is responsible to schedule compaction tests and allow adequate time for the proper execution of said tests. **This section also applies to instances when the General Contractor resumes earthwork operations after a period of pause in earthwork operations that require observations by the Geotechnical Engineer.**

F. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services, as necessary:

1. Prepare plan report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring services during blasting operations.
3. Prepare a preblast survey of all adjacent properties, including a structural inspection of the buildings and properties and shall include a written and photographic record of existing conditions.

4. Blast operations shall not commence until all reports and plans are received and approved by the Owner and the Architect.

1.22 PROJECTS AND CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.
3. Contact a utility-locator service for the area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility agencies and the City of Central Falls to shut off services if lines are active.

C. All fill to be removed from the Building Area and Influence Zone as presented on the plans and described herein.

D. Subsurface investigations indicated the presence of sandy materials which will likely be easily disturbed due to construction activities. This material is also likely to require regular moisture conditioning to obtain required compaction requirements.

E. Work under this section shall include the removal of 40 cubic yards of un-anticipated rock ledge or solid masonry or concrete foundations in mass or trench excavations, or boulders over two (2) cubic yards in open excavations and over one (1) cubic yard in size in trenches. Such removals shall be measured by the Landscape Architect/Engineer by notifying the Landscape Architect/Engineer prior to removal. If not performed, credits to the extent of material removal deducted from the 40 cubic yards in the measurements shall be applied to the contract price. The contract price shall be reduced by the extent of the work not undertaken as called for in this section.

1.23 MEASUREMENT

A. Measurement of Unsuitable Soil over excavation:

1. Strip vegetation, topsoil, subsoil, buried organic material and fill to a minimum depth of 1 foot below the existing grades in accordance with the Contract Documents or in accordance with Drawings. Remove existing asphalt, curbing, and structures.
2. Employ a Registered Land Surveyor to survey to bottom of the excavation for unsuitable soils throughout the building footprint. Excavation shall be surveyed at each corner, at highs and lows. The maximum spacing for survey points is 20 feet in each direction on a grid.
3. Remove unsuitable soils as shown on the Contract Documents or as directed in the field by the Owner’s Geotechnical Consultant.
4. Employ a Registered Land Surveyor to survey to bottom of the excavation for unsuitable soils throughout the building footprint. Excavations shall be

surveyed at the corners, high and low points, and a maximum spacing for survey points of 20 feet in each direction on a grid.

5. The results of the surveys are to be plotted on an AutoCAD drawing showing the bottom of subsoil grades, the bottom of proposed subgrade including the zones of influence and bottom of unsuitable soils. The volume of over-excavated unsuitable soil removal is to be calculated by a Registered Land Surveyor. Submit volume calculations of over-excavated unsuitable soils and all survey information to the Architect for review. Submission must include raw survey data, AutoCAD bottom of subsoil surface, AutoCAD bottom of proposed subgrade including the zones of influence AutoCAD bottom of unsuitable soils surface, and volume calculations in a spreadsheet (electronic format).
6. Quantities shall be measured in their original position to the limits of clearly defined vertical construction lines and to the depth required for the defined construction. Payment will be at the Contract Unit Prices.

PART 2 - PRODUCTS

2.1 GENERAL

A. Segregate excavated material based upon material type to enable reuse in appropriate locations based upon material type as described in Section 3.5.

B. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

2.2 SOIL MATERIALS

A. Use of materials shall be as described below and as shown in the Drawings.

B. Fill material will not be accepted from off-site borrow sources that are RIDEM disposal sites. Common borrow material obtained from off-site borrow sources that have no known releases or disposal of oil and/or hazardous material shall be acceptable for use only when accompanied by documentation stating there has been no known releases or disposal of oil and/or hazardous materials at the off-site borrow site.

C. Fill material shall be free from frost/ice and snow, rocks with a diameter greater than 2/3 of the loose lift thickness as specified herein, and foreign matter, such as construction debris, asphalt, trash, wood, roots, leaves, sod, and organic matter. All fill material shall be maintained by the contractor at suitable moisture contents for proper placement and compaction as specified herein

D. Offsite pulverized pavement and crushed concrete are not acceptable for fill material except as specified herein.

2.3 STRUCTURAL FILL

A. Structural Fill shall have a plasticity index of less than 6 and shall meet the gradation requirements shown below. Structural Fill shall be compacted in maximum 9-inch loose lifts to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557), with moisture contents within ±2 percentage points of optimum moisture content.

Sieve Size	Percent Passing by Weight
3 inches	100
1 ½ inch	80 – 100
½ inch	50 – 100
No. 4	30 – 85
No. 20	15 – 60
No. 60	5 – 35
No. 200*	0 - 10

*0 – 5 for the top 12 inches under sidewalks, exterior slabs, pads, and walkways

Use structural fill within building areas beneath floor footings and slabs, retaining wall foundations, and in other soil-bearing situations.

Crushed concrete can be used as Structural Fill provided it meets the requirements of these specifications. If used, the crushed concrete shall be used up to 6 inches below the bottom of footings and 12 inches below the bottom of slabs.

2.4 ORDINARY FILL

A. Ordinary Fill shall have a plasticity index of less than 6 and shall meet the gradation requirements shown below. Ordinary Fill shall be compacted in maximum 9-inch loose lifts to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557), with moisture content s within ±2 percentage points of optimum moisture content.

Sieve Size	Percent Passing by Weight
6 inches	100
1 inch	50 – 100
No. 4	20 - 100
No. 20	10 - 70
No. 60	5 – 45
No. 200	0 - 20

Use Ordinary Fill for general grading; as backfill for embankments, behind the free draining backfill behind retaining walls, landscape areas, and athletic fields.

Crushed concrete can be used as Ordinary Fill provided it meet the requirements set forth by this specification.

Based on grain-size analyses, the existing fill free of organic matter may be used as Ordinary Fill. Existing on-site soils shall not be reused under foundations, paved surfaces, sidewalks, exterior slabs, pads, and walkways.

2.5 COMMON BORROW

A. Common Borrow material shall be soil containing no stone larger than 8 inches and shall be substantially free of organic loam, wood, trash, or other objectionable materials which may be decomposable, compressible or which cannot be properly compacted. Common Borrow materials shall not contain more than 30 percent by weight of silt and clay.

1. No Common Borrow shall be imported until available onsite Ordinary Fill has been utilized or with prior written approval from the Architect.
2. Common Borrow material from off-site borrow sources shall contain no detectable concentrations of asbestos.
3. Common Borrow to be placed within 12 inches of athletic fields shall be soil containing no stone larger than 3 inches and shall meet all other requirements listed herein.
4. Crushed concrete shall not be used as Common Borrow.

2.6 GRAVEL BORROW

A. Bank Run Processed Sand/Gravel shall be onsite or imported material conforming to Item M.01.02, type 1a of the State Standards.

B. Reclaimed Processed Material shall be onsite or imported material conforming to Item M.01.02, type 2a of the State Standards.

C. Gravel Borrow may be anticipated to be onsite in limited quantities.

D. Crushed concrete shall not be used as Gravel Borrow.

2.7 BEDDING MATERIAL

A. Gravel Borrow Bedding Material shall be imported material conforming to Item M.01.04 State Standards.

B. Crushed Stone Bedding Material shall be imported material conforming to Item M.01.04 of the State Standards.

2.8 SAND FILL

A. Sand Fill: To be used as utility bedding and backfill. It shall be hard, durable sand free from ice, snow, roots, sod and other deleterious matter The allowable amount of material passing a No. 200 sieve as determined by AASHTO T11 shall not exceed 10% by mass. The Sand Fill shall be used as backfilling material around banks of pipes. The Sand Fill shall be graded within the following limits:

Sieve Size	% Passing by Weight
3/8-inch	100
No.200	0-10

2.9 DENSE GRADED CRUSHED STONE FOR SUBBAASE

A. Dense graded Crushed Stone for subbase shall be imported material conforming to Item M.01.09, Type II of the State Standards.

B. Crushed concrete cannot be used as Dense Graded Crushed Stone for Subbase.

C. Dense graded Crushed Stone for subbase are not anticipated to be present onsite.

2.10 CRUSHED STONE

A. Crushed Stone shall be impacted durable material with maximum of 1 ½ ” or 2” as specified in the Drawings. Stone used for drainage components shall be double

washed. For all other applications fines shall be <1% unless otherwise noted. Crushed stone shall meet the following gradation:

Size (inches)	Percent Finer
1 ½" – 2"	100%
1 ¼"	85% - 100%
¾"	10% - 40%
½"	0% - 8%
#200	< 1%

2.11 PEA GRAVEL

A. Clean naturally rounded aggregate with particle sizes no larger than 3/4 of an inch with no more than 5% passing the #8 sieve. The dry density shall be a minimum of 95 pounds per cubic foot.

2.12 WASHED STONE

A. Washed stone shall be free from shale, clay, organic materials, and debris with stone sizes conforming to No. 4 stone as specified by ASTM D448. Not more than 0.5 percent of satisfactory material passing a No. 200 sieve shall be allowed to adhere to the stone. Laboratory testing shall be completed in compliance with ASTM D6913, and results shall be submitted to the **Civil Engineer** for approval.

2.13 FILTER FABRIC

A. Filter fabric shall be nonwoven, needle-punched geotextile, manufactured for subsurface drainage applications, made from polypropylene fibers with elongation greater than 50 percent and complying with AASHTO M288. Filter fabric shall consist of Mirafi 140N, US120NW, GeoTex 401, or approved equal.

B. High Visibility Filter Fabric shall consist of US 160NW-HVO non-woven orange filter fabric, GeoTex 601OR, or Mirafi 160N/O, or approved equal.

2.14 GEOTEXTILE FABRIC

A. Geotextile No. 1: Geotextile Fabric for erosion control/slope protection shall conform to the State Standards. Geotextile No. 1 is a nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that fibers retain their relative position. The product is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	**Test Method**	**Unit**	**Minimum Average Roll Value**
Grab Tensile Strength	ASTM D 4632-91	lbs	120
Grab Tensile Elongation	ASTM D 4632-91	%	50
Trapezoid Tear Strength	ASTM D 4533-91	lbs	50
Mullen Burst Strength	ASTM D 3786-87	psi	225
Puncture Strength	ASTM D 4833-00	lbs	65

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Apparent Opening Size (AOS)	ASTM D 4751-99A	U.S. Sieve	70
Permittivity	ASTM D 4491-99A	sec^{-1}	1.8
Permeability	ASTM D 4491-99A	sec	0.21
Flow Rate	ASTM D 4491-99A	gal/min/ft	135
UV Resistance (at 500 hours)	ASTM D 4355-02	% strength retained	70

Physical Properties	Test Method	Unit	Typical Value
Weight	ASTM D 5261-92	oz/yd	4.8
Thickness	ASTM D 5199-01	mils	55
Roll Dimensions (width x length)	--	ft	12.5 x 360 / 15 x 360
Roll Area	--	yd	500 / 600
Estimated Roll Weight	--	lb	164 / 197

B. Geotextile No. 2: Geotextile No. 2 is a nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that fibers retain their relative position. The product is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength	ASTM D 4632	lbs	160
Grab Tensile Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs	60
Mullen Burst Strength	ASTM D 3786	psi	305
Puncture Strength	ASTM D 4833	lbs	95
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Sieve	70
Permittivity	ASTM D 4491	sec^{-1}	1.4

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Permeability	ASTM D 4491	sec	0.22
Flow Rate	ASTM D 4491	gal/min/ft	110
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70

C. Geotextile No. 3: Geotextile for the installation of underground tank

1. Woven geotextile fabric with a minimum grab tensile strength of 120 lbs/inch and a maximum apparent opening size of #50 US sieve (0.300 mm)

D. A geotextile fabric shall not be used between crushed stone and soil fill material at the base of retaining walls. Where separation between crushed stone and soil fill material is required, the crushed stone shall be choked by means of a soil filter.

2.15 OTHER SOIL MATERIAL

A. Drainage Aggregate: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

B. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

C. Fine Aggregate: ASTM C 33; fine aggregate, natural, or manufactured sand.

D. River Stone: River stone shall be 1 ½" to 3" rounded and 3" to 6" rounded and oval, smooth stone, color range shall be warm tones of buff, beige, tan and gray. Color range shall be consistent throughout. Stone shall be clean and washed free of deleterious material. Contractor to submit 5-gallon container sample for each size range with source indicated.

E. Rip-rap: rip-rap shall be sound, durable rock which is angular in shape in accordance with the State Specifications.

2.16 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for

corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to commencing work, the Contractor shall establish property line locations and place construction control markers clearly visible and understandable to workers in the field. The Contractor shall exercise due care so as not to disturb adjacent structures and shall leave the Site in clean and orderly condition upon completion of the work.

B. Unanticipated Soil Conditions:

1. Removal of unsuitable materials up to the depths shown in the geotechnical report shall be part of the base bid and shall not be considered an unanticipated soil condition. The depth to the bottom of unsuitable material shall be estimated by interpolating between the depths to unsuitable material in the nearest borings and/or test pit.
2. If unsuitable bearing materials are encountered at the specified subgrade depths, i.e., deeper than the elevations shown in the Geotechnical Report, the Contractor shall notify the Architect. The Contractor shall carry excavation deeper and replace the excavated material with suitable/approved compacted fill or lean concrete as directed by the Architect or geotechnical engineer.
3. Removal of such material and its replacement as directed will be paid an extra compensation in quantity approved by the Architect and calculated using survey points of the excavated area. Only changes in the work authorize in advance by the Architect in writing shall constitute an adjustment in the Contract Price.
4. Material that is above or below optimum moisture for compaction of the particular material in place as determined by the Architect or the Soils Representative and is disturbed by the Contractor during construction operations so that proper compaction cannot be reached shall not be construed as unsuitable bearing materials. This material shall be removed and replaced with lean concrete or with approved material as directed by the Architect or Geotechnical Engineer or Soils Representative at no additional cost to the Owner.
5. The Contractor shall follow a construction procedure which permits visual identification of firm natural ground.

C. Excessive Excavation: If any part of the general or trench excavation is carried, through error, beyond the depth and dimensions indicated on the Drawings or called for in the Specifications, the Contractor at his own expense, shall furnish and install compacted gravel fill, concrete, or take other remedial measures as directed by the Architect to bring fill material up to the required level or dimension.

D. The Contractor shall reuse on-site all on-site excavated soils that meet the gradation requirements of materials specified herein. Solid waste consisting of brick, concrete, asphalt, cobbles, boulders, and all unsuitable excavated materials shall become the property of the Contractor and be legally disposed of off-site at no additional cost to the Owner.

Samples and Testing:

1. Excavated material taken directly from on-site cuts that will meet the Specifications may be used as fill provided the Contractor obtains written approval from the Architect. No such fill material shall be put in place until approved for use by the Architect in writing and until test results, including gradation and compaction tests are approved by the Geotechnical Engineer.
2. Testing of materials as delivered may be made from time to time. Materials in question may not be used, pending test results. Tests of compacted materials will be made regularly. Remove rejected materials and replace with new, whether in stockpiles or in place.
3. The existing fill and the natural soil may contain high fines contents. Such soils are very susceptible to disturbance when exposed to moisture. Care shall be exercised during construction to maintain a dry working subgrade. Provide working mats, e. g., crushed stone or concrete mud mats, to reduce the potential for disturbance of the foundation subgrade and to improve working conditions. The use of crushed stone to stabilize soft subgrade shall be at no additional cost to the Owner.

E. Deficiency of Fill Material: Provide required additional fill material to complete the work if a sufficient quantity of suitable material is not available from the required excavation on the project site at no additional cost to the Owner.

F. Surplus Fill Material: Surplus fill that is not required to fulfill the requirements of the Contract shall be removed from the site and legally disposed of at no additional cost to the Owner.

G. Protect all benchmarks, monuments, and property boundary pins. Replace if destroyed by contractor’s operation.

3.2 PREPARATION

A. The Contractor shall be deemed to have inspected the Site and satisfied himself/herself as to actual grades and levels and true conditions under which the Work will be performed.

B. Areas required for execution of Work shall be cleared. The work area shall be free of standing water and shall be dry.

C. All site health and safety controls shall be fully established and in operation prior to beginning any demolition, soil, and fill excavation. Site controls shall include but not be limited to work zones properly barricaded, wheel wash and decontamination facilities, and all support equipment and supplies including personal protective equipment. All site controls shall be reviewed by the Architect in the field.

D. The Contractor shall provide all layout field data, including ties, to the Architect. The Contractor shall maintain all required field controls throughout the performance of the Work.

E. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

F. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 31 10 00 Site and Preparation Clearing."

G. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section 31 25 00 – Erosion and Sedimentation Controls.

H. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.3 SUBGRADE PREPARATION

A. The surficial topsoil, subsoil, if any, asphalt, and other deleterious matter should be entirely removed from within the proposed building footprint before the start of foundation work.

B. Tree stumps, root balls, and roots larger than ½ inch in diameter should be removed and the cavities filled with suitable material and compacted per this Specification and the Geotechnical Report.

C. Cobbles and boulders should be removed at least 6 inches from beneath footings, and 24 inches beneath the bottom of proposed slab and paved areas. The resulting excavations should be backfilled with compacted Structural Fill under the building and with Ordinary Fill under the subbase of paved areas.

D. Due to the high susceptibility of the natural soil for disturbance under foot and vehicular traffic, the Contractor shall place a minimum of 6 inches of Structural Fill at the bottom of the excavation or 4 inches of lean concrete to serve as a working mat.

E. The base of the footing excavations in granular soil should be compacted with a dynamic vibratory compactor weighing at least 200 pounds and imparting a minimum of 4 kips of force to the subgrade before placing the required 6 inches of Structural Fill.

F. The subgrade of the slab should be compacted using a vibratory roller compactor imparting a minimum of 40 kips of force to the subgrade before placing Structural Fill.

G. Where soft zones are revealed during the preparation of the subgrade, the soft materials or buried organic soil should be removed and replaced with Structural Fill within the building footprint and with Ordinary Fill beneath the subbase of paved areas.

H. To reduce the potential of increasing lateral pressures on any retaining walls, fill placed within 3 feet of the walls, if any, should be compacted using a small plate compactor imparting a maximum dynamic effort of 4 kips. The fill within 3 feet of the walls should be placed in maximum 8-inch loose lifts.

I. Fill placed within the footprint of the proposed building should meet the gradation and compaction requirements of Structural Fill as described in this Specification.

J. Fill placed in the top 12 inches beneath sidewalks and exterior slabs should consist of Structural Fill with less than 5 percent fines.

K. When crushed stone is required in the drawings or it is used for the convenience of the contractor, it should be wrapped in a geotextile fabric for separation. The geotextile fabric should not be used under retaining walls as it promotes a plane of sliding.

L. In areas requiring rock excavations, if encountered, disturbed rock material shall be removed and replaced with Structural Fill or crushed stone within the footprint of the proposed building, and with Ordinary Fill beneath the pavement subbase of the proposed parking lots and driveways.

M. Granular fill shall not be placed directly on rock surfaces containing voids. Suitably sized crushed stone or a geotextile for separation shall be placed on the fractured surface prior to placing the fill to limit migration of smaller particles into the voids.

N. Under utility pipes, manholes, and catch basins, rock shall be cut a minimum of 12 inches beneath the pipe or structure.

O. Laterally, the rock shall be removed at least 1 foot beyond the limits of footings and 3 feet beyond the limits of walls. Rock shall be cut a minimum of 12 inches outside utility structures and a minimum of 18 inches on each side of utility pipes.

P. All excavated materials shall be segregated such that reusable material meeting the gradations provided for above are separated from organics and all other deleterious material.

Q. Once the final subgrade has been reached, and upon acceptance by the Architect and Soils Representative, Contractor shall backfill the excavated area with Structural Fill in the influence zone of building areas and Ordinary Fill in paved areas. Limits of excavation shall be determined in the field based upon observed conditions.

3.4 SUBGRADE PREPARATION FOR PAVED AREAS, SIDEWALKS, AND EXTERIOR PADS

A. Topsoil, root balls, and other deleterious material should be entirely removed from within the paved areas and under sidewalks.

B. After the surficial topsoil is entirely removed from within the proposed paved areas and under sidewalks, the exposed existing fill should be improved by compacting the exposed surface with at least six (6) overlapping passes of a vibratory roller compactor imparting a dynamic effort of at least 40 kips. Where soft zones of soil are observed, the soft soil should be removed, and the grade should be restored using Ordinary Fill to the bottom of the proposed subbase layer.

C. Fill placed under the subbase of paved areas and sidewalks should meet the gradation and compaction requirements of Ordinary Fill.

D. The subbase of paved areas should conform to the recommendations in this specification.

E. The subbase of sidewalks should consist of Structural Fill with less than 5 percent fines.

3.5 PROOF COMPACTING

A. Areas requiring excavation shall be excavated to subgrade and then proof compacted as specified in Section 1.2 of this Specification Section.

B. Where soft zones are revealed by compaction efforts and where organic soil is exposed, the soft material or organic soil shall be removed and replaced with Structural Fill in the influence zone of building areas and utility trenches and Ordinary Fill in paved areas.

3.6 REUSE OF ONSITE MATERIALS AND PROCESSING OF ONSITE MATERIALS

A. Organic soils cannot be reused for backfill except as directed by the landscape architect.

B. Based on the Geotechnical Engineer's field observations and the results of the grain-size analyses, some of the onsite fill free of organic matter may be used as Ordinary Fill and may be improved by blending with crushed stone to use as Structural Fill.

C. The Contractor should avoid mixing the reusable soils with fine-grained and/or organic soils. The soils to be reused should be excavated and stockpiled separately for compliance testing. Soils with 20 percent or greater fines contents are generally very sensitive to moisture content variations and are susceptible to frost. Such soils are very difficult to compact at moisture contents that are much higher or much lower than the optimum moisture content determined from the laboratory compaction test. Therefore, strict moisture control should be implemented during the compaction of onsite soils with fines contents of 20 percent or greater. The Contractor should be prepared to remove and replace such soils if pumping occurs.

D. Solid waste consisting of brick, concrete, asphalt, cobbles and boulders that measure less than 3 cubic yards in volume shall become the property of the Contractor and be legally disposed of off-site at no additional cost to the Owner.

E. Excavated onsite soils which are suitable for re-use at the time of excavation but become frozen or too wet for re-use due to poor material handling practices shall be disposed of off-site and replaced as necessary at no additional cost to the Owner.

F. The Contractor must inspect all existing stockpiles on site including soil testing for each stockpiled material.

G. The Contractor must amend the existing stockpiles if testing determines that the stockpiles do not meet the specifications for their intended use. The Contractor shall provide third party sampling and testing for all soils amended on-site.

H. The contractor shall protect stockpiled unprocessed materials from exposure to moisture using tarps. The tarps shall be secured so as not to be moved by wind or other action. No claim shall be made, by the contractor, due to failure to comply with this requirement.

I. The reuse of onsite soil shall not be permitted within one foot of finished grade.

3.7 EXCAVATION, GENERAL

A. The Contractor shall remain responsible for adequacy and safety of construction means, methods and techniques.

B. The Contractor shall complete all excavations regardless of the type, nature or condition of the material encountered. The Contractor shall be solely responsible for making all excavations in a safe manner.

C. The Architect shall be notified of unexpected subsurface conditions. Work shall be discontinued in affected areas until notified to resume work by the Architect.

D. Displaced or loose soil shall be prevented from falling into any excavation. The stability of soil slopes shall be maintained in accordance with applicable local, state and federal regulations and guidelines.

E. All loose material shall be removed from the bottom of the excavation so that the bottom shall be in an undisturbed condition. If removal of the loose material results in excavation beyond the work limits and over excavation has not been approved by the Architect; the restoration of the excavation to grade shall be done at no additional cost to the Architect.

F. When the bottom of the excavation shall, by error of the Contractor, have been taken to a depth greater than the depth specified, or directed by the Architect, said condition shall be corrected by refilling to the proper grade with granular fill or the design shall be altered in a fashion acceptable to the Architect to compensate for said error. All measures taken to rectify conditions caused by over excavation shall have the Architect's approval, and any increase in cost resulting from such measures shall be borne by the Contractor.

G. Excavation shall not be performed when weather conditions or the conditions of the materials are such that, in the opinion of the Architect, work cannot be performed satisfactorily.

H. Appropriate measures shall be provided to retain excavation sidewalls and to ensure that persons working in or near the excavation are protected. Sheeting shoring or bracing may be used to support the walls of excavations. Method, design, construction and adequacy of any required bracing shall meet the OSHA requirements of 29 CFR Part 1926 and are the responsibility of the Contractor.

I. All damage related to or caused by the excavation shall be repaired at the expense of the Contractor.

J. Unclassified Excavation - For the purposes of payment, materials shall be unclassified except for those beyond the greater of the lines and grades shown in the Drawings. Unclassified excavation shall comprise and include the satisfactory excavation, removal, and disposal of all materials encountered within the lines and grades shown in the Drawings or limits specified herein, whichever is deeper, regardless of the nature of the materials, and shall be understood to include, but not be limited to, earth, topsoil, subsoil, hardpan, fill, foundations, pavements, curbs, piping, railroad track and ties, cobblestones, footings, bricks, concrete, abandoned drainage and utility structures, debris, and materials classified as unsuitable materials. All excavation and replacement, if applicable, with suitable material within the lines and grades shown in the Drawings or the limits specified

herein, whichever is deeper, will be considered and bid as unclassified and shall be included in the Contractor's lump sum (i.e., shall not be paid for using Unit Prices)

K. Removal of unsuitable material beyond the grades and lines shown on the Drawings and specified herein and its replacement, if applicable, as directed will be paid on the basis of contract conditions relative to changes in work or as provided for under the unit rates for respective classification in accordance and following the method of measurement and verification of quantities as defined in this specification.

L. Should quantities of certain materials or classes of work be increased or decreased from what is shown in the drawings and specified herein, the Contract Unit Rates listed below (see Section 3.6.M) should be the basis of payment to the Contractor, or credit to the Owner, for such increase or decrease in the work. The Contract Unit Rates shall represent the exact net amount, per unit, to be paid to the Contractor in the case of increases in the quantities, and the exact amount to be refunded to the Owner in the case of decreases in the quantities. No additional adjustment shall be allowed for overhead, profit, insurance, or other direct or indirect expenses by the Contractor. Contract Unit Rates of materials shall include hauling, storing, stockpiling, moving, importing, spreading, and compacting. Increases or decreases in the quantities should be approved by the Owner.

1. The Contractor shall excavate soil and fill to the limits necessary to achieve the required grades determined by the Architect. The limits of excavation may not coincide with those areas indicated on the Drawings. The excavation areas shown on the Drawings are estimated areas only.
2. If unanticipated bearing soils are encountered beyond the limits of excavation as specified on the Drawings and in the Specifications and at the specified subgrade depth, the Contractor shall notify the Owner’s Representative in writing. The Contractor shall carry the excavation deeper and replace the excavated material with appropriate specified material or concrete as directed by the Architect or Engineer.
3. Removal of topsoil, subsoil, rock, boulder, and organic silt, or silty sand as specified herein and in the Geotechnical Report will not be considered as unanticipated, unsuitable soil conditions at an elevation above specified subgrade elevations. Similarly, removal of these materials within paved areas as specified herein will not be considered unanticipated unsuitable soil conditions. Proposed over excavation as shown on the plans will not be considered unanticipated soil conditions.

M. Provide unit process as follows:

1. For each type of material listed in PART 2 - PRODUCTS, separate unit rates shall be provided for imported material and material processed onsite. The unit rates shall include furnishing/processing, stockpiling, placing, and compacting the material)
2. Provide unit rate for rock excavation in trenches and pits, removed from the site, and any placement of fill required to bring excavated surface to specified subgrade.
3. Provide unit rate for rock excavation as open excavation, removed from the site, and any placement of fill required to bring excavated surface to specified subgrade.

N. Unsuitable Soil Allowance: The Contractor shall carry in the base bid 1,000 cu. yds. for removal of unanticipated, unsuitable soil materials beyond the subgrade limits shown on all contract drawings and defined within the specification and beyond the quantity required for over excavation as shown on the plans and defined within the specifications. Allowance shall cover removal and disposal of unsuitable soil and furnishing imported suitable backfill materials compacted in place as directed herein. The base bid shall cover all costs related to such excavation, removal off site, disposal, and replacement with compacted fill of approved material, overhead, and profit. No amount other than that herein specified will be paid by the Owner for the work defined herein.

1. If the total void volume of unanticipated unsuitable material excavation below specified subgrades, and its replacement with compacted fill exceeds the amount included in the Contract as listed above, the Owner shall pay the excess excavation and replacement at the unit price submitted in the Bid Attachment – Unit Prices Schedule.
2. If the total quantity of unanticipated unsuitable materials below specified subgrades, and its replacement with compacted fill is less than the amount included in the Contract as listed above, the contract sum will be decreased by the difference in excavation and its replacement multiplied by the unit price submitted in the Bid Attachment – Unit Prices Schedule.
3. Final excavated surfaces shall be surveyed by the Contractor and shall be measured from specified subgrade to bottom of excavation. Payment shall be based upon actual volumes with no bulking or swell factors applied. Contractor shall submit all survey data and quantity calculations to Architect for approval.

O. Petroleum Contaminated Soil Allowance: The Contractor shall carry in the base bid 100 cu. yds. for removal of unanticipated, petroleum contaminated soil materials. Allowance shall cover removal and disposal of petroleum contaminated soil and furnishing imported suitable backfill materials compacted in place as directed herein. The base bid shall cover all costs related to such excavation, removal off site, disposal, and replacement with compacted fill of approved material, overhead, and profit. No amount other than that herein specified will be paid by the Owner for the work defined herein.

1. If the total void volume of unanticipated petroleum contaminated material excavation, and its replacement with compacted fill exceeds the amount included in the Contract as listed above, the Owner shall pay the excess excavation and replacement at the unit price submitted in the Bid Attachment – Unit Prices Schedule.
2. If the total quantity of unanticipated petroleum contaminated materials, and its replacement with compacted fill is less than the amount included in the Contract as listed above, the contract sum will be decreased by the difference in excavation and its replacement multiplied by the unit price submitted in the Bid Attachment – Unit Prices Schedule.
3. Final excavated surfaces shall be surveyed by the Contractor and shall be measured from specified subgrade to bottom of excavation. Payment shall be based upon actual volumes with no bulking or swell factors applied. Contractor shall submit all survey data and quantity calculations to Architect for approval.

3.8 ROCK EXCAVATION

A. Definitions and Classifications: The following classifications of excavation will be made only when rock excavation is required.

1. “Earth Excavation” consists of removal and disposal of pavement and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as rock excavation.
2. “Rock Excavation” consists of removal and disposal of materials encountered that cannot be excavated without continuous and systematic drilling and blasting or continuous use of a ripper or other special equipment, except such materials that are classed as earth excavation. Typical of materials classified as rock excavation are as follows:
    a. Rock, stone, or weathered bedrock in original ledge.
    b. Sandstone in original ledge.
    c. Boulders on site, outside trench limits, exceeding three cubic yards in volume.
    d. Boulders within trench limits, exceeding one cubic yard in volume.

B. Should highly fractured or weathered bedrock be encountered during excavation, the following shall apply:

1. When the material is encountered in trenching operations or under footings, it shall be excavated or ripped with a hydraulic backhoe equal to or larger than Caterpillar 225 backhoe and will be classified as Earth Excavation. When it is demonstrated to the satisfaction of the Architect and the Soils Representative that this material can no longer be removed with a hydraulic backhoe and requires drilling and blasting, this material shall be classified as Rock Excavation. For excavation procedures when this material is encountered under footings, refer to paragraph below.
2. When this material is encountered in open excavation, it shall be classified as earth excavation until drilling and blasting or continuous ripping is necessary as defined hereinabove.

C. Intermittent drilling and ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

D. Allowance for Rock Excavation: The Contractor shall carry in the Base Bid an allowance for 20 cubic yards or rock encountered in trench excavation removed from the site. The Contractor shall also carry in the Base Bid an allowance of 20 cubic yards of open rock excavation removed from the site. The Base Bid shall cover all costs relating to such rock excavation, including blasting, removal and placement of the excavated material, overhead and profit. No amount other than that herein specified will be paid by the Owner for excavation herein defined.

1. Quantities shall be measured by the volume of void created using survey points of the excavated area. The fixed unit price shall be applicable to variations in excess of the allowance quantity up to 100% of the allowance quantity.
2. If the total quantity of Rock Excavation, open and/or trench, is less than the amount of Rock Excavation included in the Contract as listed above, the

Contract sum will be decreased by the difference in Rock Excavation multiplied at the fixed unit price. Quantities shall be measured by the volume of void created using survey points of the excavated area. The fixed unit price shall be applicable to variations of the allowance quantity by decreases of 100% of the allowance quantity.

E. Measurements:

1. When, during the process of excavation, rock is encountered, such material shall be uncovered and exposed in such a manner that the unbroken ledge surface is clearly visible, and the Architect shall be notified by the Contractor, before proceeding further. The areas in question shall then be cross-sectioned as hereinafter specified.
2. Failure on the part of the Contractor to uncover such material and to notify the Architect and proceeding by the Contractor with the rock excavation before cross-sections are taken, will forfeit the Contractor's right of claim towards the stated allowance or additional payment over and above the stated allowance at the quoted unit price.
3. The Contractor shall employ and pay for a Professional Civil Engineer or Land Surveyor registered in the State of Rhode Island to take cross-sections of rock before removal and to make computations of volume of rock encountered within the Payment Lines. Cross-sections shall be taken in the presence of the Soils Representative and the computations approved by the Architect. The Owner has the option to perform independent cross-sections and computation of rock quantities.
4. Where removal of boulder or ledge is required outside the established payment lines, the extent of this removal and basis of payment shall be determined by the Architect.

F. If ledge is encountered within the limits of the Proposed Building Area, the Contractor shall excavate this material 12 inches below subgrade of footings and 18 inches below subgrade of slabs and pavement unless otherwise directed by the Architect or Soils Representative. All loose or shaken rock shall be removed and replaced with compacted gravel fill, crushed stone or lean concrete as directed by the Soils Representative.

G. Rock excavation for foundations outside of the Building Area: Remove rock to foundation or footing subgrade. All rock bottoms for foundations shall be carefully examined. Loose or shaken rock shall be removed to solid bearing, and the rock surface leveled, or shelved to a slope not exceeding one inch per two feet, or as directed.

H. Prepared rock subgrades shall be compacted with at least four passes of a self-propelled vibratory roller such as Dyna Pac CA-30D (44,000 lbs. Centrifugal force) or equivalent. Rock subgrades in utility trenches shall be recompacted with at least four passes a walk-behind vibratory drum roller or other equivalent equipment having at least 10,000 pounds centrifugal force and sufficient to provide a firm, stable subgrade.

I. If any part of the rock excavation at footings to be carried beyond the depth and the dimensions indicated on the Drawings or called for in the Specifications, the Contractor shall, at his own expense, furnish and install concrete of same strength as footings to the required subgrade level of the footings as shown on the Drawings. Dowelling or other corrective structural measures as directed by the

Architect may also be required to properly anchor or reinforce the concrete. If rock excavation is carried beyond the depth and dimensions to subgrade in other areas, the Contractor shall, at his own expense, furnish and install compacted gravel fill to subgrade as directed by the Architect.

J. Basis of Payment: The total amount of rock excavation will be based upon the in-situ volume of rock excavated within and/or above the lines referred to in the next paragraph as “Payment Lines”. The payment lines are only to be used as a basis of payment, and are not to be used as limits of excavation. Limits of excavation area as shown on the Drawings and as specified herein.

K. Payment Lines for Rock Excavation:

1. Payment lines for columns and footings shall be a vertical line one-foot off the edge of the footings; the depth shall be measured at 12 inches below the bottom elevations shown on the Drawings. Payment lines for walls to be damp-proofed shall be a vertical line three feet outside the walls. Vertical payment lines shall be as specified hereinafter.
2. Payment lines for manholes and catch basins shall be one-foot outside of the outer wall and 12 inches below subgrade beneath the structure.
3. Payment lines for rock excavation under slabs on grade shall be 18 inches below the bottom of the slab. Payment lines for rock excavation at plant beds shall be 12” at edge and full depth of required elevation for loam.
4. Payment lines for rock excavation at paved areas and lawns shall be 18 inches below bottom of asphalts.
5. Payment lines for rock excavation under pipes within the building and for utility trenches outside the building lines shall in no case be calculated as greater in width than the outside diameter of the pipe plus two feet for pipes up to 18 inches. For pipes 18 inches and larger payment lines shall in no case be calculated as greater in width than the outside diameter of the pipe plus three feet. Payment lines at bottom of all pipe and utility trenches shall be 12 inches below the bottom of the pipe.

3.9 STORAGE OF SOIL MATERIALS – STOCKPILING

A. The Contractor shall be responsible for managing and tracking any and all materials excavated and placed in stockpiles for testing.

B. B. Materials shall be stockpiled on site at locations proposed by the Contractor and approved by the Architect. Stockpiled materials shall be of sufficient quantities to meet project schedule and requirements

C. Tracking of the stockpiles shall be performed in accordance with the approved Work Plan submitted by the Contract in accordance with Section 01 33 00.

D. The temporary stockpiled fill must be removed from the Site in accordance with applicable regulatory deadlines however no later than the completion date of this contract or 90 days from the date the stockpile was created, whichever is encountered first.

E. Stockpiles shall be securely barricaded and clearly labeled. Differing materials shall be separated with dividers or stockpiled apart to prevent mixing.

F. The Contractor shall direct surface water away from stockpile site to prevent erosion or deterioration of materials. Soils shall be suitably dewatered prior to their relocation on Site or disposal off site.

G. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.11 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Trenches shall be excavated to the necessary width and depth for proper laying of pipe or other utility and excavation side slopes shall conform to OSHA requirements. Minimum width of trenches shall provide clearance between the sides of the trench and the outside face of the utility. Maximum trench sizes are as shown on the Drawings or as specified herein. The depth of the trench shall be twelve inches below the bottom of the pipe barrel or respective utility. If the existing soil at the final subgrade excavation is found not suitable, the Architect or Soils Representative may approve removal and replacement of material.

1. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
2. Clearance: As indicated on plans.
3. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

C. The Contractor shall provide, at his own expense, suitable bridges over trenches where required for accommodation and safety of the traveling public and as necessary to satisfy the required permits and codes.

3.12 SUBGRADE INSPECTION, COMPACTION AND PROOF ROLLING

A. Notify Architect when excavations have reached required subgrade.

B. Proof compact all subgrades in accordance with Subsection 1.2 of this Specification Section and the Geotechnical Report to identify soft pockets and areas of excess yielding. Do not proof compact wet or saturated subgrades.

1. Completely proof compact subgrade in one direction repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).

C. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect and/or Soil Representative, and replace with compacted fill as directed.

D. Proof compacting shall be completed utilizing a 20-Ton vibratory drum roller for granular soils. Should clay or other cohesive soils be encountered, sheep's foot roller shall be utilized. A total of 6 passes shall be considered complete.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect and/or soil representative, without additional compensation.

3.13 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage,
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.

B. If, through failure or neglect of the Contractor to conduct the excavation work in a proper manner, the surface of the subgrade is in an unsuitable condition for proceeding with construction, the Contractor shall, at his own expense, remove the unsuitable material and replace it. Failure of the Contractor to control surface or ground water adequately, premature excavation at the work site, or other manifestations of the Contractor's neglect or improper conduct of the work, as determined by the Architect, shall be grounds for requiring removal and replacement of unsuitable subgrade without additional compensation.

C. Grading in the vicinity of backfilling shall be properly pitched to prevent water from running into the backfilled area. Work areas shall be kept free from water during performance of the work under this Contract at no expense to the Architect. The Contractor shall build diversion berms and other devices necessary for this purpose.

D. The Contractor shall not commence backfilling operations until the Architect gives approval.

E. After the subgrade has been prepared, fill material shall be placed and built-up in successive layers until the required elevations are reached. No fill shall be placed on a frozen surface, nor shall snow, ice, or other frozen material be included in fill. Wet materials containing moisture in excess of the amount necessary for satisfactory placement or compaction shall not be used.

F. All fill shall be brought up in essentially level lifts and shall be placed in levels by standard methods. The method of placement shall not disturb or damage other work. Layers of fill shall not exceed twelve inches of uncompacted thickness before compaction, unless otherwise specified or as necessary for proper subgrade stabilization.

G. Place backfill on subgrades free of mud, frost, snow, or ice.

H. Filling operations shall continue until the fill has been brought up to the finished slopes, lines, and grades making proper allowances for thickness of surface treatment.

I. The entire surface of the work shall be maintained free from ruts and in a condition that will permit construction equipment to travel readily over any Section. The top surface of each layer shall be made level or slightly sloped away from the center of the filled area. Fills shall be graded to drain and compacted/sealed whenever precipitation is expected.

J. Backfilling shall not be performed when weather conditions or the conditions of the material are such that, in the opinion of the Architect, work cannot be performed satisfactorily.

3.14 ACCEPTABLE BACKFILL

A. Backfill materials shall be placed in the areas as indicated in the table below:

Fill below footings and slabs within the Building Area	Sand and Gravel Fill (Geotech Report)
Fill around footings for building and structures within the Influence zone	Sand and Gravel Fill (Geotech Report)
Fill below pavement subbase	Ordinary Fill (Geotech Report)
Fill below sidewalk subbase	Ordinary Fill (Geotech Report)
Fill placed in top 1 foot below sidewalks	Select Fill
Fill within utility trenches below pavement and sidewalk subbase	Granular Fill (Geotech Report)
Fill below utility bedding	Ordinary Fill
Fill placed in landscaped areas outside of the Influence Area of footings, retaining walls, and slopes	Common Borrow
Fill placed around banks of pipes	Granular Fill (Geotech Report)
Fill around footings for building and structures within the Influence zone	Structural Fill
Fill below pavement subbase	Ordinary Fill

3.15 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill material, free of particles larger than 1 inch in any dimension, to a height of 6 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Backfill voids with approved backfill material while installing and removing shoring and bracing. Where voids cannot be backfilled with compacted backfill, the voids shall be filled with flowable fill.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.16 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

1. Sequentially place and compact fill material in layers to required elevations.

B. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.17 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by +2 to -3 percent and is too wet to compact to specified dry unit weight.
3. If in the opinion of the Architect or Geotechnical Engineer, additional moisture is required, water shall be applied by sprinkler tanks or other uniform distribution devises. If excessive amounts of water or if rain should cause excessive wetness, the area shall be allowed to dry as provided above.

3.18 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross Sections, lines, and elevations indicated. Grading shall be done by standard methods.

Areas adjacent to structures and other areas inaccessible to heavy grading equipment shall be graded by manual methods. Embankments shall be graded at all times to ensure runoff of water.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Provide proper drainage from the site, no grading shall be done to direct water to damage or potentially damage adjacent property or work executed under this contract.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus [1 inch]
2. Walks: Plus or minus [1 inch]
3. Pavements: Plus or minus [1/2 inch]

3.19 FIELD QUALITY CONRTOL

A. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed in accordance with Subsection 1.7 of this Specification Section and:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 500 sq. ft. or less of paved area, but in no case fewer than 3 tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 COMPACTION REQUIREMENTS

A. The following table lists minimum compactive efforts, which are required for all, fill materials. Compaction of each lift shall be completed before placement and compaction of the next lift is started. The compaction equipment shall make an equal numbers of transverse and longitudinal coverages of each lift. The degree of compaction for fill placed in various areas shall be as follows:

1. Under concrete slabs and footings 95%
2. In paved areas

Within aggregate base course	95%
Within aggregate subbase course	95%
Below subbase course	92%

3.	In landscaped areas (To be checked/approved by RLA)	90%
4.	Around and Above Utilities below	
	Below Pavement subbase in paved areas	95%

*Percentage of maximum dry density of the materials at optimum moisture content as determined by methods or tests for ASTM designation D1551 Method D.

B. Compaction shall be accomplished by vibratory rollers, multiple wheel pneumatic tired rollers or other types of approved compacting equipment. Loaded trucks, low beds, water wagons and the like shall not be considered as acceptable compaction equipment unless specifically approved by the Architect for a particular location. Equipment shall be of any such design that it will be able to compact the fill to the specified density in a reasonable length of time. All compaction equipment shall be subject to the approval of the Architect.

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

D. Backfill shall not be placed against walls until they are braced or have cured sufficiently to develop strength necessary to withstand, without damage, pressure from backfilling and compacting operations.

E. Before backfilling against walls, the permanent structures must be completed and sufficiently aged to attain strength required to resist backfill pressures without damage. Temporary bracing will not be permitted except by written permission from the Architect. Correct any damage to the structure caused by backfilling operations at no cost to the Owner.

F. During backfilling, the difference in elevation of backfill on opposite sides of the structure shall not exceed 24 inches, except as noted. Where backfill of buried wall is only on one side, only hand-operated roller or plate compactors shall be used within a lateral distance of 5 feet of back of wall for walls less than 15 feet high and within 10 feet of back of wall for walls more than 15 feet high. The backfill material shall be compacted with a dynamic vibratory compactor weighing no more than 1000 pounds and imparting a minimum of no more than 8 kips of force to the subgrade.

G. The Contractor shall compact all fills made during the day of work prior to leaving the project for the evening. The upper layer shall be pitched as necessary to provide positive drainage towards swales or interceptor ditches to minimize ponding and erosion should it rain.

3.21 COMPACTION TESTING

A. The Contractor shall make all necessary excavations and preparations for testing. Excavations for density tests shall be backfilled with material similar to that excavated, and compacted to the specified density by the Contractor. Failure of the backfill material to achieve the specified density will be just cause for rejection of any or all portions of the excavation Section tested. The Contractor will not be granted an extension of time or additional compensation for testing or repair of backfill ordered by the Architect.

B. Field density tests will be made by the Owner’s Inspection Agency in accordance with the Method of Test for ASTM Designation D1556 or D6938, to determine

adequacy of compaction; the location and frequency of such field tests shall be at the Architect's Inspection Agency's discretion.

C. All field density tests results shall be reviewed by the Architect prior to the placement of concrete.

D. The Contractor shall notify the Inspection Agency when an area is ready for compaction testing. This notification shall be 48 hours in advance of placing or final compaction so that the Architect Inspection Agency has adequate time to take compaction tests.

E. Cooperate with the Architect in obtaining field samples of in-place materials after compaction. Furnish incidental field labor in connection with these tests. The Contractor will be informed by the Architect of areas of unsatisfactory density which may require improvements by removal and replacement, or by scarifying, aerating, sprinkling (as needed), and recompaction prior to the placement of the new lift. No additional compensation shall be paid for work required to achieve proper compaction.

F. The Owner or Architect's Inspection Agency's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the Inspection Agency nor any observations and testing performed by him shall excuse the Contractor from defects discovered in his work.

3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

1. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

B. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

1. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
2. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Project property.

3.24 REMOVAL OF EROSION CONTROL MEASURES

A. Remove temporary drainage swales, check dams, siltation sumps, hay bales, siltation fencing and other temporary drainage, erosion and siltation control measures when permanent drainage control measures have been installed and grass is established in drainage areas leading to siltation sumps. Contractor shall

excavate and remove all sediments from siltation sumps prior to backfilling the sumps. Remove erosion control measures when approved by the Architect.

End of Section

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Section 31 10 00
SITE PREPARATION AND CLEARING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SCOPE OF WORK

A. This Section includes the following but is not limited to:
1. Removing existing trees, shrubs, groundcovers, plants and grass.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Installation and maintenance of temporary erosion and sedimentation control measures.
6. Removal and disposal of site features at the locations specified on the Drawings and in Section 02 41 00 Site Demolition.

B. Work to be done includes furnishing all labor, materials, equipment and services required to complete all site preparation, erosion control and demolition work indicated on the drawings and as specified herein.

C. Special attention is directed to requirements covering existing site conditions to be protected and preserved in the finished work and to the Initial Sequence of Construction Activities and Preliminary Drainage Control specified herein.

D. It is brought to the Contractor’s attention that procedures for drainage, erosion and siltation control specified in this Section and Section 31 25 00 will be controlled by a RIPDES General Permit for Construction Activity. The Contractor is responsible for filing the RIPDES General Permit for Construction Activity. A copy of permit and associated documents shall be retained on the site during construction. In addition to this Section, the Contractor shall refer to the General and Supplemental General Conditions and Division 1, General Requirements, for other conditions related to the RIPDES Permit. Contractor is required to prepare all necessary documents required for the RIPDES Permit including Storm Water Pollution Prevention Plan for Construction Activity.

E. Applying for and obtaining an RIPDES Permit for General Construction Activity prior to any construction work at the site is the Contractor’s responsibility.

1.3 RELATED WORK

A. Division 2 – Section 02 41 00 "Site Demolition".

B. Division 31 – Section 31 00 00 "Earthwork" for soil materials, excavating, backfilling, and site grading.

C. Division 31 – Section 31 25 00 "Erosion Control" for installation and maintenance of erosion controls, minimization of disturbances to sensitive areas.

D. Division 32 – Section 32 00 00 "Bituminous Concrete Paving" for placement of vertical granite curing and paving of roadways and walkways.

1.4 LIABILITY FOR DAMAGES

A. The Contractor shall be liable for all damage and/or disturbance to existing adjacent lands beyond the Limit of Work. Actual damage to these areas, caused by the Contractor, shall be repaired to the satisfaction of the Architect, at no additional cost to the owner or Architect. Repairs may include pruning or removing damaged vegetation as specified, replacement of damaged vegetation, restoration of the ground plane to its original condition, and any other work required to restore the area to its original condition as depicted in the site photographs taken at the beginning of construction. The project will not be accepted until all repair work is complete.

1.5 PERMITS AND CODES

A. All work shall comply with all codes, rules, regulations, laws and ordinances of the City of Central Falls, State of Rhode Island, and all other authorities having jurisdiction. All work necessary to make site preparation comply with such requirements shall be provided without additional cost to the Owner.

B. The Contractor shall procure and pay for all permits and licenses required for work under this Section.

C. The Contractor shall not close or obstruct any streets, sidewalks, or passageways, unless and until they have been discontinued by the City or unless and until he shall have first secured all necessary municipal or other permits thereof. No material whatsoever shall be placed or stored in streets or passageways until they have been so discontinued. The Contractor shall conduct their operations to interfere as little as possible with the use ordinarily made of roads, driveways, sidewalks, or other facilities near enough to the work to be affected thereby.

D. The procedures for drainage, erosion, and siltation control specified in this Section and Section 312500, are related to procedures required for a RIPDES General Permit. In addition to these Sections, the Contractor shall refer to the General and Supplementary General Conditions and Division 1 General Requirements for other conditions related to the RIPDES Permit.

E. Issue submittals in accordance with Division 1. Submittals under this Section shall include manufacturer's specifications and installation instructions.

1.6 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

B. Plans, surveys, measurements and dimensions, under which the work is to be performed are believed to be correct to the best of the Architect's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found herein.

C. Information on the Drawings, Reference Drawings, and in the Specifications relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

D. Site Information – data on indicated subsurface conditions are not intended as representations or warrants of continuity of such conditions between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there from by the Contractor. Data are made available for the convenience of the Contractor. Neither the Owner nor the Soils Representative assumes responsibility for accuracy of the data other than at the particular locations and at the time the explorations were made.

1.7 STAGING AREA

A. No parking is permitted within the right of way of adjacent streets or onsite outside of the limit of work for each phase. The Contractor shall submit a plan for his/her construction staging and equipment storage within the limits of work, prior to commencing construction.

B. No parking of cars or stockpiling of construction materials shall be permitted under any trees that are scheduled to remain or be protected.

1.8 DISPOSITION OF EXISTING UTILITIES

A. Active utilities existing on the site shall be carefully protected from damage and relocated or removed or abandoned as necessitated by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings as described in this Section and both Architect and the utility owner notified in writing.

B. Inactive or abandoned utilities encountered during construction operations shall be removed, plugged, or capped. The location of such utilities shall be noted on the record drawings and reported in writing to the Architect.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCING

A. Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet (2.4 m) apart.
   a. Height: 4 feet
   b. Color: High-visibility orange, nonfading.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Restrict construction activities to those areas within the limits of construction, public rights-of –way, and easements designated on the Contract Drawings. Adjacent properties and improvements thereon, public or private, which become damaged by construction operations shall be promptly restored at the Contractor's expense to their original condition, and to the full satisfaction of the property owner.

3.2 SITE CLEARING

A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions, except for those indicated on the Contract Drawings to remain, interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal shall include digging out stumps in their entirety and grubbing roots to at least 30 inches below existing or proposed grades, whichever is deeper, as shown on the Contract Drawings.

B. Carefully and cleanly cut roots and branches of existing trees indicated to remain and be protected, where such roots and branches obstruct new construction. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.

C. Clearing shall consist of the felling and disposal of standing trees, and the removal and disposal of all brush, down timber, fences and rubbish. Trees, brush and down timber may be chipped and a portion of the chipped material shall be stockpiled on site in a location selected by the Architect and for dispersion into wooded areas in locations selected by Architect.

D. In all areas that are to be cleared, all brush, grass and other vegetation, except trees, shall be cut off flush with or below the original ground surface.

E. All lines and grade work required for this contract at the site shall be laid out by a registered land surveyor or Professional Engineer employed by the Contractor, in accordance with the Drawings and Specifications.

F. Prior to starting site clearing operations, stake out all roads, edges of parking areas, and other future paved areas as indicated, limits of cut and fill at the edges of these areas (it limits do not coincide) and areas of trees to be saved as noted on the Drawings.

G. Before any clearing is done, promptly upon completion of layout work, the Contractor shall arrange a conference on the site with the Architect to identify and mark trees and shrubs which are to remain. Adjustments to clearing lines shall be made at this time to save trees or other existing conditions on the edges of clearing lines. If necessary, minor grading adjustments shall be made to save these trees. Do no clearing without clear understanding of existing conditions to be preserved.

H. The owner shall be reimbursed should individual trees, shown on the drawings to be protected, become damaged during the course of the work. All expenses incurred shall be paid by the Contractor without additional cost to the Owner.

The owner shall be reimbursed should trees, which are beyond limits of clearing shown on the drawings or beyond limits of clearing approved by the Architect, be cleared or damaged and are part of larger, contiguous wooded areas.

These damaged trees shall be removed from the site, the stumps grubbed and the ground surface repaired. Costs for this removal shall be borne by the Contractor and not be included as part of the above schedule.

I. Fell trees in such a way as not to injure trees to be saved. Trees shall be cut three feet or less from existing grades. All brush or other material shall be cut flush to the ground. All material from clearing operations shall be chipped or cut into log lengths. All piles of chipped material (except those stockpiled for future inclusion in the work) and logs from clearing operations shall be removed from the site prior to or at the end of the clearing work.

J. Limits of clearing shall be those areas shown on the Drawings with modifications as herein specified. Removal of trees, shrubs and bushes outside these areas shall be done only as noted on Drawings.

K. No trees to be saved shall be used for crane stays, guys or other fastenings. Vehicles shall not be parked nor debris burned where damage may result to trees to be saved. Do not permit heavy equipment, materials or stockpiles within branch spread. Remove interfering branches without injury to trunks and cover scars with wound paint.

3.3 INITIAL SEQUENCE OF CONSTRUCTION ACTIVITIES AND PRELIMINARY DRAINAGE CONTROL

A. Prior to beginning grubbing and topsoil stripping operations, the Contractor shall perform the following sequence of construction operations to minimize erosion and siltation on the lower parts of the site.

1. Prior to grubbing or topsoil stripping, place all haybales, silt fence visual barrier, and catch basin filter fabric protection at the edge of the limits of work and in the location shown on the Drawings. Although installation of these measures can be phased according to the construction schedule, haybales, silt fence and visual barrier must be in place prior to any work in a specific location. During grubbing and topsoil operations, extend haybales and silt fence as necessary and maintain these until siltation sumps or other erosion control measures can be constructed. Provide all necessary erosion and siltation control measures to eliminate erosion or siltation from occurring beyond the limits of work.
2. Prior to any earthwork operations, install temporary siltation pumps, filtration dams and swales with check dams in the areas shown on the Drawings or as

otherwise approved by the Architect. Place inlet protection in any downstream catch basins that fall either within the limits of work or beyond the limits of work that will receive silts or sediments from construction operations. These measures may be installed in phases according to the Construction Schedule but must be completed prior to earthwork operations in the adjacent work area.

3. Should the work require it dewatering trenches, well points, or deep sumps will be required for pre-drainage of soils in areas where substantial work is to occur below the ground water level. These areas shall be excavated in-the-dry. Construct dewatering trenches, well points, or deep sumps in these areas. Begin immediate pumping of any water buildup in these dewatering trenches or sumps into siltation sumps or other erosion control devices approved by the Architect. During construction and during use of siltation sumps for dewatering, a 12-inch gravel filter shall be placed on the upstream side of the filtration dam. Care shall be taken to pump this water into the siltation sump in such a manner so that water laden with silt and debris will be properly filtered out through the filtration dam and so the gravel filter does not erode from pump water discharge. The gravel filter shall be replaced as necessary when it becomes clogged with silt and debris or does not permit free drainage of water through it to properly maintain its function of filtering out silt and debris. During dewatering, care shall be taken to prevent water from flowing back into the areas being pumped or into adjacent areas. It may be necessary to build a temporary dike around the edges of the siltation sump to prevent water from flowing back into adjacent areas.
4. Begin grubbing and topsoil stripping operations simultaneously with the excavation of the dewatering trenches or deep sumps. It is called to the attention of the Contractor that there are numerous locations within the limits of the work where flowing water will occur during periods of heavy rainfall and from normal rainfall that can be expected during the months that construction will occur. Temporary erosion and siltation control measures will have to be taken during construction to eliminate any erosion and siltation beyond the limits of the work until the permanent measures shown on the Drawings can be installed. All necessary measures shall be taken so this does not occur.
5. Do no grubbing, topsoil stripping or excavation operations in areas where substantial work is to occur below the water table until surface and subsurface water in this area will have drained and soils have reached a stable condition. Prior to beginning the above operations, arrange a meeting with the Architect or his designated representative to observe conditions in this area and discuss methods for proceeding the excavation operations.
6. Damaged or loose haybales and siltation fence shall be replaced as necessary to maintain their function of controlling erosion and siltation. Damaged or broken down check dams and filtration dams shall be replaced immediately. Catch basin filter fabric protection shall be replaced as necessary to maintain its function of controlling erosion and siltation.
7. Remove any accumulation of silt or soil buildup behind haybales, check dams and filtration dams, as it occurs. Remove accumulations of silt and soil buildup from the siltation sumps, and silt traps. Replace the gravel filter on the inside of the filtration dams when it becomes clogged with silt or does not permit free drainage of storm water through it, whichever occurs first. During freezing weather, ½" crushed stone may be used in lieu of gravel if approved by the Architect. Remove silt sacks under catch basin grates when they become clogged and replace with new ones.

8. Throughout excavation, filling and grading operations, in addition to drainage swales, check dams, siltation sumps, filtration dams and other items shown on the Drawings, the Contractor shall take other necessary precautions, including installation of temporary drainage swales, siltation sumps, filtration dams, check dams, haybales, siltation fence and temporary pipe to direct and control drainage from disturbed areas on the site so that erosion and siltation is minimal. In addition, no erosion or discharge of silt or larger particles shall occur onto adjacent properties.

B. If the Contractor anticipates deviations from the above procedures, he shall notify the Architect or his designated representatives as soon as possible. No substantial deviations from the above sequence of activities shall take place without the Architect's or his designated representative's approval.

C. The Contractor shall maintain these erosion control measures for the duration of this Contract or until they no longer function for their intended purpose, as determined by the Architect.

D. All silt and collected debris shall be removed from the sumps prior to backfilling of these areas.

3.4 GRUBBING

A. Limits of grubbing shall coincide with limits of clearing.

B. Remove completely all stones or surface boulders within the topsoil zone, and stumps, roots, matted roots and brush. Exposed boulders or other materials may be removed contiguous with stumps and matted roots. However, this shall be done in such a manner as not to remove topsoil in the same operation such as using a toothed blade to "rake" stones and stumps from topsoil.

C. Stumps and boulders shall be removed from the site and legally disposed of.

3.5 STRIPPING AND STOCKPILING TOPSOIL AND SUBSOIL

A. Prior to the start of General Excavation, strip all topsoil and subsoil from within areas to be regraded, as shown on the Drawings and stockpile where indicated on the Drawings or remove from the site and stockpile off-site if there is not adequate space in the location indicated on the Drawings. Do no stripping without clear understanding of the existing soil, planting and site conditions to be preserved and limits of existing topsoil stockpile and stripped areas.

B. All topsoil encountered during the stripping operations, regardless of depth, shall be removed and stockpiled on the site as shown on the Drawings or where directed by the Architect or removed from the site if the Contractor determines there is adequate topsoil to complete the work and after approval by the Architect. Areas having greater depths of topsoil than indicated on boring data sheets or reasonably anticipated shall be stripped of all such material and fill shall be used to bring such areas to the rough grade level. Stones over six inches and tree roots over two inches in any dimension shall be removed from loam before stockpiling. All other stripped soil that can be classified as fill as defined in Section 310000, EARTHWORK, shall be stockpiled for reuse in rough grading. This material shall be stripped separately from the topsoil. Topsoil and organic materials due to be stripped are as follows:

1. Building Structures, Roads, Parking Areas, and other site improvements except lawn areas – remove completely.
2. Future Lawn Areas –Topsoil shall be removed from adjacent proposed buildings, structures, site improvements, roads and parking areas a distance equal to the depth of fill plus three feet in the particular location, i.e. for a five-foot fill, topsoil shall be removed a minimum of eight feet away from the adjacent site improvements.

C. The Contractor shall so control his topsoil stripping operation so that it does not become contaminated with subsoil or other earth materials; the Contractor shall use machinery suitable for achieving this result.

D. Fill: The material directly below the topsoil indicated on the test pit logs as “fill” shall not be considered usable as Ordinary Fill as specified in Section 310000, EARTHWORK, or for topsoil. The only area where fill may be used is under lawn areas and pavement areas. This material shall be stripped separately from the topsoil and from the underlying earth materials. Fill shall be stripped as follows:
1. Building Structures and other site improvements except lawn areas – remove completely.
2. Future Lawn Areas, Sub-soil shall be removed from adjacent proposed buildings, structures, site improvements, roads and parking areas a distance equal to the depth of fill plus three feet in the particular location, i.e. for a five-foot fill, topsoil shall be removed a minimum of eight feet away from the adjacent site improvements.

E. All excess subsoil encountered in earthwork operations shall be removed from the site and legally disposed of. Topsoil shall be stockpiled as described hereinabove.

F. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

G. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. The Contractor is responsible for all construction, protection, movement and maintenance of stockpiles. Stockpiles shall be neatly trimmed and graded to provide proper drainage from their surfaces and maintained so as not to erode or pollute their surroundings.

H. The Contractor shall take reasonable care to avoid creating unsightly or unsafe conditions and to avoid unnecessary damage or injury to surroundings.

I. Do not stockpile topsoil within tree protection zones.

J. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

K. Topsoil which has been stripped and stockpiled but is not needed after the completion of all final topsoil and grassing shall be disposed of offsite. Prior to the disposal of any stockpiled excess topsoil offsite, the Contractor shall offer any excess topsoil to the Architect for their use.

3.6 RESTORATION OF SITE ITEMS

A. Wherever streets, lawns or other items within or outside the Contract Limit Lines have been damaged in fulfilling the work required under this Contract, the Contractor shall furnish and install all material at no cost to the Owner to bring finish surfaces level with the existing adjacent conditions. All work shall be installed to match the existing conditions. Notify the proper authorities, if required, prior to restoring surfaces outside the Contract Limit Lien to assure conformance to existing requirements.

3.7 REMOVAL OF EROSION CONTROL

A. At the time of acceptance of lawns by the Owner, Contractor shall remove all remaining erosion control devices such as silt fence, haybales, and visual barrier and legally dispose of them offsite.

3.8 DISPOSAL OF WASTE ITEMS

A. Removal from the Subject Property: Remove waste materials and unsuitable and excess topsoil and dispose of offsite in a legal manner. Waste materials shall include but not be limited to timber, brush, refuse, stumps, roots, vines, debris and other objectionable matter. All timber designated in the field by the Architect to not be disposed of by the Contractor shall be stored at a nearby location for ultimate disposal by the Architect.

B. Burning of cleared and grubbed materials, or other fires for any reason will not be permitted.

C. No rubbish or debris of any kind shall be buried on the site.

3.9 IDENTIFICATION OF TREES AND SHRUBS TO REMAIN

A. Prior to starting site clearing operations, stake out all areas of trees and shrubs to be saved as noted on the Contract Documents for approval by the Architect.

B. The Contractor shall be responsible for the protection of all existing trees and plants designated to remain for the length of the construction period, including liability for all damages as specified herein. The placement of protection devices additional to those specified shall, however, bet at the Contractor’s discretion and with no additional cost to the Architect.

3.10 REFERENCE POINTS

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. The Contractor shall conduct a benchmark survey throughout the Site to verify the accuracy of the benchmarks shown on the Drawings.

C. The Contractor shall install benchmarks prior to commencing work in areas, which will not be disturbed so at any time there is a benchmark within 250 feet of all portions of the work.

3.11 PROTECTION OF EXISTING UTILITIES

A. Protect existing site improvements from damage during construction.

B. Restore damaged improvements to their original condition, as acceptable to the Architect.

C. All areas disturbed through the removal and disposal of existing utilities and site improvements outside the limits of final grading shall be loamed and seeded or paved to match or exceed existing conditions.

D. The Contractor shall protect existing utility poles, overhead wires, and other electrical or communications elements within and adjacent to the property.

E. Any damage to these utilities or structures resulting from the construction operation shall be repaired to meet or exceed the existing condition at the Contractor's expense.

F. Any losses to the property or any other utility company resulting from the interruption of service from construction or blasting activity, both directly or indirectly, shall be the responsibility of the Contractor, and shall result in no additional cost to the Architect.

G. The Contractor shall make every effort to protect existing utilities including electrical and communications conduits and structures during construction. Any damage to utilities designated to remain shall be repaired immediately at the Contractor's expense.

End of Section

Section 31 23 19
DEWATERING AND DRAINAGE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. A dewatering plan shall be prepared by a licensed Rhode Island Professional Geotechnical Engineer and submitted for review. Submittal of plan does not constitute approval.

B. The objective of this Section is to remove standing water from excavations as needed to perform the work as specified and collect water which may enter the excavation during Contractor's excavation activity.

C. Contractor will obtain a RIPDES Permit and shall be responsible for collecting and analyzing the requisite water samples to meet the Permit requirements. Contractor is responsible for providing this information to the proper regulatory authorities in a manner consistent with the requirements of the Permit.

D. Contractor shall repair damage caused by dewatering and drainage system operations, at no additional cost to the Owner.

E. Obtain and pay for all permits required for temporary dewatering and drainage system.

F. Furnish, install, operate, monitor, maintain and remove temporary dewatering and drainage systems as necessary to lower and maintain groundwater levels below subgrades of excavations. Prevent surface water runoff from entering or accumulating in excavations.

G. Collect and properly dispose of all water from dewatering and drainage systems in accordance with local, State and Federal requirements and permits.

H. Remove temporary dewatering and drainage systems when no longer needed. Restore all disturbed areas.

1.4 RELATED WORK

A. Submittals are included in Section 01 33 00 – SUBMITTAL PROCEDURES.

B. Demolition procedures are included in Section 02 41 00 – SITE DEMOLITION.

C. Earth excavation and backfill are included in Section 31 00 00 – EARTHWORK.

1.5 SUBMITTALS

A. Shop Drawings for Information in accordance with Section 01 33 00 as part of the Work Plan:

1. For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

2. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.

3. Include a written report outlining control procedures to be adopted if problems arise with the proposed system.

4. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation with geotechnical expertise, retained by the Contractor.

5. Submittal will be for information only. The Contractor shall remain responsible for adequacy, safety, and compliance with appropriate local, state and federal regulations, of construction means, methods and techniques.

1.6 DEFINITIONS

A. Where the phrase “in-the-dry” is used in these specifications, it shall be defined as the in-situ soil moisture content, which will allow the excavated soils to be managed without the generation of free liquids.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the User Agency or others unless permitted in writing by the Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Groundwater is anticipated to be encountered throughout construction.

PART 2 - PRODUCTS (NOT SPECIFIED)

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall control surface water and groundwater such that excavation to final grade is made in-the-dry, and bearing soils are maintained undisturbed, Contractor shall prevent softening, or instability of, or disturbance to, the subgrade due to water seepage.

B. Contractor shall provide protection against flotation for all work.

C. The impact of anticipated subsurface soil/water conditions shall be considered when selecting methods of excavation and temporary dewatering and drainage systems. Type of dewatering system, spacing of dewatering units and other details of this work shall address site specific conditions.

D. Contractor shall take all necessary measures to prevent damage to adjacent structures, utilities, property(ies), and other features.

E. Contractor shall modify, redesign, and/or replace the dewatering system at no additional cost to the Owner, if design criteria are not continuously and effectively fulfilled.

F. Contractor shall repair damage to adjacent structures, utilities, and properties resulting from the operation of the Contractor's dewatering and treatment system, at no additional cost to the Owner.

G. Contractor shall locate dewatering facilities where they will not interfere with utilities, the safe passage of traveled ways, or other work to be done on the Site under the Specifications.

H. Contractor shall take all necessary precautions during dewatering activities to prevent adverse effects on the Site and on adjacent properties.

3.2 SURFACE WATER CONTROL

A. Contractor shall control surface water runoff to prevent flow into excavations, and shall provide temporary measures such as dikes, ditches and sumps.

3.3 EXCAVATION DEWATERING

A. Contractor shall provide and maintain adequate equipment and facilities to remove promptly and dispose of properly all water entering excavations. Contractor shall keep excavations in-the-dry, so as to maintain an undisturbed sub grade condition throughout construction below grade, including backfill and fill placement.

B. Contractor shall collect precipitation or surface runoff in shallow ditches around the perimeter of the excavation, drain to sump and pump from the excavation to maintain in-the-dry conditions.

C. Dewatering and drainage operations shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the sub grade at the bottom of the excavation. If the sub grade becomes disturbed for any reason, the unsuitable sub grade material shall be removed and replaced with concrete, compacted granular fill, or other approved material to restore the bearing capacity of the subgrade to its original undisturbed condition.

D. Dewatering and drainage operations shall be conducted in a manner that does not cause loss of ground or disturbance to the pipe bedding or soil that supports overlying or adjacent structures.

3.4 DISPOSAL OF DRAINAGE

A. All water collected in temporary drainage systems will be collected in the dewatering system and disposed of in the same manner as the dewatered groundwater.

B. The Contractor shall be responsible to ensure that such discharge is in compliance with the RIPDES Program. If discharge is conducted in accordance with a Pretreatment Permit, Contractor is responsible for completing applicable laboratory analysis and maintaining compliance with all permit conditions. Contractor is also

responsible for all consequences of non-compliance and/or permit violations. If discharge is completed through off-site disposal, the Contractor is responsible for completing all necessary laboratory analysis to ensure material is within the permit requirements of the accepting facility.

3.5 DISPOSAL OF INCIDENTAL SEDIMENT

A. Other than the collected solids from filtration, any sediment, solids, sludge or soil which accumulates as a result of the dewatering operation, either within the dewatering equipment or external to it, shall be removed from the equipment and the Site and disposed of at no additional cost to the Owner.

End of Section

Section 31 25 00
EROSION CONRTOL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. This Section specifies requirements for control of erosion from the Limits Work onto adjacent down gradient areas as shown on the Drawings, as specified herein for applicable construction activities.

B. Furnish and install hay bales, silt fence, swales, soil berms, mulches, grasses, channels, crushed stone, rip-rap, grading to control runoff, dewatering filter basins, and all other devices required to control erosion. Continually maintain all erosion control devices within the limits of the contract areas. Remove and clean up of all erosion control devices within the limits of the contract areas.

C. RELATED WORK: The following items are not included in this Section and will be performed under the designated Sections.

1. Section 31 00 00, “Earthwork” for excavation, backfilling and compaction requirements
2. Section 33 40 00, “Storm Drainage Systems” for installation of Storm Drainage System

1.3 APPLICABLE REGULATIONS

A. In order to prevent erosion and sedimentation from construction activities related to the performance of this project, the Contractor and his subcontractors shall comply with permits issued for the project, all applicable federal, state and local laws and regulations concerning erosion and sediment control, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

1. Rhode Island Soil Erosion and Sediment Control Handbook, latest revision

1.4 QUALITY ASSURANCE

A. The Contractor shall install and maintain sedimentation control devices during construction as specified and as required by the RIPDES Permit to prevent the movement of sediment from the construction site to off site areas via surface runoff or underground drainage systems. Measures in addition to those indicated to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.

1.5 DESIGN CRITERIA

A. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.

B. Stabilize disturbed earth surfaces in the shortest practical time and employ any and all such temporary erosion control devices as may be necessary until such time as that adequate soil stabilization has been achieved or permanent erosion control devices are operational.

C. The erosion control devices specified herein represent the minimum required work for erosion control. The Contractor shall add to these minimum devices any and all measures to effectively prevent migration of sediment from the limits of the work area.

D. Within this section, the Rhode Island Soil Erosion and Sediment Control Handbook revised 2014 shall be the standard source for all erosion and sedimentation control procedures.

E. Within this Section, the Rhode Island Soil Erosion and Sediment Control Handbook and the RIPDES guidelines shall be the standard source for all erosion and sedimentation control procedures.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 – SUBMITTALS for submittal provisions and procedures.

B. At least 5 days prior to the start of any other construction, the Contractor will review the installed erosion controls with the Architect.

C. At least 5 days prior to intended use, the Contractor shall provide the following samples and/or submittals for approval. Do not order materials until the Architect's approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples.

1. Silt Fence: Submit manufacturer's material specification and installation instructions.
2. Inlet Protection.
3. Mulch Material: Submit one Cubic Foot Sample.
4. Mesh of Matting: Submit One square foot sample and manufacturer's technical description and installation instructions.

D. Implementation Plan

Prior to commencement of the work, the Contractor shall:

1. Meet with the Architect to develop mutual understandings relative to compliance with the provisions of this Section.
2. Install all erosion control measures as specified on the Drawings.
3. Should the Contractor desire to change or modify the specified erosion controls then he shall submit in writing his plans to the Architect for implementing erosion and sediment control including, but not limited to, placement of hay bales, silt fence, containment berms, temporary channels, settling ponds, and dewatering filter basins, as well as a description of all construction techniques intended to minimize erosion and sedimentation, and a program for maintenance of these facilities throughout the performance of construction activities.
4. The Contractor shall submit design and sizes of all dewatering filter basins.

PART 2 - MATERIALS

2.1 HAY BALES

A. Bales shall be made of straw or hay with 50 pounds minimum weight and shall be bound with no less than two strings or wires and contain as a minimum five (5) cubic feet of material. Bales shall be anchored by two 1-inch by 1-inch wooden oak stakes that are three (3) feet long. As an alternate, No. 4 size steel reinforcing bars may be used with rubber safety tops.

2.2 SILT FENCE

A. Silt fences or sedimentation barriers shall consist of wood posts with industrial support netting and sediment control filter fabric attached.

B. Wood posts shall be a minimum of 36 inches long hardwood stakes commonly used to support filter fabric. Posts shall have a minimum cross sectional area of three (3) square inches. Steel posts shall be standard T and U section weighing not less than one (1) pound per linear foot. Posts shall be set at a maximum distance of 8 feet on center.

C. Wire fence (for fabricated units): Wi

Minimum Acceptance

Fabric Properties	**Value**	**Test Method**
Grab Tensile Strength (lbs)	90	ASTM D1682
Elongation of Failure (%)	50	ASTM D1682
Mullen Burst Strength (PSI)	190	ASTM D3786
Puncture Strength (lbs)	40	ASTM D751 (Modified)
Slurry Flow Rate (gal/min/sf)	0.3	
Equivalent Opening Size (sieve)	40-80	US Std Sieve CW-02215
Ultraviolet Radiation Stability (%)	90	ASTM G-26

E. Control fabric should be at least 3 feet wide.

2.3 CATCH BASIN INSERTS

A. Siltsack®, Basin bag, Ultra-BasinGuard or equal shall be manufactured from a specially designed woven polypropylene geotextile. The insert will be manufactured to fit the opening of the catch basin or drop inlet.

2.4 FILTER SOCKS

A. Filter Socks are biodegradable sediment-trapping devices. Manufacturers include SiltSoxx, Corr Logs, Straw Wattles, or equivalent.

2.5 STONE STABILIZATION PAD

A. Material as shown on Drawings to ensure no offsite tracking of soil.

2.6 WATER

A. Water used for dust control and equipment washes shall be clean and free of salt, oil, and other injurious materials. Water is not available on site. The Contractor shall provide all necessary water.

PART 3 - EXECUTION

3.1 GENERAL EROSION CONTROL REQUIREMENTS

A. All materials and installation shall be in accordance with the Drawings.

B. Means of protection as noted on the Drawings indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as needed for continued or unforeseen erosion problems, at no additional expense to the Owner.

C. The Architect has the authority to control the surface area exposed by construction operations and to direct the Contractor to immediately provide permanent or temporary erosion control measures to prevent contamination of adjacent streams, watercourses, lakes, ponds or other areas of water impoundment. Every effort shall be made by the Contractor to prevent erosion on the site and abutting property.

D. All slopes shall be stabilized by mulching, seeding or otherwise protected as the work progresses to comply with the intent of this specification. All damaged slopes shall be repaired as soon as possible. The Architect shall limit the surface area of earth material exposed if the Contractor fails to sufficiently protect the slopes to prevent pollution.

E. The Contractor shall at all times have on hand the necessary materials and equipment to provide for early slope stabilization and corrective measures to damaged slopes.

F. The Contractor shall continually maintain all erosion control devices within the contract work limit and shall remove such devices upon completion of the Work and surface stabilization, or if ordered by the Architect.

G. The Contractor shall operate all equipment and perform all construction operations so as to minimize pollution. The Contractor shall cease any of his operations, which will increase pollution during rainstorms.

H. The Contractor shall place additional erosion and sedimentation controls in accordance with by laws and regulations.

I. After any significant rainfall (more than 1 inch of rainfall in a 24 hour period), sediment control structure shall be inspected for integrity. Any damaged devices shall be corrected immediately.

3.2 HAY BALE INSTALLATION

A. Bales shall be set lengthwise on the contour for sheet flow applications. They shall be held in place by two wooden stakes in each bale as detailed on the Drawings. Bales shall be maintained or replaced until they are no longer necessary for the purpose intended or are ordered removed by the Architect.

B. Bales shall be set with bindings parallel to grade and entrenched to a depth of 4 to 6 inches. Stakes shall be three (3) feet long, driven into the ground and cut off flush with the top of the bale.

C. After the bale lines are staked, the end joints shall be chinked with loose straw to close any gaps. Excavated soil shall then be backfilled against the uphill side of the barrier to a depth of 4 inches above the downhill grade.

D. Inspection shall be immediately after each rainfall or daily during periods of prolonged rainfall and repair or replacement shall be made as needed.

E. Following compaction of the backfill, loose straw shall be scattered over the surface directly behind the barrier.

F. Hay bale checks should be placed in diversions generally at 50-foot intervals and in accordance with the detail on the Drawings. Sediment shall be removed from behind the checks when it has accumulated to one half the original height of the dam measured at the low point.

3.3 SILT FENCE INSTALLATION

A. Silt fence shall be installed utilizing posts 3 feet long minimum staked at least 8’ on center. Prior to installation, a 6-inch by 8-inch deep anchor trench shall be installed at the base of the fence and the final height will be at minimum 2 feet.

B. Inspect siltation fence periodically and remove accumulated sediment.

3.4 DIVERSIONS

A. Diversions for directing surface runoff away from and/or around trenching and other construction operations shall be installed and stabilized in advance of new work. The Contractor shall select the cross-sectional shape (parabolic, v shaped or trapezoidal) of diversions and shall have proper equipment available on-site for maintenance of the diversions.

B. The minimum capacity of the diversion shall be sized to accommodate a 10 year, 24-hour design storm not less than 0.3 feet.

C. Periodic cleaning shall be done to maintain capacity.

3.5 DEWATERING DISCHARGES

A. All pumped discharges and surface water flow from work areas shall be passed through a filter barrier of hay bales and silt fence combination or dewatering bags before being discharged into gutters, ditches, drainage swales, storm sewer systems, wetlands, natural water bodies, streams, or rivers. The method of all such discharges shall be subject to the approval of the Architect.

B. The Contractor shall design and size all dewatering discharge basins such that the discharge from the basins is free of silt and debris to the satisfaction of the Architect and all applicable regulatory agencies.

3.6 CATCH BASIN INSERTS

A. Installation of inserts shall be prior to any upstream soil disturbance.

B. Inserts shall be inspected after each rain event and at a minimum every two weeks.

C. Debris and silt shall be cleaned on a regular basis.

3.7 REMOVAL AND CLEAN-UP

A. All temporary erosion control facilities and accumulated sediments shall be removed and legally disposed in a neat and workmanlike manner when all disturbed areas have been satisfactorily stabilized.

End of Section

Section 32 00 00

BITUMINOUS CONCRETE PAVEMENT, CURBING AND EDGING

PART 1 - GENERAL

1.1 Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 WORK TO BE PERFORMED

A. Work under this section includes installation of bituminous concrete pavements, curbing and pavement markings for roadways and parking areas as shown on the Drawings. All existing pavement to remain, but damaged, as a result of the construction operations, shall be restored in accordance with the requirements of this Section. Trench fills for trench excavations through roadways shall consist of general pavement structures according to this Section.

B. The Contractor shall install all pavement and drives, which have been removed or damaged during construction operations. Pavement shall include satisfactory repair by the Contractor of driveways and any other surface disturbed by his/her operations by the same materials as removed or as specified herein. Driveway aprons shall be part of the work.

C. Items to be Installed:

1. Concrete Curbing
2. Granite Curbing
3. Pavement Markings
4. Bituminous concrete curbs
5. Paving

D. Related Work:

1. Section 03 30 00 – CAST-IN-PLACE CONCRETE
2. Section 31 00 00 – EARTHWORK
3. Section 31 23 19 – DEWATERING AND DRAINAGE
4. Section 32 17 23 – PAVEMENT MARKINGS

1.3 REFERENCES

A. All work specified in this Section shall conform to the RI Department of Transportation Standard Specifications for Highway and Bridges latest revision, herein referred to as "State Standards".

B. American Society of Testing and Materials (ASTM) (latest edition):

1. C 33 Specification for Concrete Aggregates.
2. C 136 Method for Sieve Analysis for Fine and Coarse Aggregate.
3. C 140 Sampling and Testing Concrete Masonry Units.
4. C 144 Standard Specifications for Aggregate for Masonry Mortar.
5. C 936 Specifications for Solid Interlocking Concrete Paving Units.

6. C 979 Specification for Pigments for Integrally Colored Concrete.
7. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
8. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.
9. D 2940 Graded Aggregate Material for Bases and Subbases for Highways or Airports.
10. C 29 Bulk Density and Voids in Aggregate Materials.

1.4 PRODUCT HANDLING

A. Use all means necessary to protect bituminous concrete pavement materials before, ongoing, and after installation, and to protect the installed work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary as directed by the Architect.

1.5 SUBMITTALS

A. The Contractor shall submit to the Architect, data showing gradation and composition of materials proposed.

B. The bituminous concrete mix formula must be submitted to the Architect prior to the initiation of paving operations.

1.6 QUALITY CONTROL

A. For actual finishing of bituminous concrete surfaces and operation of the required equipment, use only personnel who are thoroughly trained and experienced in the skills required and whose prime occupation is this type of work.

B. Existing paved areas damaged or removed shall be repaired or replaced, respectively, with the same materials and level of quality as on the Project.

1.7 GUARANTEE / WARRANTY

A. Material Guaranty: Before any contract is awarded, the Bidder may be required to furnish without expense to the Architect complete statement of the origin, composition and manufacture of any or all materials proposed to be used in the construction of the work, together with samples, which may be subjected to the tests required by the Architect to determine the quality and fitness of the material.

PART 2 - MATERIALS

2.1 MATERIALS

A. Subgrade base course material shall conform to the applicable subsections of Section 310000, Earthwork of this Specification.

B. Bituminous Concrete Pavement shall conform to the applicable subsections of Section 460, Class I Bituminous Concrete Pavement, Type 1 of the “Standard Specifications.”

2.2 PAVEMENT BASE

A. Processed Gravel as specified in Section 31 00 00, EARTHWORK.

2.3 PAVEMENT SUB-BASE

A. Processed Gravel as specified in Section 31 00 00, EARTHWORK.

2.4 SUBGRADE

A. Reuse on-site material or imported material as specified in Section 31 00 00, EARTHWORK.

2.5 CONCRETE CURBING

A. All curbing shall be placed so that areas behind curbs shall be graded smooth, and topsoil and seed shall be placed.

B. Concrete curbs shall be in accordance with the State Standards.

C. Concrete curb inlets shall conform with the State Standards.

2.6 GRANITE CURBING

A. All curbing shall be placed so that areas behind curbs shall be graded smooth, and topsoil and seed shall be placed.

B. Granite curbs shall be in accordance with the State Standards.

C. Granite curb inlets shall conform to with the State Standards.

2.7 BITUMINOUS BERM / CURB

A. Bituminous berm shall be Class I Bituminous Concrete, Type I-1 in accordance with the State Standards.

PART 3 - EXECUTION (Not Used)

3.1 GENERAL REQUIREMENTS

A. Contractor Requirements:

1. The Contractor shall perform and complete the Work within the limits indicated in a continuous manner so that the pavement placement work may proceed without delay.

2. The Contractor shall, at all times, prior to acceptance of the work by the Architect, maintain the completed work in a safe and satisfactory condition. All maintenance and repairs to the completed work shall be subject to the approval of the Architect and the controlling municipal and State authorities. All maintenance and repairs of the completed work shall be provided by the Contractor at no additional cost to the Architect.

3. Equipment used in the work will be subject to approval by the Architect and shall be maintained in a satisfactory condition at all times. Unless otherwise permitted, compaction shall be performed by use of suitable power rollers. Finished surfaces of new asphaltic surface courses shall finish even with adjacent existing pavement surfaces and be free from surface irregularities.

4. It shall be the responsibility of the Contractor to obtain from the controlling municipal authorities all required permits for cutting roadway pavements and to perform the work in accordance with all customs and requirements of the controlling authorities, in addition to those specified herein, and at no additional expense to the Architect.

5. Existing pavements outside of the indicated work limits which are damaged as a result of the Contractor's operations, including base courses, bituminous tack coats and surface courses, shall be replaced by the Contractor in accordance with the requirements specified herein for the respective type of pavement; in a satisfactory manner and at no additional cost to the Architect.

6. In case of settlement or other defects in new or replaced pavements, the Contractor shall cut out, replace, restore, or repair the damaged pavements at no additional expense to the Owner. This requirement shall remain in effect for 2 years after the acceptance of the work by the Architect. The pavement area to be replaced, repaired, or restored, shall extend from edge of pavement to edge of pavement, a minimum of 20 feet on either side of the defect; final pavement course shall be feathered to provide a smooth finish detail.

7. This Contract shall not be considered complete until the replacement, restoration and repair of pavements has been provided in a manner satisfactory to the Architect, and in accordance with the requirements specified herein.

8. Cement concrete used for granite curb installation shall be installed in such a manner that allows for the full required planting bed depth to be installed above in accordance with Section 32 93 00.

B. All materials and each part of detail of the work shall be subject to inspection by the Architect. The Architect shall be allowed access to all parts of the Work and shall be furnished with such information and assistance by the contractor as is required to make a complete and detailed inspection, (such assistance may include furnishing labor, tools, and equipment, at no expense to the Architect.)

C. If the Architect so requests, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the Work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering or the removing and the replacing of the covering or making good of the parts removed, will be at the Contractor's expense.

D. Any work done or materials used without authorization by the Architect may be ordered removed and replaced at the Contractor's expense. The Contractor shall furnish written information to the Architect stating the original sources of supply of all materials manufactured away from the actual site of the work. In order to ensure a proper time sequence for required inspection and approval this information shall be furnished at least two weeks in advance of the incorporation in the work of any such materials.

E. For the purpose of observing work that affects their respective properties, inspectors for the municipalities, public agencies and the utility companies shall be permitted access to the work, but all official orders and directives to the Contractor will be issued by the Architect.

F. The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill the terms of the Contract a herein prescribed by the plans and specifications.

G. Failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor obligate the Architect to make final acceptance.

H. The Contractor shall give prior notice to the Architect when work on the various items is to be performed by him or his Subcontractors. If work is suspended on any item, prior notice shall be given to the Architect before resumption of such work.

3.2 SUBGRADE PREPARATION

A. Prepare subgrade by shaping and compacting to proper grade. Remove all soft and yielding material from the subgrade and replace with suitable material. Compact thoroughly using approved types of rollers or tampers. Ensure that all areas are stable and dry.

B. Saw cut edges of existing pavement along even lines to obtain undisturbed, clean and sound vertical edges of original pavement.

C. Do not store or stockpile materials on the subgrade.

3.3 PAVEMENT

A. The subbase to be placed under pavement (at least 8 inches at on-site access and parking areas and 12 inches at city or state owned roadways) shall consist of processed gravel as specified in Section 31 00 00, Earthwork, evenly spread and thoroughly compacted.

1. Compaction of the subbase shall be in accordance with Section 31 00 00 Earthwork
2. All thicknesses are measured after rolling. The permanent surface course shall be evenly spread and rolled with a power roller having a minimum weight of 5 tons.

3.4 COMPACTION

A. The Contractor shall conform to the State Standards for pavement operations, including compaction.

B. Immediately after the bituminous mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture is in the proper condition and when rolling does not cause undue displacement, cracking and shoving.

C. The number, weight and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. Rolling shall be continued until all roller marks are eliminated and the minimum densities have been obtained based upon 95 percent of laboratory Marshall Densities made in the proportions of the job-mix formula, AASHTO T-245.

D. Steel-Tired, Static Weight Rollers: The maximum roller speeds for steel-tired static-weight rollers for various operations shall not exceed three miles per hour. The wheels of steel-wheel rollers shall be kept moist and clean to prevent adhesion of the fresh material, but an excess of water will not be permitted.

E. Vibratory Rollers: The maximum roller speed for vibratory rollers shall be that which provides impact spacing less than the compacted lift thickness. When vibratory rollers are used in the static mode, roller speed shall not exceed three miles per hour.

1. When an approved vibratory roller is used for breakdown rolling in a vibratory mode, intermediate rolling will not be required. When the vibratory roller is used for finish rolling it shall be used in the static mode. Rolling shall progress continuously until the specified density of the corresponding daily plant Marshall Density, AASHTO T-245 has been attained. Finish rolling shall continue until all roller marks are eliminated.

F. Unless otherwise directed, rolling shall start longitudinally at the sides and gradually progress toward the center of the pavement.

G. The motion of the rollers shall be slow enough at all times to avoid displacement of the hot mixture. Any displacement resulting from reversing the direction of the rollers or from any other cause shall be satisfactorily corrected.

H. When the base course or binder course fails to comply with the density requirements herein specified, additional compaction may be applied when permitted and as directed, to attain the required density. If satisfactory density

cannot be attained the Contractor shall be required to remove and replace, at his own expense, any affected area, which is proven to be structurally inadequate and/or incapable of maintaining material integrity.

I. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be removed and replaced with fresh hot mixture, which shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of bituminous material shall be removed and replaced.

J. In the event of dispute as to the creditability of the results, density shall be determined from cores taken from the pavement.

3.5 FIELD QUALITY CONTROL

A. Thickness: Test in-place asphalt concrete courses for compliance with requirements for thickness. Repair or remove and replace unacceptable paving as directed by the Architect. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness.

B. Compaction:

1. The Bituminous mixture shall be compacted to at least 95% of the density achieved on the laboratory testing of the design mix for the project.
2. Density will be checked by the Nuclear Density gage Method, ASTM 2950.

C. Guarantee: During the two-year guarantee period, the Contractor shall maintain the surfacing and shall promptly fill with similar material in compliance with the above specifications, any depressions and hold that may occur so as to keep the surfacing in a safe and satisfactory condition for traffic.

End of Section

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Section 32 12 17
ASPHALT FOR COURTS AND TRACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following sections contain requirements that relate to this section.
1. Section 03 30 00 – Cast in Place Concrete
2. Section 31 00 00 – Earthwork
3. Section 32 13 13 – Concrete Paving
4. Section 32 18 24 – Textured Acrylic Color Surfacing
5. Section 32 18 25 – Synthetic Track Surface
6. See Item 1.8 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings or as specified herein.
1. Crushed Stone Base
2. Hot Mix Asphalt courses

B. **This item may be affected by Add Alternates – refer to Plans for further information.**

1.3 PROTECTION

A. Entire courts and track areas shall be protected from damage until accepted. All damaged items shall be removed and replaced. Refinishing or replacement of pavement may be required after being reviewed with Owner's Representative. All remediation work shall be done at no additional expense to the Owner.

1.4 SUBMITTALS

A. Submit product data for all pre-manufactured material.

B. Asphalt Mix Design

C. All intermittent testing required by this speciation for planarity, survey and compaction.

D. Gravel base submittal sieves and physical samples required.

E. All submittals must be prior to fabrication and or field installation work.

F. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application. The installer shall be an authorized applicator of the specified system.

G. Project References: Submit manufacturer's list of successfully completed asphalt basketball court surface color coating system projects, including project name, location, and date of application.

H. Applicator's Project References: Submit applicator's list of successfully completed asphalt track or tennis court system projects, including project name, location. Reference of at least 5 projects of similar scope done in each of the past 3 years.

I. Surfacing shall conform to the guidelines of the ASBA for planarity.

J. All surface coatings products shall be supplied by a single manufacturer.

K. The contractor shall provide the inspector, upon request, an estimate of the volume of each product to be used on the site.

1.5 INTRODUCTION

A. The extremely strict tolerances for gradients and flatness, which are stipulated by the Sport Federations or Associations for the synthetic surfaces, mean that the construction of an adequate base is of supreme importance. Tolerances are required to be met not only by the newly completed facility, but also over its life, which might be two or three times the expected life of the synthetic surface

B. The finished appearance of any resilient synthetic surface will be determined in part by the base over which it is installed. Rough, uneven bases, of substandard construction, with non-recommended materials, can reduce the life and impair the appearance of the synthetic surface. Therefore, proper construction and preparation utilizing recommended materials are important for a durable, good quality flooring installation.

C. The base should be designed to meet the following criteria:
1. It should be capable of supporting and transmitting to the existing ground the loads of all vehicles, machines and materials to be used in the construction, without causing deformation of the site, or exceeding the ground-bearing capacity;
2. It should be capable of supporting and transmitting all the loads on the synthetic surface from athletes and maintenance equipment, without permanent deformation of the base;
3. It should be sufficiently flexible to provide protection to the synthetic surface from the effects of sub-soil movement and frost heave;
4. It should be sufficiently impermeable to provide total protection to the synthetic surface from ground
5. It should ensure that the above criteria are maintained throughout the life of the installation.

1.6 PROCEDURES

A. A comprehensive Geotechnical investigation should be carried out to accurately determine the sub-soil conditions: it is important to ascertain the strata at depths down to approx. 8 feet (2.5m).

B. Excavation to remove vegetable matter, soil, loose or frost susceptible material down to firm, load-bearing sub-soil.

C. An adequate sub-drain system shall be provided since adequate surface and subsurface drainage is essential for a stable base.

D. Compaction of the sub-soil, graded to falls within the tolerances specified for accuracy of finished level.

E. Laying and compacting of ordinary fill to create the sub-base layer (the minimum thickness of the layer to be determined based on the Geotechnical characteristics of the sub-soil and on the expected loads), graded to fall within the tolerances specified for accuracy of finished level and thickness.

F. Laying and compacting of 4” (10 cm) thick crushed stone to create the base under layer,

graded to falls within the tolerances specified for accuracy of finished level, straightness and thickness.

G. Laying and compacting of minimum 3" (10 cm) thick hot mix asphalt pavement in two layers. The bottom layer, Asphalt Binder Course, shall be a minimum of 1.5" (40 mm) thick, graded to falls and checked for accuracy of finished level, straightness and thickness within the tolerances specified. A Tack Coat is applied just prior to placing subsequent pavement layers. The top layer, Asphalt Top Coat, shall be a minimum of 1.5" (40mm) thick, graded to falls and checked for accuracy of finished level, straightness and thickness within the tolerances specified.

1.7 Typical construction cross-section (See Landscape Athletic Details for typical Athletic Pavement Cross Section

1.8 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."
1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section "Substitution Procedures" for NE-CHPS substitution procedures.
2. Division 01 Section "Submittal Procedures" for NE-CHPS submittal requirements.
3. Division 01 Section "Construction Controls and Temporary Facilities" for requirements for temporary facilities.
4. Division 01 Section "Product Requirements" for additional NE-CHPS submittal requirements.
5. Division 01 Section "Construction Waste Management and Disposal" for waste management, recycling and disposal.
6. Division 01 Section "Sustainable Design Requirements" for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section "Construction Indoor Air Quality (IAQ) Management Plan" for material and procedure requirements.

PART 2- PRODUCTS

2.1 ORDINARY FILL

A. Ordinary Fill shall be natural soil, well graded and free from all organic or other weak or compressible materials and of any frozen materials. Fill shall contain no stone larger than 4'' (10 cm) in any dimensions.

B. It shall be of such nature and character that it can be dried and compacted in a reasonable length of time which shall not unduly interfere with the progress of construction.

C. It shall be free of all expansive materials such as highly plastic clays, of all materials subject to decay, decomposition or dissolution and of cinders or other unsuitable material.

D. It shall have a maximum dry density of not less than 115 pounds per cubic foot as determined by ASTM D1557, Method D.

2.2 CRUSHED STONE BASE

A. Crushed Stone Base Course: Provide clean, washed, crushed stone base course material conforming to ASTM C 33 and gradation requirements of AASHTO No. 67 as per below.

AASHTO No. 67	
Sieve Size	**Percent Passing**
1 in (25 mm)	100
¾" (19mm)	90 to 100
3/8 in (9.5 mm)	20 to 55
No. 4 (4.75 mm)	0 to 10
No. 8 (2.36 mm)	0 to 5

2.3 HOT MIX ASPHALT

A. Hot mix asphalt for surface courses shall consist of coarse and fine aggregates and mineral filler plant-mixed with bitumen binder.

B. All hot mix asphalt shall be in accordance with applicable provisions of State or Provincial Department of Transportation "Standard Specifications for Road and Bridge Construction", except as herein modified.

C. The hot mix asphalt shall be plant-mixed and the bituminous material for mixture shall be AC-1, 85 - 100 penetration grade. The asphaltic cement (AC-1) content shall be 4.0 % - 6.0% (by weight) of the total composite mixture.

D. Coarse aggregate (material retained on the 4.75mm sieve) shall be sound, angular crushed stone or gravel (shale is not approved for use).

E. Fine aggregate (material passing the 4.75mm sieve and retained on the # 200 (0.075mm) sieve) shall be sand, stone sand and stone screening Class B quality or better and gradation FA - 3.

F. Mineral filler (Material passing the # 200 (0.075mm) sieve) shall be dry limestone or dust.

G. The aggregate shall have the following maximum limits of detrimental substances:
1. Soft fragments, AASHO T189: 2.00%
2. Coal and lignite, AASHO T113: 0.25%
3. Clay lumps, GHD 1: 0.25%
4. Flat or elongated pieces (length greater than five times average thickness): 10.00%
5. Sulfur content computed as sulfide sulfur, ASTM E30: 0.01%
6. Other local detrimental Substances: 2.00%

H. The gradation of the composite aggregate for the Asphalt Binder Course shall conform to or near the following:

Sieve	Total % Passing	
3/4"	100	
1/2''	90 - 100	
3/8"	80	
#4	45 - 70	
#8	25 - 55	
# 30		(19)
# 50	5 - 20	(12)

# 100	5 - 16	(6.5)

Note: The aggregate grain should be as close as possible to the figures in brackets to give maximum density to the asphalt mixture.

I. The gradation of the composite aggregate for the Asphalt Top Coat shall conform to or near the following:

	Sieve	Total	% Passing
	½"		100
	3/8"	90-100	(100)
#	4	60-90	(70)
#	8	35-65	(49)
#	30		(22)
#	50	6 -25	(14)
#	100		(8)
#	200	2 -10	(3)

Note: The aggregate grain should be as close as possible to the figures in brackets to give maximum density to the asphalt mixture. A majority of the minus 200 material should consist of mineral filler.

The increase in the amount of mineral filler has, in many instances, increased the toughness of the asphalt. This can be accomplished by using a resultant mineral aggregate having a minus 200 content of about 7% - 8%.

J. The asphalt "Binder Course" and "Top Coat" mixtures are the type IV mixes recommended by the Asphalt Institute. Asphaltic concrete mixtures may differ from the above provided specifications, meet or exceed the present specifications. Athletic Surfacing installer/vendor must be informed about proposed changes/deviations to the present specifications and provide written approval.
Determination of the job mix formula shall be based on attaining a mix having a Marshall Stability (ASTM D1559, 75 blows each Side) of 750 lbs. or greater.

K. Samples of the job mix from the asphalt plant shall be laboratory tested for Marshall Stability. A compacted specimen shall be retained for density (ASTM D2726) comparison with core samples from the installed pavement.

2.4 PRIME COATS AND TACK COATS

A. The primer for application on crushed stone base under layers (prime coat) shall be MC-1.

B. The primer for application on asphalt surfaces (tack coat) shall be RC-1.

PART 3- EXECUTION

3.1 SUB-GRADE

A. The excavation levels should be determined to allow paving, pits, etc. to rest on firm, load bearing, undisturbed sub-soil, also capable of properly supporting the paving equipment and haul trucks.

B. The sub-soil shall be excavated and compacted to a surface parallel to the theoretical finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layers.

C. The excavation shall proceed in such a manner that disturbance of soils below the excavation level by equipment is avoided.

D. Surface shape of the sub-grade shall be such that water cannot accumulate at any point. If this is not possible, it is important to provide all necessary equipment, including automatically operated pumps and piping to run-off facilities, to maintain the excavations, pits, depressions free from accumulated water during the entire period of construction.

E. Excavation may encounter soft, non-bearing soils below the excavation level over some of the area. When the nature at the soil is such that appropriate load bearing cannot be achieved at the excavation levels originally designed, additional excavation to good bearing is necessary. The non-bearing material will be replaced with suitable ordinary fill as will permit rough grades to be as specified.

F. When encountered in the work and indicated on the drawings, all existing active sewer, water, gas, electric, steam, irrigation and other utility services and structures shall be protected at all times and, if required for the proper execution of the work, shall be relocated.

G. The sub-soil shall be rolled and compacted by a roller to a minimum density at ninety-five percent (95 %) as determined by the Modified Proctor Test (AASHO T99).

H. Should a section of the work be not acceptable on the basis of inadequate compaction, further compaction effort shall be applied until the specified standard is achieved.

I. If the moisture content varies outside the specified limits, add water or allow drying as necessary; before commencing rolling mix mechanically for a minimum depth of mm 300 to ensure uniform distribution of moisture.

J. Surface shape of the sub-grade shall comply with the tolerances itemized in the following table:

ITEM	CHARACTERISTIC	TOLERANCE
Sub-grade	Level	+7mm / -7mm
	Thickness	Unspecified

K. Should a section of the work be not acceptable on the basis of level, high areas shall be graded off, low areas shall be corrected by adding and compacting material similar to that already in place.

L. If the sub-grade has dried and becomes loose and dusty due to construction traffic, it should be watered, lightly bladed and rolled prior to placement of the sub-base layer.

M. The placement of the sub-base layer shall not be commenced until the sub-grade has been approved following inspection and/or testing.

3.2 SUB-BASE AND CRUSHED STONE BASE

A. Each layer of the pavement shall be completed to a surface parallel to the theoretical finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layers.

B. Surface shape of each layer shall be such that water cannot accumulate at any point. If this is not possible, it is important to provide all necessary equipment, including automatically operated pumps and piping to run-off facilities, to maintain the excavations, pits, depressions free from accumulated water during the entire period of construction.

C. All fill material and crushed stone shall be spread evenly by direct tipping from suitable vehicles or by the use of a mechanical spreader above the approved sub-grade. Care should be taken to avoid segregation of granular material during tipping and spreading.

D. Layers of pavement material shall be not less than 3" (10 cm) in compacted thickness. Maximum layer thickness shall be limited to that which will allow compaction to specified densities by the equipment in use.

E. Ordinary fill material and crushed stone, when delivered, shall have a moisture content within +/- 2% of the modified optimum moisture content. During compaction moisture content shall be maintained in the correct range. If the fill material or crushed stone does not contain the proper moisture content for compaction, it shall be wetted or dried as required before rolling. Water spraying equipment used for this purpose shall be capable of uniformly distributing water in controlled quantities over uniform lane widths.

F. Each layer of the ordinary fill material shall be disked whenever necessary to break down clods, thoroughly mix the different materials, secure a uniform moisture content and ensure uniform density and proper compaction.

G. When the moisture content and condition of each spread layer is satisfactory, the area shall be rolled by an approved type roller to a minimum density of ninety-five (95%) as determined by the Modified Proctor Test (AASHO). The final rolling shall be accomplished with a tandem steel roller.

Rollers of variable mass shall receive ballast to the greatest mass that can be supported without distress to the pavement or sub- grade.

H. Surfaces of fine crushed rock shall be constructed slightly higher than the specified levels and cut to profile by power grader towards the end of the compaction process. Rolling shall then continue to specified density to produce a tight, even surface without loose stones or slurry of fines.

I. Should a section of the work be not acceptable on the basis of inadequate compaction, further compaction shall be applied until the specified standard is achieved. If the moisture content varies outside the specified limits, add water or allow drying as necessary. Before commencing rolling mix mechanically for the full depth of the layer to ensure uniform distribution of moisture.

J. Pavement base courses shall comply with the tolerances itemized in the following table:

ITEM	CHARACTERISTIC	TOLERANCE
Crushed Stone Base	Level Straightness Thickness	+5mm / - 5mm mm maximum deviation from 4m straight-edge in all directions +15mm / -15mm
Sub base	Level Thickness	+10mm / -10mm +30mm / -30mm

K. Should a section of the work be not acceptable on the basis of elevation, flatness or depth, high areas shall be graded off, low areas shall be scarified to the full layer depth, built up as necessary and re-compacted as specified.

L. Each successive layer shall not be commenced until the underlying layer has been approved following inspection and/or testing.

M. The crushed stone base must be firm, non-yielding and not pumping under the travel of haul trucks and other construction equipment at the time of the laying of the hot mix asphalt. Base under layers that show movement under trucks or construction equipment will need additional compaction work or other remedial work to repair the substandard installation.

3.3 HOT MIX ASPHALT PAVEMENT

A. Mixing of hot mix asphalt should be undertaken in a mixing plant capable of effectively drying and heating the aggregate to the specified temperature, accurately proportioning and uniformly mixing coarse and fine aggregate, filler and binder to meet the specified requirements at all times.

In general, batch-mixing plants are preferable to drum mixing plants, because of their greater capability to fine-tune the aggregate gradation.
For all types of mixing facilities:

1. Cold aggregates must be handled and stored in a manner that avoids contamination and minimizes degradation and segregation.
2. Filler shall be stored and handled in a separate system from that which handles aggregate
3. The bitumen storage and handling shall be arranged so that contamination of the bitumen by flushing liquids or other materials cannot occur.
4. The bitumen storage tanks shall be capable of holding at least sufficient bitumen for one day's production.
5. Heating of bitumen shall be accomplished by steam coils, electricity or other means that will allow no direct flame to come into contact with the heating tank.
6. Discharge from the plant shall be so arranged as to minimize segregation.
7. Asphalt, which has been stored for more than twenty-four hours or produced at temperatures not in accordance with those specified, shall not be used.
8. The mix shall leave the mixing facility at a temperature between 285°F (140°C) and 325°F (163°C).

B. The hot mix asphalt must be kept clean during hauling and covered if necessary, during transit with canvas or other material that will retain the desired pavement temperatures. The mixtures must not be hauled in such a manner that segregation of the ingredients takes place or that a crust is formed on the surface, or that mixture will crumble or flatten out when dumped. Trucks that transport the mixture must have metal beds, and the beds must be clean, smooth and free of holes. Before loading, the truck bed is coated with a thin film of a release agent (oil or soap solution) that assists in preventing fresh hot mix asphalt from sticking to the surface of the bed. After the bed is coated, any excess release agent must be drained from the bed.

C. The hot mix asphalt shall be spread with a self-propelled machine spreader having a floating screed assembly controlling the elevation of the strike-oft. The use of road graders or towed spreaders will not be allowed. Means shall be provided to heat the screed uniformly over its full width. The screed shall be equipped with automatic screed controls to adjust automatically to place a uniform mat of desired thickness, grade and shape.

D. Typical members of the paving crew should be: paving superintendent, paver operator, dump person, two screed people, and two people to lute and take care of joints and mat repairs. Co-ordination of the entire crew with the paving superintendent and screed people is essential to achieve all the desired goals.

E. Self-propelled rollers are required as compaction equipment. Towed type rollers should not be used. Hand-held or vibrating plate compactors can be used in small, inaccessible areas. Steel-wheeled non-vibrating rollers shall have a mass of 10 tons (9 metric tons). Steel wheeled vibrating rollers shall have a mass of 5 tons (4.5 metric tons). Pneumatic tired multi-wheeled rollers shall not be used.

F. The hot mix asphalt shall be placed with a minimum delay after delivery. On no account shall hot mix asphalt be reheated.

G. The day's work shall be organized so that each layer spread covers the full width of the pavement.

H. Hot mix asphalt shall be spread to a depth consistent with the specified compacted thickness. Each layer shall be completed to a surface parallel to the finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layer or layers specified.

I. Hot mix asphalt shall not be placed during rain, or when the air temperature in the shade and away from artificial heat is 40°F (5°C) or less, or while the surface is wet or when the pavement temperature does not comply with the Table below.

Pavement surface temperature in shade	Minimum Laying Temperatures Binder Course	Minimum Laying Temperatures Top Coat
40°F - 50°F (5°C - 10°C)	302°F (150°C)	293°F (145°C)
50°F - 60°F (10°C - 15°C)	293°F (145°C)	284°F (140°C)
60°F - 77°F (15°C - 25°C)	284°F (140°C)	275°F (135°C)
Over 77°F (Over 25°C)	275°F (135°C)	266°F (130°C)

J. Maximum laying temperature of the mixture shall be 325°F (163°C)

K. The temperature of the mix shall be measured in the truck just prior to discharging into the paver hopper. A suitable stem type thermometer shall be used. The stem shall be inserted into the mix to a depth of approximately 8" (200mm) at a location at least 12" (300mm) from the side of the truck body. An average of at least two readings shall be adopted as the temperature of the mix.

L. There are three acceptable types of sensing devices used with the automatic screed control system:
1. The Wand Sensor
2. The Ultra Sonic Sensor
3. The Laser Sensor

M. The grade reference used with the above listed sensing devices can be either a fixed string line tied between graded iron pins or on an existing surface, a previously placed surface, a curb line, etc.

N. The area to be surfaced with hot mix asphalt shall be cleared of all foreign or loose material with power blowers, power brooms or hand brooms.

O. Crushed stone or asphalt surfaces shall be primed prior to the installation of the binder course and top coat. Prime crushed stone surfaces at the rate of 0.3 gallons per square yard.

P. Prime asphalt surfaces at the rate of 0.05 gallons per square yard. Sprayers shall be capable of spraying the tack coat uniformly through jets in a spray bar at the desired rate of application. Each sprayer shall be fitted with a hand lance.
1. Tack Coat shall be applied, not less than thirty (30) minutes nor more than two (2) hours before asphaltic concrete is placed.
2. When spraying the tack coat, shields shall be used and all necessary precautions taken to protect curbs, gutters, channels, adjoining structures, surfaces and grassed areas.
3. Any pools of tack coat which may form in small depressions or surface irregularities shall be brushed out over the adjacent area with brooms or rubber squeegees before the emulsion breaks.
4. In dusty conditions, every precaution shall be taken to prevent freshly coated surfaces from being contaminated by dust or other foreign material.

Q. Uniformity of operations is essential in hot mix asphalt paving. Uniform, continuous operation of the paver produces the highest quality pavement.
1. Starting blocks equal to 1.25 times the thickness of the non-compacted mat are required to set the thickness and to null the screed. By using starting blocks the grade can be very close at the beginning of the operation.
2. Blocks equal to 25% of the non-compacted thickness are used to start from a joint. The 25% additional thickness allows for proper roll-down or compaction while maintaining proper grade. Extended screeds will require multiple shims for each extension area.
3. The screed must be initially heated at the start of each new paving operation. If not, the mix will tear and the texture will look open and coarse, as if the mix were too cold.
4. If the mat being placed is uniform and satisfactory in texture, and the thickness is correct, no screed adjustments are required. But when adjustments are required, they should be made in small increments. Time should he allowed between the adjustments to permit the paver screed to complete reaction to the adjustments sequentially.

5. The minimum non-compacted thickness of a hot mix asphalt course is equal to 1.25 times its minimum compacted thickness, which is equal to three times the nominal maximum size aggregate. When the mat falls below this thickness, it pulls, tears, cools rapidly and generally will not be able to achieve the proper density and pavement smoothness.
6. There are places where spreading with a paver is either impractical or impossible. In these cases, hand spreading may he required. Placing and spreading by hand should be done very carefully and the material distributed uniformly so there will be no segregation of the mix. When the HMA is dumped in piles, it should be placed upon arrival on steel dump sheets outside the area in which it is to be spread and shall then be immediately laid to the required depth. In the spreading process, all material should be thoroughly loosened and evenly distributed. Any part of the mix that has formed into lumps and does not break down easily should be discarded. After the material has been placed and before rolling starts, the surface should be checked with templates or straightedges and all irregularities corrected.

R. Asphaltic concrete shall be spread in such a manner as to minimize the number of transverse and longitudinal joints in the pavement.
1. Transverse joints shall be constructed where the spreading operation is stopped for longer than 20 minutes. Transverse joints in adjoining spreader runs shall be offset by not less than 8 feet (2.44m). Transverse joints shall be offset from layer to layer by not less than 8 feet (2.44m). Transverse joints shall be constructed at right angles to the direction of spreading and be cut to a straight vertical face for the full depth of the layer.
2. When the construction is ready to end of the day or for a period longer than 20 minutes, the following procedure is used to form a suitable transverse joint:
   a. If the joint is satisfactory, a 6" (150mm) width of the fresh mix is rolled transversely and the joint checked for smoothness. If the joint is satisfactory, transverse rolling is continued in 6" to 12" (150 to 300mm.) increments until the entire width of the roller is on the new HMA. If straight edging shows an uneven joint, the surface of the new mat must he scarified while still warm and workable. Scarification is done with the fine side of the lute. Excess material can then be removed or additional material added, and the joint rolled. During rolling, timbers should he placed along the edges of the mat to prevent the roller from driving off the longitudinal edge and distorting it.

S. Longitudinal joints shall be offset from layer to layer by not less than 6" (150mm). Longitudinal joints shall be parallel to the center line of the pavement. Alignment of the mat is dependent on the accuracy of the guideline provided for the paver operator and his alertness in following it. Attention to this detail is vital to the construction of a satisfactory longitudinal joint, since only a straight edge can be properly matched to make the joint

T. Hot joints are formed by two payers operating in echelon. The screed of the rear paver is set to match the grade or thickness of the unrolled edge of the first mat placed. The advantages of a hot joint are that the two mats are automatically matched in thickness, the density on both sides of the joint is uniform because both sides are compacted together, and the hot mats form a solid bond. The disadvantage is that traffic cannot move in one of the lanes while the other is being paved. Both lanes are blocked simultaneously.

U. In building a cold joint, one lane is placed and compacted. At a later time, after the HMA in the first lane has cooled, the companion lane is placed against it and compacted. Special precautions must be followed to ensure a joint of good quality.

V. The following procedure is used to form a suitable longitudinal joint:
1. The exposed edge of the first lane shall be formed while hot to a straight line with a dense face, which shall lie between vertical and 45° to the vertical for the full depth of the layer.
2. The unsupported longitudinal edges of spread material should be side tamped to raise the level of the asphaltic concrete slightly to secure maximum edge compaction from subsequent rolling
3. While placing the companion lane, the paver screed should be set to overlap the first mat by 1" to 2" (25 to 50 mm).
4. The elevation of the screed above the surface of the first mat should he equal to the amount of roll-down expected during compaction of the new mat
5. The coarse aggregate in the material overlapping the cold joint should be carefully removed and wasted. This leaves only the finer portion of the mixture to be pressed into the compacted lane at the time the joint is rolled.

W. The placing of hot mix asphalt against abutting structures such as curbs, gutter manhole or adjoining pavement shall be carried out in the same manner as for longitudinal and transverse joints. Any spaces left unfilled between the spreader run and abutting edges shall be filled with sufficient material to the proper height prior to compaction.

X. After the paving mixture has been property spread, it shall be thoroughly and uniformly compressed by rolling with power rollers.

Y. Hot mix asphalt shall be compacted uniformly to the standard specified as soon as it will support rollers without undue displacement. All rolling shall be completed while the mix is at a temperature above 185°F (85°C)

Z. The pavement shall be compacted to 97% or more of the density (ASTM F2726) obtained on a retained job mix specimen by the seventy-five blow Marshall procedure (ASTM D1559), Marshall stability (ASTM D1559) shall be 750 lbs. or greater.

AA. The exact number of passes of a roller that will be required to obtain adequate density will be determined on a test strip using a nuclear density gauge to measure the density of the mat after each pass, until maximum achievable density is indicated by the test results. The rolling pattern used on the test strip should be the same that will be used on the remainder of the job. The number of rollers and/or the rate of production will be adjusted accordingly.
1. The speed of rollers at all times shall be slow enough to avoid displacement of the mix and shall not be greater than 3 miles/h (5 km/h).
2. Steel wheel rollers shall be operated with minimum wetting of rollers.
3. The driving roll shall be nearer the spreader.
4. Vibratory mechanisms shall be disengaged before stopping or reversing direction.
5. Rollers shall not remain stationary on asphaltic concrete while it is still warm. Roller wheels shall be kept free from any build-up.
6. The roller shall pass over the unprotected end of the freshly laid mixture only when a transverse joint has to be made.
7. Initial (breakdown) rolling shall be performed with a static steel-wheeled roller. Transverse joints shall be rolled first, then the longitudinal joint and the outside edge. Breakdown rolling shall continue longitudinally, commencing on the lower side and proceeding to the higher side of the spreader run. The roller shall overhang the unsupported edges of the run by about 4-inch (100mm). Each longitudinal pass shall overlap the previous pass by about 4-inch (100mm) and adjacent passes of the roller shall be of different lengths.
8. Secondary rolling to obtain required density before the mixture cools to 185°F (85°C) shall be performed as soon as possible after initial rolling and shall be performed with a static or a vibratory steel wheeled roller. Rolling shall be

carried out longitudinally commencing on the lower side and proceeding to the higher side of the spreader run. Each roller pass shall overlap the previous pass and adjacent passes shall be of different lengths.

9. Final rolling for the improvement of the surface while the mixture is still warm enough to permit removal of any roller marks shall be performed with static steel wheeled roller.
10. When paving in echelon, the edge of the run common to adjacent spreaders shall be left unrolled for a width of 8 inch (200mm) until the longitudinal joint has been constructed. This strip shall be rolled together with the edge of the adjacent spreader run. Rolling shall commence before the temperature of the material along the edge of the first spreader run has fallen below 95°C (203°F)

3.4 ACCEPTANCE OF PAVING WORK- REMEDY WORK

A. Each successive layer shall not be commenced until the underlying layer has been approved following inspection and/or testing.

B. Acceptance of paving work as far as compaction and Marshall Stability specifications is concerned will be based on tests to be performed on core samples taken from each layer shortly after application. Test results shall be submitted to Landscape Architect.

C. Should a section of the work be not acceptable on the basis of inadequate compaction and/or the mixture became loose and broken, mixed with dirt or in any way defective, it shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area.

D. On completion of placement and compaction, pavement courses shall comply with the tolerances itemized in the following table.

ITEM	CHARACTERISTIC	TOLERANCE
Top Coat	Level	+2mm / -2mm from design levels
	Thickness	+5mm / -0 mm from design thickness
	Flatness	3mm maximum departure from a 3m straight-edge in all directions
Binder Course	Level	+4mm / -4mm from design levels
	Thickness	+5mm / -0mm from design thickness
	Flatness	4mm maximum departure from a 3m straight-edge in all directions

E. Surface shape of each layer of pavement shall be such that water cannot accumulate at any point and the surface shall free drain to drainage channels.

F. The whole surface of each layer of pavement should be checked for levels by third party licensed surveyor, and for flatness with a 10-foot straightedge in all directions; the surface shall also be flooded and inspected for ponding, ‘‘bird baths”, ridges, etc. After testing, all high and low areas shall be marked on the leveling course surface.

G. Areas of one (1) square inch or more showing excess of bitumen shall be removed and replaced.

H. Asphalt infrared repair techniques: high and low asphalt sections can be remedied using infrared asphalt heaters that allow continuous, uniform re-heating of the asphalt to the same temperature that new asphalt is manufactured at the plant. The softened asphalt can be scarified to mix in fresh hot mixture, or to remove and dispose the excess. The repaired area shall be thoroughly compacted to the specified tolerance. Infrared repair techniques are typically 25% faster than conventional remove and replace repair techniques since they eliminate saw cutting, jack hammering, removal, loading, and trucking and they do not leave a joint around the perimeter of a repair.

I. Asphalt removal and replacement: high and low asphalt sections, sections that became loose and broken because of localized cohesive failure, or mixed with dirt or mud, or showing excess of bitumen, or contaminated by oil spills that penetrated deep into the asphalt can be remedied by cutting out the top course to full depth - or to a minimum depth of 1" - and replacing with new hot mixture at the correct elevation. First the area must be tack coated. The repaired area shall be thoroughly compacted to the specified tolerance. Areas affected by cracks and fissures generated by instability of the subbase shall be cut out to the full depth of the stone base and replaced. First the defective subbase shall be remedied or replaced.

J. Asphalt profile milling: minor profile deficiencies of asphalt pavements can be remedied through profile milling. Profile milling equipment is typically used to provide roughened texture to an existing asphalt pavement. Prior to the installation of the surfacing, the grooved surface resulting from profile milling shall be leveled using Mondo's 2-component polyurethane adhesive as a leveling compound.

K. Additional finish rolling of asphalt in warm weather, when pavement temperature is equal to or above 85°C (185°F), can be performed to remedy minor profile deficiencies and to remove tire marks and roller marks. Additional finish rolling shall be immediately interrupted in the event of over-compaction.

L. Asphalt leveling with Mondo's 2-component polyurethane adhesive: shallow, low asphalt sections can be leveled using Mondo's 2- component polyurethane adhesive as a leveling compound. The depth of the leveling layer must be limited to ¼" or less. Extensive use of polyurethane adhesive as leveling compound is no substitute for proper installation and/or repair of the base. No urethane products other than Mondo's 2-component polyurethane adhesive shall be used as a leveling compound. Mondo's 2-component polyurethane adhesive must be applied on fully oxidized asphalt (minimum 30-day curing time). No personnel other than Mondo's certified outdoor installers shall perform leveling work with Mondo's 2-component polyurethane adhesive. If leveling is performed to correct drainage problems, the Owner/GC shall supply adequate means to flood the track throughout the duration of the installation.

M. All contaminants must be removed from the base via mechanical abatement such as power washing, sanding, wet grinding, scarifying or shot-blasting. The degree of aggressivity required will vary with the type and depth of penetration of the compound on the surface.

N. Never use chemical abatement methods as residual chemicals on or penetrating the surface of the base can lead to failures.

O. No open flames shall be applied to soften the asphalt since open flames would burn bitumen and reduce the internal cohesion of the mixture.

P. No filling of low spots with sand mixes shall be allowed. Sand mixes lack sufficient internal cohesion.

Q. No tar emulsions shall be applied to the surface. Nor shall any other type of asphalt or tar leveling or sealing product (hot or cold) be coated on the surface.

R. No asphalt milling shall be performed to remedy profile deficiencies since the texture resulting from milling is too rough to be leveled using Mondo's 2-component polyurethane adhesive as a leveling compound.

3.5 CURING OF HOT MIX ASPHALT INSTALLATIONS

A. The asphalt leveling course will have to cure a minimum of thirty (30) days prior to installation of the Mondo surface in order to allow the escape of surface volatiles, oils. etc. and to maximize resin adhesion of the Mondo flooring to the asphalt pavement.

3.6 DISCLAIMER

A. The General Contractor, Architect, and/or Asphalt Sub-Contractor will be notified by Surface vendor/installer of any evident sub-surface defect or installation conditions, which could result in unsatisfactory performance. The responsibility for remedying defective work rests with the General Contractor and/or the Asphalt Sub-Contractor.

B. Surface vendor/installer must be provided with the respective tests results in advance of visiting the project site. The Owner will obtain written confirmation from Surfacing vendor/installer, based on site observations and test results supplied by the Contractor, that the bituminous concrete base appears satisfactorily finished and adequately cured to permit the installation to begin.

C. Surfacing vendor/installer will not be held responsible for any delays past expected substantial completion dates, caused by the incorrect installation of the asphalt base. As such no liquidating damages and or penalties will be imposed on surfacing vendor or installer. Any subsequent visits to re-inspect the corrected asphalt base will be at the Sub-Contractors/General Contractors cost.

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Section 32 13 12
SITE CONCRETE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work included: Provide all labor, materials, equipment, and transportation necessary to complete the placement of concrete. Such work includes, but is not limited to, the following:
   1. Furnishing, placing, curing, finishing and protection of all plain and reinforced concrete work, above and below grade of the Site. Also, include all concrete work necessary to complete the work of other trades.
   2. Coordination with all other trades for location of all pipe sleeves, duct openings, electrical boxes and conduits and other devices required by other trades.
   3. Prepare program of inspections of all concrete work and perform such tests and inspections.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections.
   1. Section 31 00 00, “Earthwork” for excavation, backfill and compaction requirements.
   2. Section 32 00 00, “Bituminous Concrete Pavement” for installation of curbing.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittals provisions and procedures.
   1. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
   2. Plant mix design for concrete.
   3. Submit manufacturer’s literature describing products, installation procedures and routine maintenance.
   4. Samples for Verification Purposes: Submit three (3) samples of surface applied polyurethane tactile mat of the kind proposed for use.
   5. Shop drawings are required for products specified showing fabrication details; tile surface profile; adhesives; plans of mat placement including joints, and material to be used as well as outlining installation materials and procedure.

1.4 REFERENCE STANDARDS

A. The following standards are applicable to the Work of this Section to the extent referenced herein:

1. All work shall conform to the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, hereinafter referred to as the Standard Specification, and dated December 2022 or latest revision.
2. ASTM: American Society for Testing and Material.
3. AASHTO: American Association of State Highway and Transportation Officials.
4. ACI: American Concrete Institute.
5. All ramps and curb ramps shall comply with American Disabilities Act Accessibility Guidelines and the Rhode Island Governor's Commission on Disabilities.

1.5 TESTING, CONTROL AND INSPECTION

A. The Contractor will retain the services of a qualified independent testing agency, approved by the Architect, to test aggregate and to prepare a mix design for each strength of concrete specified; and shall submit such mix designs and test results to the Architect for approval. Mix designs may also be based on proven current designs accompanied by test results. The costs of all such preliminary services shall be borne by the Contractor.

B. The Owner will retain the services of a concrete testing company to provide concrete sampling and testing.
1. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Architect, the testing laboratory shall provide such auxiliary personnel and services needed to accomplish the testing work.
2. Concrete test cylinder tests shall be taken for each 50 cubic yards of concrete placed, but at least one set for each day of concrete placements.
3. Testing required because of changes requested by the Contractor in materials, sources of materials or mix proportions, and extra testing of concrete or materials because of failure to meet the Specification requirements shall be paid by the Contractor.
4. Concrete shall be sampled and tested for quality control as follows:
   a. Sampling fresh concrete: ASTM C172
   b. Concrete test specimens: ASTM C31
   c. Slump: ASTM C143. – Slump shall be one to three inches, or five to seven inches with Super plasticizer.
   d. Air Content: ASTM C231 – Air content shall be 6% +/- 1%.
   e. Compressive strength: ASTM C39 – Concrete shall be 4000 psi at 28 days
   f. Unit Weight: ASTM C29

1.6 NOTIFICATION OF RELATED TRADES

A. Notify all other trades responsible for installing chases, electrical handholes, conduit, and other electrical utilities when ready for such installation, and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.

PART 2 - PRODUCTS

2.1 BOLLARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable.

B. Bollard Construction:

1. Bollard shall be constructed of 6” ID Schedule 40 steel pipe and filled with 3,000 PSI concrete.
2. Bollard shall be capped with 1/4” steel plate welded to pipe and shall be grinded smooth.

C. Steel Finish: Color Coated.

1. Color: As indicated on Drawings.

2.2 CONCRETE

A. Portland Cement: ASTM C-150 Type 1: All cement shall be from a single source.

B. Natural Aggregates:

1. Fine Aggregate for Concrete: Shall be natural sand consisting of clean, hard, durable, uncoated particles, conforming to ASTM C33. Organic content shall be determined according to ASTM C40. Allow no frozen or partially frozen aggregate in the mix.
2. Course Aggregate for Concrete: For regular weight concrete use crushed stone or gravel from approved source conforming to ASTM C33. Coarse aggregate shall not contain greater amounts of deleterious material than specified in table III, ASTM C33.

C. Water from approved source, potable, clean and free of oils, salt, alkali, organic matter and other deleterious material.

2.3 CONCRETE ADA ACCESSIBLE CURB CUTS

A. Contractor shall install concrete ADA accessible curb cuts at all locations shown on plans. Curb cut configurations shall be as detailed on the Drawings.

1. All concrete curb cuts shall be isolated from surrounding concrete pavement when applicable.
2. Curb cuts shall be built with cut curbstone to match concrete curb cut slopes.

B. Curb cuts shall comply with all requirements established by the Rhode Island Governor's Commission on Disabilities.

C. Curb cuts shall not exceed:

1. Cross-slopes at front and back of curb cuts: 1.5% max.
2. Curb cuts: 7.5% max

D. All planes of the finished curb cuts shall be field checked for slopes using a two-foot electronic “smart” level.

1. Curb cuts that do not comply with the slope requirements shall be cut out in their entirety and completely rebuilt.

2.4 CONCRETE RAMPS

A. All ramps to comply with ADA Accessibility Guidelines.

B. All ramps shall be sloped no greater than 1:12.

C. Ramps shall have level landings at bottom and top of each ramp and each ramp run. Landings shall have the following features:

1. The landing shall be at least as wide as the ramp run leading to it.
2. The landing length shall be a minimum of 60 in (1525 mm) clear.
3. If ramps change direction at landings, the minimum landing size shall be 60 in by 60 in (1525 mm by 1525 mm).

2.5 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.6 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

C. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

H. Plain-Steel Wire: ASTM A 82/A 82M

I. Deformed-Steel Wire: ASTM A 496/A 496M.

J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated.

K. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

L. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

M. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

N. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

O. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

P. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

Q. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

R. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

S. Zinc Repair Material: ASTM A 780.

PART 3 - EXECUTION

3.1 CONCRETE BOLLARDS

A. EXAMINATION

1. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. INSTALLATION, GENERAL

1. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
2. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
3. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
4. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
5. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
6. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

3.2 MIXING PROCESS FOR CAST-IN-PLACE CONCRETE

A. Ready-mixed concrete shall be mixed and transported in accordance with specification for Ready-Mixed Concrete" ASTM C94, Alt. No. 3 and ACI Standard 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

B. The concrete shall be of such consistency and be so spaced and worked that a smooth mortar face will be replaced.

3.3 EMBEDDED ITEMS FOR CAST-IN-PLACE CONCRETE

A. Coordinate the installation of all inserts required by other trades.

3.4 PLACING OF CAST-IN-PLACE CONCRETE

A. Notify the Architect at least 48 hours prior to each placement.

B. Do not place concrete until conduit, catch basin frame and grates, manhole frames and covers, granite curing and other work to receive the concrete have been inspected and approved by the Architect and all other trades concerned.

C. In hot weather all concreting shall be done in accordance with ACI 306, "Recommended Practice for Hot Weather Concreting".

D. In cold weather, all concreting shall be done in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting".

E. Conveying: Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods that will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.

F. Depositing: Delivery and placement of concrete shall be programmed so that the time lapse between batching and placement shall not exceed 1-1/2 hours. Concrete shall not be allowed a free fall over 4 feet. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing.

G. Concrete shall be deposited continuously, in horizontal layers of such thickness (not deeper than 18 inches) that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the Section. Placing shall be carried out at such a rate that the concrete, which is being integrated, with fresh concrete is still plastic. Concrete which ash partially hardened or which ash been contaminated with foreign materials shall not be deposited.

3.5 INSTALLATION OF DETECTABLE WARNING SYSTEM

A. During all concrete pouring and REP Tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The physical characteristics of the concrete shall be consistent with the Contract Specifications while maintaining a slump range of 4 - 7 to permit solid placement of the REP Tile. An overly wet mix will cause the REP Tile to float. Under these conditions, suitable weights such as 2 concrete blocks or sandbags (25 pounds) shall be placed on each REP Tile.

C. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to REP Tile placement.

D. To the maximum extent possible, the REP Tiles shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple REP Tiles regardless of size are used, the truncated domes shall be aligned between the detectable warning surface tiles and throughout the entire detectable warning surface installation.

E. The REP Tiles shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the detectable warning surface tile is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

F. On Continuous Runs: The Installer shall leave a 1/8” nominal gap between successive Detectable Warning Surface Tiles. As part of the concrete finishing operation, the Installer shall apply ¼” edge treatment around the perimeter of the detectable warning surface tiles to facilitate future replacement of the detectable warning surface tile. A urethane sealant such as Sikaflex 1a or BASF NP1 shall be applied to the edge treatment for a watertight detectable warning surface tile installation.

G. During and after the REP Tile installation and the concrete curing stage, it is imperative that there are no walking, leaning or external forces placed on the REP Tile to rock the REP Tile, causing a void between the underside of the REP Tile and the concrete substrate.

H. Remove protective plastic sheeting from REP Tile within 24 hours of installation of the REP Tile. Particularly under hot weather conditions (80 degrees or higher), plastic sheeting will adhere strongly (resulting in difficult removal of same) to detectable warning surface tile when not removed quickly.

I. Clean REP Tiles by method specified by the manufacturer.

3.6 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.7 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

End of Section

Section 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Rhode Island Department of Transportation (RIDOT), Standard Specifications for Highways and Bridges, latest Edition with amendments, hereinafter referred to as the “Standard Specifications”.

C. Rhode Island Department of Transportation (RIDOT), Construction Standards, latest Edition with amendments hereinafter referred to as the “Construction Standards”.

D. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 03 00 00 – Cast-In-Place Concrete
2. Section 31 00 00 – Earthwork
3. See Item 1.9 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Work included: Provide all labor, materials, equipment, and transportation necessary to complete the placement of concrete. Such work includes, but is not limited to, the following:
1. Broom finish concrete walkways at the locations shown on the Plans and specified herein.

B. This item may be affected by Add Alternates – refer to Plans for further information.

1.3 SUBMITTALS

A. General: Refer to Division 01 Submittals provisions and procedures.
1. Provide product data for all materials and items, including reinforcement and forming accessories, aggregates, admixtures, joint systems, curing compounds and sealants.
2. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
3. Plant mix design for concrete.

B. The Contractor shall provide a shop drawing indicating pouring sequence based on the Plans.

C. The Contractor shall fabricate in the field one mock-up of the broom finish concrete paving in a single pour measuring 10’ long x 5’wide x 4” thick for approval by the Landscape Architect. The sample shall demonstrate the final surface finishes,

texture, each joint type, sealant and color that will be provided uniformly throughout the project.

1. If the sample is approved, it may become part of the final work and shall be the basis of workmanship for all other broom finish concrete paving.

D. Provide all qualification data listed in Section 1.4 of this specification

1.4 QUALITY ASSURANCE

A. Qualifications: The foreman and labors shall be thoroughly trained and experienced in the skills required to complete concrete flatwork, be completely familiar with the design and application of the work, be present at all times during the work and perform the work. The foreman and labors shall have no less than five years minimum proven experience in the required paving techniques and desired results. Submit list of installations, indicating location, Owner, Architect/Engineer, date of installation, Contractor, and setting bed, for approval by the Architect.

1.5 REFERENCE STANDARDS

A. ASTM: American Society for Testing and Material.

B. AASHTO: American Association of State Highway and Transportation Officials.

C. ACI: American Concrete Institute.

D. All ramps and curb ramps shall comply with American Disabilities Act Accessibility Guidelines

1.6 TESTING, CONTROL AND INSPECTION

A. The Contractor will retain the services of a qualified independent testing agency, approved by the Architect, to test aggregate and to prepare a mix design for each strength of concrete specified; and shall submit such mix designs and test results to the Architect for approval. Mix designs may also be based on proven current designs accompanied by test results. The costs of all such preliminary services shall be borne by the Contractor.

1. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Architect, the testing laboratory shall provide such auxiliary personnel and services needed to accomplish the testing work.
2. Concrete test cylinder tests shall be taken for each 50 cubic yards of concrete placed, but at least one set for each day of concrete placements.
3. Testing required because of changes requested by the Contractor in materials, sources of materials or mix proportions, and extra testing of concrete or materials because of failure to meet the Specification requirements shall be paid by the Contractor.
4. Concrete shall be sampled and tested for quality control as follows:
   a. Sampling fresh concrete: ASTM C172
   b. Concrete test specimens: ASTM C31
   c. Slump: ASTM C143. – Slump shall be one to three inches, or five to seven inches with Super plasticizer.
   d. Air Content: ASTM C231
   e. Compressive strength: ASTM C39 – Concrete shall be 4000 psi at 28 days
   f. Unit Weight: ASTM C29

1.7 NOTIFICATION OF RELATED TRADES

A. Notify all other trades responsible for installing chases electrical handholes, conduit, when ready for such installation, and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.

1.8 PRE-INSTALLATION CONFERENCE

A. Installer of the Work of this Section is required to attend pre-installation conference specified under this Specification.

B. Contractor shall request in writing an on-site meeting with the Owner's Representative, the General Contractor and Site Contractor, the Landscape Architect and the Civil Engineer to review the scope of work prior to any work taking place to review the site conditions. Any deficiencies in the site conditions shall be remedied by the Contractor and approved by the Owner prior to commencing any work.

1.9 SUSTAINABILITY LANGUAGE IF APPLICABLE NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."
   1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
   1. Division 01 Section "Substitution Procedures" for NE-CHPS substitution procedures.
   2. Division 01 Section "Submittal Procedures" for NE-CHPS submittal requirements.
   3. Division 01 Section "Construction Controls and Temporary Facilities" for requirements for temporary facilities.
   4. Division 01 Section "Product Requirements" for additional NE-CHPS submittal requirements.
   5. Division 01 Section "Construction Waste Management and Disposal" for waste management, recycling and disposal.
   6. Division 01 Section "Sustainable Design Requirements" for general procedures for compliance with NE-CHPS prerequisites and credits.
   7. Division 01 Section "Construction Indoor Air Quality (IAQ) Management Plan" for material and procedure requirements.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for all radii indicated on the Plans.

B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS

A. Reinforcing Steel Bars: Shall be newly rolled billet steel conforming to ASTM A615 (Grade 60 unless noted). Bars shall be bent cold. Reinforcing bars being welded shall conform to ASTM A706, Grade 60.

B. Joint Dowel Bars: Stainless steel bars, ASTM A955. Cut bars true to length with ends square and free of burrs.

C. Welded Wire Mesh shall be welded plain cold-drawn steel wire fabric, ASTM A 185 and shall be supplied in sheets.

D. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.
   1. Use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforced steel where application allows.

2.3 CONCRETE MATERIALS

A. The Contractor shall insure that the final appearance of the sidewalks is consistent throughout the whole project. Any differences in color, texture, or finish will not be accepted by the Landscape Architect.
   1. Any portion of sidewalk or walkway that does not match the color, texture, or finish of previously constructed sidewalks will be removed and replaced with a sidewalk that matches the recently poured sidewalks at the expense of the Contractor.

B. Portland Cement: ASTM C 150, Type I for resistance to salt and ice melt chemicals.
   1. Use one brand of cement throughout Project.

C. Natural Aggregates:
   1. Fine Aggregate for Concrete: Shall be natural sand consisting of clean, hard, durable, uncoated particles, conforming to ASTM C33. Organic content shall be determined according to ASTM C40. Allow no frozen or partially frozen aggregate in the mix.
   2. Coarse Aggregate for Concrete: For regular weight concrete use crushed stone or gravel from approved source conforming to ASTM C33. Coarse aggregate shall not contain greater amounts of deleterious material than specified in table III, ASTM C33.

D. Water from approved source, potable, clean and free of oils, salt, alkali, organic matter and other deleterious material.

2.4 ADMIXTURES

A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, C494M, Type D.

D. High-Range Water-Reducing Admixture: ASTM C 494, C494M, Type F

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, C494M, Type D.

2.5 CONCRETE ADA ACCESSIBLE CURB CUTS

A. Contractor shall install concrete ADA accessible curb cuts at all locations shown on plans. Curb cut configurations shall be as detailed on the Drawings.
1. All concrete curb cuts shall be isolated from surrounding concrete pavement when applicable.
2. Curb cuts shall be built with cut curbstone to match concrete curb cut slopes.

B. Curb cuts shall not exceed:
1. Cross-slopes at front and back of curb cuts: 1.5% max.
2. Curb cuts: 7.5% max

C. All planes of the finished curb cuts shall be field checked for slopes using a two-foot electronic “smart” level.
1. Curb cuts that do not comply with the slope requirements shall be cut out in their entirety and completely rebuilt.

2.6 ADA DETECTABLE WARNING TILES

A. Provide cast iron wet set ADA tactile tiles with detectable warning surface that comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act. Detectable warning tiles as manufactured the following:
1. Tuf-Tile Cast Iron
2. Duralast Cast Iron
3. Neenah Foundry Cast Iron
4. or approved equivalent.

B. Detectable warning tiles shall be manufactured and installed to the sizes and dimensions indicated on the Contract Documents.
1. Tile sizes will vary to meet various locations shown on Plans with beveled top edges. **Tiles shall have the ability to meet radial layouts as shown on the Plans.**
2. Tile thickness shall be as shown the plans.
3. Width and thickness shall not vary by greater than 1/16 inch.
4. The finish shall be non-slip texture.

5. Tile shall be cast iron and shall provide a 60% color contrast from the abutting curb ramp pavement color, as required by the Americans with Disabilities Act.

2.7 CONCRETE RAMPS

A. All ramps to comply with ADA Accessibility Guidelines.

B. All ramps shall be sloped no greater than 1:12.

C. Ramps shall have level landings at bottom and top of each ramp and each ramp run. Landings shall have the following features:
1. The landing shall be at least as wide as the ramp run leading to it.
2. The landing length shall be a minimum of 60 in (1525 mm) clear.
3. If ramps change direction at landings, the minimum landing size shall be 60 in by 60 in (1525 mm by 1525 mm).

2.8 JOINTS AND JOINT SEALANTS

A. Joint Material: Preformed polyethylene foam expansion joint material. Joint material shall be flexible, lightweight, non-staining, polyethylene, closed-cell joint filler. Joint material shall come pre-scored with a removable strip.

B. Joint Sealant: Sealant shall be a single component, Type HL1, self-leveling, premium-grade polyurethane sealant. Color shall match adjacent pavements.

2.9 CONCRETE CURING AND SEALING COMPOUND

A. Concrete curing and sealing compound shall be non-yellowing, solvent b sed curing and sealing compound design to cure new concrete. A ready-to-use, acrylic curing and sealing compound shall conform to:
ASTM C 1315, Type 1 Class A and ASTM C 309, Type 1 Class A & B.
AASHTO Specification M 148, Type 1, Class A & B
1. Basis of Design Product:
a) Euclid Chemical Company (The); Super Diamond Clear$_{350}$ www.euclidchemical.com
2. Manufacturer shall have ISO 9001 Quality Certification.
3. Note: Paraffin based coatings or latex based surface coatings, or curing agents shall not be used or approved for this application.

B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9oz. per sq. yd., complying with AASHTO M 182, Class 2.

C. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
1. Waterproof paper.
2. Polyethylene film.
3. White burlap-polyethylene sheet.

D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete lab surfaces for temporary protection from rapid moisture loss.

E. Contractor shall use the same manufacturer for the curing compound and sealer.

PART 3 - EXECUTION

3.1 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
   1. Do not use the Owner's field quality-control testing agency as the independent testing agency.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28-Day), ASTM C39: 4000 psi.
   2. Maximum Water-Cement Ratio at Point of Placement: 0.45.
   3. Slump Limit at Point of Placement, ASTM C143: 3 inches maximum.
      a. Slump limit for concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.

C. Add air-entraining admixture, ASTM C231, at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1-1/2 percent:
   1. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.
   2. Air Content: 6.0 percent for 1-inch maximum aggregate.
   3. Air Content: 6.0 percent for 3/4-inch maximum aggregate.
   4. Air Content: 7.0 percent for 1/2-inch maximum aggregate.
   5. Air Content: 2.5 to 4.5 percent.

D. Addition of Synthetic Reinforcement: None.

E. Adjustment to Concrete Mixes: Contractor may request to the Architect Mix design adjustments when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

3.2 CONCRETE MIXING

A. Ready-mixed concrete shall be mixed and transported in accordance with specification for Ready-Mixed Concrete” ASTM C94, Alt. No. 3 and ACI Standard 304, “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

3.3 SURFACE PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving. Note: Contractor shall confirm that all compaction requirements of the base course have been met.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Conform to requirements of ACI 318, Chapter 6 “Conduits and Pipes Embedded in Concrete”, and as specified below.

B. Installation if inserts required by other trades shall be coordinated with or shall be installed prior to placing of reinforcing steel. All inserts to be supplied by the respective trade and installed by the General Contractor.

3.5 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:
1. Top of Forms: Not more than 1/8 inch in 10 feet.
2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent ensuring separation from concrete without damage.

3.6 PLACING OF CONCRETE

A. Notify the Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Notify the Architect at least 48 hours prior to each placement.

B. Do not place concrete until conduit, catch basin frame and grates, manhole frames and covers, granite curing and other work to receive the concrete have been inspected and approved by the Architect and all other trades concerned.

C. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

D. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

E. Conveying: Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods that will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.

F. Depositing: Delivery and placement of concrete shall be programmed so that the time lapse between batching and placement shall not exceed 1-1/2 hours. Concrete shall not be allowed a free fall over 4 feet. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing.

G. Concrete shall be deposited continuously, in horizontal layers of such thickness (not deeper than 18 inches) that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the Section. Placing shall be carried out at such a rate that the concrete, which is being integrated, with fresh concrete is still plastic. Concrete which ash partially hardened or which ash been contaminated with foreign materials shall not be deposited.

H. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.

I. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

J. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

K. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
1. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
2. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

L. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

M. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. Note to Contractor that exposed aggregate concrete flatwork shall not be done under extreme cold conditions.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix de-

signs.

N. Hot-Weather Placement: Comply with provisions of ACI 305R and as follows when hot weather conditions exist.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 JOINTS

A. General: Construct contraction, construction and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to building corners and changes in pavement direction unless indicated otherwise on the Plans.
1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise on the Plans.
2. Contractor shall sequence paving operations in logical order based on the plan layout and approved shop drawings.
3. Contractor shall coordinate with Landscape Architect if there are any discrepancies on the Plans or if there are specific questions regarding joint placement.

B. Contraction or Control Joints: Provide weakened-plane contraction or control joints off of all building corners, columns, changes in pavement directions and as shown on the Drawings. Construct contraction or control joints for a depth equal to at least 1/3 of the concrete thickness, as follows:
1. Sawed Joints: Sawcut contraction joints shall be as indicated on the Plans with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.
2. Formed or Tooled Joints: Formed contraction joints shall be as indicated on the Plans and with a grooving tool before concrete sets.
3. Joints perpendicular to walls may be less than required depth within 6 inches of the wall, and may stop 2 inches from the wall.
4. If a wet saw is used, all surrounding surfaces need to be washed to remove all slurry and fines caused by the wet saw.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than ½ hour, unless paving terminates at isolation joints. Construction joints should be planned so that they coincide with contraction joint spacing to eliminate extra joints.
1. Construction Joint support: Contractor shall provide sleeved round steel dowels or haunched keyways at construction joints as shown on the Plans.

2. Contractor shall manually insert dowel bars into the construction joints a minimum of 48” on center or two per joint.
3. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.

D. Isolation Joints: Form isolation joint material and sealant.

1. Isolation joints shall generally be located where there is a need to isolate flatwork from other paving material where there is a need for the concrete to expand and contract such as edges of buildings and structures, columns, manholes, footings, roadway curbing and changes in material and as specifically shown on the Plans.
2. Extend polyethylene foam joint fillers to full width and depth of joint.
3. Furnish polyethylene foam joint fillers in one-piece lengths. Where more than one length is required, lace or clip polyethylene foam joint filler sections together.
4. Contractor shall manually insert dowel bars into the isolation joints a minimum of 48” on center or two per joint.
5. After concrete is poured, top perforated portion of polyethylene foam joint filler shall be removed.
6. Joint Sealant shall be applied in isolation joint after perforated portion of polyethylene foam joint filler is removed. Sealant color shall match concrete color and **Shall Not be Bright White.**

3.8 CONCRETE PROTECTION, CURING AND SEALING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power

spray or roller
according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

E. Sealer: Apply uniformly in 2 coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat.
1. Begin sealing dry surface no sooner than 14 days after concrete placement. Apply sealer at a uniform coverage rate in accordance with manufacturer's instructions.

3.9 FIELD QUALITY CONTROL TESTING

A. Employ a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement as follows:

B. The Owner will employ a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:
1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
a. Slump: ASTM C 143; one test at point of placement for each compressive- strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
b. Air Content: ASTM C 231, pressure method; one test for each compressive- strength test but no less than one test for each day's pour of each type of air-entrained concrete.
c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below

specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section. Concrete workmanship that has crumbled and broken edges will not be accepted.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland Cement Concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

End of Section

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Section 32 14 00
UNIT PAVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following sections contain requirements that relate to this section.
1. Section 05 21 10 – Steel Framed Roof Deck
2. Section 06 20 13 – Exterior Finish Carpentry
3. Section 07 71 00 – Roof Specialties
4. Section 07 72 00 – Roof Accessories
5. Section 07 72 73 – Vegetated Roof Systems
6. See Item 1.9 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. The scope of work includes providing all materials, equipment and labor necessary to complete the work as indicated on the drawings and as specified herein.

B. This Section includes the following:
1. Installation of Type A Concrete Paver on pedestal rooftop system overlay.
2. Installation of Type B Concrete Paver on pedestal rooftop system overlay.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 for all manufactured/fabricated items. All submittals must be prior to fabrication and/or field installation work.
1. Shop drawings shall include plans, details, elevations and specifications and shall indicate profiles, sizes, dimensions, connection attachments, size and type of fasteners, accessories, and color and finish as indicated in these specifications and the plans.
2. Submit manufacturers printed product literature, specifications and data sheets.
3. Clearly indicate on the shop drawings any deviations from the plans and specifications.

B. Submit Contractor Qualifications as required under Quality Assurance section stated herein.

C. Submit warranty information of all manufactured/fabricated items as required under Warranty section stated herein.

D. Submit samples of all materials listed in Part 2 herein showing texture, finish and range of colors of all materials. Samples will establish the standard by which materials provided will be judged.

E. Submit drawings and instructions of manufacturers/fabricators installation requirements.

F. Submit material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated herein, based on comprehensive testing of current materials.

G. Submit list of materials used in constructing mockups including generic product names together with manufacturers, manufacturers' product names, sources of supply, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Landscape Architect and approved in writing.

1.4 MOCK-UPS

A. Paving Mock-ups: The Contractor shall fabricate in the field one sample using all unit pavers specified including specified base material for approval by the Landscape Architect. Mockups shall be sized to meet mock up detail in Plans. The sample shall set quality standards for materials and execution and demonstrate the final surface finish, texture, each joint type and color that will be provided uniformly throughout the project. If the sample is approved, it may become part of the final work and shall be the basis of workmanship for all other unit paver work.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Preconstruction Compatibility and Adhesion Testing: Submit to latex-additive manufacturer, for testing indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.
   1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be non staining to, installed pavers and other materials constituting paver installation.

1.6 PRE-INSTALLATION CONFERENCE

A. Installer of the Work of this Section is required to attend pre-installation conference specified under this Specification.

B. Contractor shall request in writing an on-site meeting with the Owner’s Representative, the General Contractor, the Landscape Architect, the Architect, the primary roofing installer, the vegetated roofing installer, the paver installer and installers whose work interfaces with or affects roofing to review the scope of work prior to any work taking place to review the site conditions. Any

deficiencies in the roof conditions shall be remedied by the Contractor and approved by the Owner prior to commencing any work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store all materials specified herein as to not impact, damage or otherwise corrupt other work. Contractor shall be responsible for corrective measures as a result of incorrect storage.

B. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store liquids in tightly closed containers protected from freezing.

F. Store asphalt cement and other bituminous materials in tightly closed containers.

1.8 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

1.9 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
   1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
   1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
   2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
   3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
   4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
   5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.

6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 – PRODUCTS

2.1 Any manufacturer’s names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that “or equivalent” applies to all products denoted herein. It is understood that all manufacturers will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an equivalent. It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

2.2 UNIT PAVER TYPE A – AT ROOFTOP TERRACE

A. Unit Paver Type A shall be concrete unit pavers meant for rooftop pedestal overlay installation. Surface shall be smooth, but non-slip. Size shall be a nominal 24”x24”x2” deep concrete unit paver fabricated from normal weight aggregates conforming to ASTM C 33, Portland cement, air-entraining agents, integral water repellants, finely-ground silica, integral colorant, and other filler materials; having a compressive strength of not less than 8,000 psi, a maximum water absorption of 5 percent after 24-hour submersion in cold water, and having no breakage when subject to 50 cycles of freezing and thawing, as per ASTM C67, Section 8. Paver finish and size shall be similar to **Prest Pavers** by Hanover. Color shall be similar to **Charcoal** by Hanover. **Contractor shall refer to the plans for details of base.**

B. Acceptable Manufacturers for Type A pavers include the following:
1. Hanover – Basis of Design
2. Unilock
3. Belgard
4. Techo-Bloc
5. Or equivalent.

2.3 UNIT PAVER TYPE B – AT ROOFTOP TERRACE

A. Unit Paver Type B shall be concrete unit pavers meant for rooftop pedestal overlay installation. Surface shall be smooth, but non-slip. Size shall be a nominal 24”x24”x2” deep concrete unit paver fabricated from normal weight aggregates conforming to ASTM C 33, Portland cement, air-entraining agents, integral water repellants, finely-ground silica, integral colorant, and other filler materials; having a compressive strength of not less than 8,000 psi, a maximum water absorption of 5 percent after 24-hour submersion in cold water, and having no breakage when subject to 50 cycles of freezing and thawing, as per ASTM C67, Section 8. Paver finish and size shall be similar to **Prest Pavers** by Hanover. Color shall be similar to **Limestone Gray** by Hanover. **Contractor shall refer to the plans for details of base.**

B. Acceptable Manufacturers for Type B pavers include the following:

1. Hanover – Basis of Design
2. Unilock
3. Belgard
4. Techo-Bloc
5. Or equivalent.

2.4 UNIT PAVER PEDESTAL SYSTEM

A. See Specification Section 07 72 00 – Roof Accessories for Product information on the Unit Paver Pedestal System

2.5 FLATNESS TOLERANCES

A. A 4-foot dimension in any direction on the surface shall determine variation from true plane, or flat surfaces. The maximum variation from true plane shall not exceed 1/8 inch per 12 inches or 1/8 of the specified joint width, whichever is greater.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Perform pre-installation conference as specified in Part 1.

B. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.
2 Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

3.2 PREPARATION

A. Remove substances from base surface and/or concrete substrates that could impair pedestal bond, including curing and sealing compounds, form oil, and laitance.

B. Clean substrates to remove dirt, dust, debris, and loose particles.

C. Pavers shall be installed on pedestal system.

3.3 INSTALLATION GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, un-chipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

3.4 INSTALLATION OF PAVERS ON ADJUSTABLE PEDESTALS

A. See Specification Section 07 72 00 – Roof Accessories for information on the Installation of Unit Paver Pedestal System

3.5 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Cleaning: Remove excess sand, dirt, debris, mortar or grout from exposed paver surfaces; wash and scrub clean.

End of Section

Section 32 15 40
CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification section, apply to work of this section.

B. Related sections include the following:
1. Section 03 00 00 – Cast in Place Concrete
2. Section 11 68 00 – Play Field Equipment and Structures
3. Section 31 00 00 – Earthwork
4. See Item 1.7 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. The scope of work includes providing all materials, equipment and labor necessary to complete the work as indicated on the drawings and as specified herein.

B. The principal work of this section includes, but may not be limited to the following:
1. Stone Dust surfacing at Shot Put throwing area

C. This item may be affected by Add Alternates – refer to Plans for further information.

1.3 SUBMITTALS

A. Submit manufacturers printed product literature, specifications and data sheets for products and materials specified herein.
1. Clearly indicate any deviations from the plans and specifications.

B. Submit warranty information of all product items as required under Warranty section stated herein.

C. Submit samples showing texture, finish and range of colors of all materials. Samples will establish the standard by which materials provided will be judged.

D. Submit drawings and instructions of manufacturers/fabricators installation requirements.

E. Submit material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated herein, based on comprehensive testing of current materials.

F. Submit list of materials used in constructing mockups including product names together with manufacturers, manufacturers' product names, sources of supply, and other information as required to identify materials used. Include mix proportions for source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Landscape Architect and approved in writing.

1.4 MOCK-UP

A. Contractor shall provide a 5'x6' mockup complete with steel edging, base course, geotextile, and stone sand surface for review and approval by the Landscape Architect prior to installation.

1.5 PRE-INSTALLATION CONFERENCE

A. Installer of the Work of this Section is required to attend pre-installation conference specified under this Specification.

B. Contractor shall request in writing an on-site meeting with the Owner's Representative, the General Contractor and Site Contractor, the Landscape Architect and the Civil Engineer to review the scope of work prior to any work taking place to review the site conditions. Any deficiencies in the site conditions shall be remedied by the Contractor and approved by the Owner prior to commencing any work.

1.6 QUALITY ASSURANCE

A. Qualifications: The foreman and labors shall be thoroughly trained and experienced in the skills required to complete stabilized stone aggregate work, be completely familiar with the design and application of the work, be present at all times during the work and perform the work. The foreman and laborers shall have no less than five years minimum proven experience in the required paving techniques and desired results. Submit list of installations, indicating location, Owner, Architect/Engineer, date of installation, Contractor, and setting bed, for approval by the Architect.

1.6 UNDER DELIVERY, STORAGE AND HANDLING

A. Store all materials specified herein as to not impact, damage or otherwise corrupt other work. Contractor shall be responsible for corrective measures as a result of incorrect storage.

1.7 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."
   1. The Construction Manager is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 Any manufacturer’s names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that “or equivalent” applies to all products denoted herein. It is understood that all manufacturers will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an equivalent. It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

2.2 STONE AGGREGATE PAVEMENT

A. Stone dust shall be 3/8” minus pulverized stone that is locally sourced. Color shall be Rose. Submit color samples for approval
1. Crushed Aggregate Material shall consist of sound, angular, durable particles.
2. Gradation, in accordance with ASTM C136:

Sieve Size	Percent Passing
3/8” in (9.51 mm)	100
4 (4.76 mm)	80 to 100
8 (2.36 mm)	65 to 90
16 (1.18 mm)	50 to 70
30 (0.6 mm)	25 to 55
50 (0.3 mm)	15 to 35
100 (0.149 mm)	10 to 20
200 (0.074 mm)	5 to 15

2.3 OTHER MATERIALS

A. Base Course: complying with requirements in Section 31 00 00 - Earthwork.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Perform pre-installation conference as specified in Part 1.

3.2 STONE AGGREGATE PAVEMENT

A. Stone aggregate shall be installed to the lines, grades and depth indicated in the Construction Drawings.

B. Ensure that the subgrade and base are properly graded and compacted to required specifications.

C. Stone aggregate during rain.

D. Protect all nearby surfaces, plants, and structures from possible contamination from materials or damage by equipment.

E. Prepare the Subgrade
1. Excavate the area to the depth required so that finish grade can be established as noted on plans.
2. Compact the subgrade to 95% Modified Proctor Density using vibratory compaction.
3. Refer to grading plans for established slopes required in stabilized stone aggregate pavements.

F. Prepare the Base
1. Spread and compact the base material. Base material – refer to Earthwork spec for Sand Gravel Fill.
2. Compact the subgrade to 95% Modified Proctor Density using vibratory compaction.

G. Spreading
1. Spread 4” of the loose and uncompacted stone aggregate over the compacted base material.

H. Compaction
1. Aggregate shall be compacted with a single or double drum static roller. Compact making 4-6 passes using a 1 ton double or single static drum roller, or equivalent.
2. Compaction will vary with different aggregates due to particle shape and size. Compact to 95% Modified Proctor Density.

I. Completing installation
1. Apply a light spray to the surface of the material to give a clean appearance. Apply water until the water begins to run-off.
2. Do not allow any traffic on the newly installed pathway until fully cured

J. Repairs and protection
1. Excavate the damaged area and scarify exposed stone aggregate.

2. Pre-blend the replacement crushed stone aggregate material. Apply the material to the excavated area and compact.
3. Re-compact the material, ensuring that the final grade and crown are maintained. Do not use a vibratory compactor.

End of Section

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Section 31 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within SECTION 01 - GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. This Section shall include: Labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. The work covered under this Section of the Specifications includes furnishing all labor, equipment, appliances and materials, and performing all operations in connection with the furnishing and placing of the pavement marking as indicated on the Drawings and as herein specified.

B. Related Sections include the following:

1. Section 31 00 00 "Earthwork" for soil materials, excavating, backfilling, and site grading.
2. Section 32 00 00 “Bituminous Concrete Pavement”, for placement of vertical granite curbing and paving of roadways and walkways.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 – SUBMITTAL PROCEDURES for submittal provisions and procedures.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified pavement marking installer whose work has resulted in successful establishment pavement markings.

1. Installer’s Field Supervisions: Require Installer to maintain an experienced full-time supervisor on Project Site when work is in progress.

1.5 REFERENCE STANDARDS

A. All work shall conform to the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, hereinafter referred to as the Standard Specification, Section M17, and dated December 2022 or latest revision.

1.6 LIABILITY FOR DAMAGES

A. The Contractor shall be liable for all damage to existing signs prior or during removal and resetting.

PART 2 - MATERIALS

2.1 FINAL PAVEMENT MARKINGS

A. Final Pavement Markings within RIDOT Right-of-way shall be thermoplastic, conforming to Standard Specifications.

B. Final Pavement Markings onsite shall be epoxy resin, conforming to Central Falls and Standard Specifications.

C. Pavement markings shall be “white” or “yellow” in color, unless otherwise noted on Drawings.

D. General pavement marking delineation for parking stalls shall measure 4 inches in width. All other pavement

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of pavement markings shall be in accordance with the RIDOT Standard Specifications and Manufacturer’s Requirements.

B. Pavement marking should be installed within 48 hours after the final pavement installation.

3.2 INSPECTION

A. All materials and each part or detail of the work shall be subject to observation by the Architect. The Architect shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the contractor as is required to make a complete and detailed inspection, (such assistance may include furnishing labor, tools, and equipment, at no expense to the Architect).

B. Any work done or materials used without authorization by the Architect may be ordered removed and replaced at the Contractor’s expense. The Contractor shall furnish written information to the Architect stating the original sources of supply of the materials manufactured away from the actual site of the work. In order to insure a proper time sequence for required inspection and approval this information shall be furnished at least two weeks (or as otherwise directed by the Architect) in advance of the incorporation in the work of any such materials.

C. For the purpose of observing work that affects their respective properties, inspectors for the municipalities, public agencies and the utility companies shall be permitted access to the work, but all official orders and directives to the Contractor will be issued by the Architect.

D. The observation of the work shall not relieve the Contractor of any of his obligations to fulfill the terms of the Contract as herein prescribed by the plans and specifications.

E. Failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered or obligate the Architect to make final acceptance.

End of Section

Section 32 17 24
SIGNS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within SECTION 01 - GENERAL REQUIREMENTS that are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. This Section shall include: Labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. The work covered under this Section of the Specifications includes furnishing all labor, equipment, appliances and materials, and performing all operations in connection with the furnishing and placing of signs as indicated on the drawings and as herein specified.
2. Furnishing and installing appropriate signs, of the type specified and at the locations shown on the Drawings or as indicated by the Architect in conformity with these specifications.
3. Install handicap-parking signs as indicated on the drawings and all other parking instructional signs and gates as specified by the manufacturer's installation instructions.

B. Related Sections include the following:

1. Section 31 00 00 "Earthwork" for soil materials, excavating, backfilling, and site grading.
2. Section 32 00 00 "Bituminous Concrete Pavement" for placement of vertical granite curbing and paving of roadways and walkways.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedures for submittal provisions and procedures.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified sign installer whose work has resulted in successful establishment signs.

1. Installer's Field Supervisions: Require Installer to maintain an experienced full-time supervisor on Project Site when work is in progress.

1.5 REFERENCE STANDARDS

A. All work shall conform to the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, hereinafter referred to as the Standard Specification, and dated December 2022 or latest revision.

B. Traffic Sign work under this item shall conform to the relevant provisions of the Manual on Uniform Traffic Control Devices (MUTCD).

1.6 LIABILITY FOR DAMAGES

A. The contractor shall be liable for all damage to existing signs prior or during removal and resetting.

PART 2 - PRODUCTS (Not Used)

2.1 MATERIALS

A. Traffic Signs

1. Materials for all sign panels shall be aluminum panels Type A-1 with high intensity Type III reflective sheeting in accordance with the relevant provisions of the Standard Specifications.
2. Sign supports and foundations shall be in accordance with the details and MUTCD as indicated on the Contract Drawings and in the Standard Specifications.

PART 3 - EXECUTION

3.1 INSPECTION

A. All materials and each part or detail of the work shall be subject to inspection by the Architect. The Architect shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the contractor as is required to make a complete and detailed inspection, (such assistance may include furnishing labor, tools, and equipment, at no expense to the Owner).

B. If the Architect so requests, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examine prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed, will be at the Contractor’s expense.

C. Any work done or materials used without authorization by the Architect may be ordered removed and replaced at the Contractor’s expense. The Contractor shall furnish written information to the Architect stating the original sources of supply of the materials manufactured away from the actual site of the work. In order to insure a proper time sequence for required inspection and approval this information shall be furnished at least two weeks (or as otherwise directed by the Architect) in advance of the incorporation in the work of any such materials.

D. For the purpose of observing work that affects their respective properties, inspectors for the municipalities, public agencies and the utility companies shall be permitted access to the work, but all official orders and directives to the Contractor will be issued by the Architect.

E. The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill the terms of the Contract as herein prescribed by the plans and specifications.

F. Failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered or obligate the Architect to make final acceptance.

G. The Contractor shall give prior notice to the Architect when work on the various items is to be performed by him or his Subcontractors. If work is suspended on any time, prior notice shall be given to the Architect before resumption of the work.

3.2 EXECUTION

A. Sign fabrication and erection shall be in accordance with the relevant requirements of the Standard Specifications.

1. Post foundations, except in ledge, shall be excavated by an auger to the next lines of the outside diameter of the footing without disturbing the soil around or below the excavation.

B. The Contractor shall mark the location of all on-site signs and shall obtain the approval of the Architect before any signs are installed.

C. Signs located in areas subject to pedestrian traffic shall be mounted with a minimum 7-foot clearance to the bottom of the sign. The Contractor shall install the sign types and posts at the locations shown on the Contract Drawings.

D. Signs shall be mounted at right angles to the direction of, and facing, the traffic they are intended to serve. The sign panel shall be located a minimum of one foot from the curb line or edge of pavement.

End of Section

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SECTION 32 18 24
TEXTURED ACRYLIC COLOR SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification section, apply to work of this section.

B. Related sections include the following:
1. Section 31 00 00 – Earthwork
2. Section 32 12 17 – Asphalt for Courts, Play Areas and Tracks
3. See Item 1.9 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. The scope of work includes providing all materials, equipment and labor necessary to complete the work as indicated on the drawings and as specified herein.

B. The principal work of this section includes, but may not be limited to the following:
1. Textured acrylic surfacing for asphalt courts.

C. References
1. National Asphalt Paving Association (NAPA)
2. United States Tennis Association (USTA)
3. International Tennis Federation (ITF)
4. American Sport Builders Association (ASBA)

1.3 QUALITY ASSURANCE

A. Surfacing shall conform to the guidelines of the ASBA for planarity.

B. All surface coatings products shall be supplied by a single manufacturer.

C. The contractor shall record the batch number of each product used on the site and maintain it through the warranty period.

D. The contractor shall provide the inspector, upon request, an estimate of the volume of each product to be used on the site.

E. The installer shall be an authorized applicator of the specified system.

F. The manufacturer’s representative shall be available to help resolve material questions.

G. All colors shall be pre-mixed in Factory by manufacturer.

1.4 SUBMITTALS

A. Manufacturer specifications for components, color chart and installation instructions. Owner shall have final approval of the recommended colors selected and shown on the plans.

B. Authorized Applicator certificate from the surface system manufacturer.

C. ITF classification certificate for the system to be installed.

D. Reference list from the installer of at least 5 projects of similar scope done in each of the past 3 years.

E. Current Material Safety Data Sheets (MSDS).

F. Product substitution: If other than the product specified, the contractor shall submit at least 7 days prior to the bid date a complete type written list of proposed substitutions with sufficient data, drawings, samples and literature to demonstrate to the Owner's satisfaction that the proposed substitution is of equal quality and utility to that originally specified. Information must include a QUV test of at least 1000 hours illustrating the UV stability of the system. The color system shall have an ITF pace rating in Category 2. Under no circumstances will systems from multiple manufacturers be considered.

G. Sustainability Submittals – if applicable

1.5 MATERIAL HANDLING AND STORAGE

A. Store materials in accordance with manufacturer specifications and MSDS.

B. Deliver product to the site in original unopened containers with proper labels attached.

C. All surfacing materials shall be non-flammable.

1.6 GUARANTEE

A. Provide a guarantee against defects in the materials and workmanship for a period of two years from the date of substantial completion.

1.7 INSTALLER QUALIFICATIONS

A. Installer shall be regularly engaged in construction and surfacing of acrylic tennis courts, play courts or similar surfaces.

B. Installer shall be an Authorized Applicator of the specified surface system.

C. Installer shall be a builder member of the ASBA.

1.8 MANUFACTURER QUALIFICATIONS

A. System manufacturer shall provide documentation that the surface to be installed has been classified by the ITF as a medium pace surface.

B. System manufacturer shall be a US owned company.

C. System manufacturer shall be a member of the ASBA.

1.9 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."

1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Substitutions: Submit requests at least 7 days prior to the bid date with a complete type written list of proposed substitutions with sufficient data, drawings, samples and literature to demonstrate to the Owner’s satisfaction that the proposed substitution is of equal quality and utility to the specified product. Information must include a QUV test of at least 1000 hours illustrating the UV stability of the system. The system shall have an ITF pace rating in Category 2. Under no circumstance may the final color surface contain silica sand added at the job site.

B. Color Surface System
1. Laykold ColorFlex System – Basis of Design
Advanced Polymer Technology Corporation
Harmony, PA
888-266-4221
www.laykold.com
2. Approved equivalent

2.2 MATERIALS

A. All components of Color Surface System shall be supplied by an ISO 9001 and ISO 14001 certified manufacturer. Color Surface System components shall not contain ANY lead, mercury, nor any heavy metals, PCB, or formaldehyde.

B. Poly Primer/Laykold Epoxy VTB Primer. Primer for use on concrete substrates only. Shall be a two-component, 100% solids, solvent-free primer.
1. Percent Solids by Weight 98% (minimum)
2. Weight 9.01 lbs./gallon

C. NuSurf filler coat. A premium grade, highly flexible, acrylic-based emulsion used for smoothing rough pavements.
1. Percent Solids by Weight 55 - 58.6 % (minimum)

2. Weight 9.47 - 9.52 lbs./gallon

D. ColorFlex textured batch mixture. A premium grade, highly flexible, pigmented, wear-resistant acrylic emulsion batch mixed at project site with silica sand and water. 2-coats minimum required.
   1. Percent Solids by Weight 51.6 - 54.6 % (minimum)
   2. Weight: 9.47 - 9.52 lbs./gallon

E. Line Prime. Clear drying acrylic emulsion line primer. 1-coat required.
   1. Percent Solids by Weight 29%
   2. Weight: 8.9 lbs/gallon

F. Textured White Line Paint. Factory textured, wear-resistant acrylic emulsion line marking paint. 1-2 coats as needed.
   1. Percent Solids by Weight 67% minimum
   2. Weight: 11.4 lbs/gallon

PART 3 - EXECUTION

3.1 INSTALLATION LIMITATIONS

A. Asphalt pavement must be in place a minimum of 28 days prior to commencing any preparation or surface coating work. If approved by the Owner's Representative and the Landscape Architect, time sensitive and/or high RH level is present, Laykold Epoxy VTB Primer can be applied to 5-day old (minimum) concrete substrates according to coatings manufacturer guidelines. RH testing is required by the Contractor.

B. Do not install when rainfall in imminent or extremely high humidity prevents drying.

C. Do not apply unless surface and air temperature are 50°F and rising.

D. Do not apply if surface temperature is in excess of 140°F.

3.2 EXAMINATION

A. Perform pre-installation conference as specified in Part 1.

B. The Surfacing Installer shall inspect and approve the base surface. Written acceptance shall be provided to the Owner's Representative from both the Site Contractor and the Surface Installer indicating acceptance of the base prior to the color surface system installation.

C. Inspect substrate for dryness. Substrates are to be tested according to coatings manufacturer guidelines using ASTM F2170 (Relative Humidity testing via probe) or ASTM F1869-98 (Anhydrous Calcium Chloride test). Report any discrepancies to the Owner's Representative.

D. Surface of substrate shall be cleaned by Site Contractor as required. The substrate shall be CLEAN and DRY before coatings are applied. The surface of the substrate shall be inspected by the Contractor and the Surface Installer and make sure the surface is free of grease, oil, dust, dirt, loose residue and other foreign matter before any coatings are applied.

E. Pressure washing will be necessary to adequately clean areas to be coated. Any areas previously showing algae growth shall be treated with Clorox or approved product to kill the organisms and then be properly rinsed.

3.3 INSTALLATION PROCEDURES

A. Primer (for concrete substrates only): After RH tests less than 75%, Laykold Poly Primer can be applied. Laykold Poly Primer is mixed by pouring the “B” component into the “A” component and mixing using a low-speed jiffy mixer (400 to 600 rpm) for 2 minutes. Scrape down the sides of the bucket and mix for an additional minute. Do not incorporate air when mixing. Spread the mixed primer on the substrate using a high-quality, medium nap roller to achieve a total coverage of approximately 0.030 gal/yd^2 (0.15 kg/m^2 - 300 ft^2/gal). The working time for the Primer is approximately 50 minutes and is reduced in high temperatures. Lightly broadcast 40 to 60 mesh silica sand into the wet primer at the rate of 5 pounds per 100 sq. ft. (0.24 kg/m^2) to create a rough texture. Allow 5 to 6 hours drying time before proceeding. If the concrete substrate tests with RH of 75% or greater or a MVER (Anhydrous Calcium Chloride) of greater than 3 lbs/1000 sqf/24 hours, more cure time is required or Laykold Epoxy VTB Primer can be used (see Laykold Epoxy VTB Primer TDS for application guidelines). Acrylic Concrete Primer may be substituted under certain conditions when approved by owner and/or design professional. If approved for use, see Acrylic Concrete Primer technical data sheet for application details.

B. Poly Primer rust/stain block primer: Laykold Poly Primer (152) is mixed by pouring the “B”, or smaller, component into the “A”, larger, component and mixing using a low-speed jiffy mixer (400 to 600 rpm) for 2 minutes. Scrape down the sides of the bucket and mix for an additional minute. Do not incorporate air when mixing. Spread the mixed Poly Primer (152) on the substrate using a high-quality, medium nap roller to achieve a total coverage of approximately .02 - .05 gals/yd² (0.20 – 0.25 kgs/m²) (175 – 230 ft²/gal). The working time for the Poly Primer is approximately 40 - 50 minutes and is reduced in high temperatures. Broadcast 20 to 40 mesh silica sand onto the wet primer at the rate of 5 pounds per 100 sq. ft. (0.25 kg/m^2) to create a rough texture. Excess sand is to be removed after the Poly Primer has cured. Allow 5 to 7 hours drying time before proceeding with excess sand removal. Poly Primer is not UV stable and should be over-coated with subsequent coatings within 24-48 hours.

C. Patching: Once the surface has been thoroughly cleaned and is free of all loose material, dirt, or dust, the court should be flooded and allowed to drain a minimum of 30 minutes and a maximum ds water (birdbaths) in a depth greater than 1/16 inch (1.6 mm or the thickness of a nickel) shall be outlined and patched.
   1. Surface Leveling: Birdbaths shall be leveled using a Laykold Acrylic Deep Patch court patch binder slurry. Prime area with a 50/50 mixture of Laykold Acrylic Deep Patch and water. Primer shall be brushed into place and allowed to dry prior to patching. Patch mix shall consist of Laykold Acrylic Deep Patch, 50-mesh sand and Type 1 Portland cement. Mix as per manufacturer directions.
   2. Crack Filling: Cracks shall be cleaned, primed, and filled using Laykold Acrylic Resurfacer if cracks are 1/16 inch or less. If greater than 1/16 inch, Laykold Acrylic Deep Patch court patch binder slurry should be used to fill cracks. Mix as per manufacturer directions. Refer to Laykold Deep patch technical data sheet for additional mixing details and application instructions for various sized cracks.

3. All areas that are repaired/leveled/corrected using a court patch binder mixture shall be allowed to fully cure and then ground smooth and level with the substrate by stone or an acceptable mechanical method.

D. NuSurf Filler Coat(s): Apply one coat of Laykold NuSurf as filler coat using a 24", 30" or 36" wide 70 Durometer flexible rubber squeegee. Batch mix shall consist of 55 gallons (260 kg) of Laykold NuSurf, 25 gallons (95 kg) of potable water, and 400 to 500 pounds (181 – 227 kg) of clean, bagged silica sand (60 to 80 mesh). The application rate shall be 0.05-0.07 gal/yd^2 (0.29-0.40 kg/m^2 - 129-180 ft^2/gal) of undiluted Laykold NuSurf per coat. NOTE: If the asphalt is very porous, an optional 2nd application of Laykold NuSurf may be applied. Each coat should be completely dry before applying subsequent coats.

E. Textured ColorFlex Coats:
Apply two coats of Laykold ColorFlex textured batch mixture using a 24", 30" or 36" 50 Durometer flexible rubber squeegee. Batch mix shall consist of 55 gallons (260 kg) of ColorFlex, 38 to 41 gallons (144 - 155 kg) of potable water and 225 to 300 pounds (102 - 136 kg) of clean, bagged silica sand (60 to 80 mesh). The application rate shall be 0.05-0.07 gal/yd^2 (0.29-0.40 kg/m^2 – 129-180 ft^2/gal) of undilute ColorFlex per coat. Each coat should be completely dry before applying subsequent coats.
Each coat should be completely dry before applying subsequent coats. Allow topcoat to cure a minimum of 24 hours before applying game lines.

F. Game Lines:
1. Wait a minimum of 24 hours after final color coat before applying line paint.
2. All lines are to be applied by painting between masking tape with a paintbrush or roller according to U.S.T.A. and A.S.B.A. specifications.
3. Prime masked lines with Laykold Line Prime and allow a minimum drying time of 1-hour.
4. Apply 1 to 2 coats as needed of Laykold Textured White Line Paint with a brush or roller.
5. Remove masking tape immediately after lines are dry.
6. Allow lines to dry a minimum of 24 hours before allowing play on court.

3.4 PROTECTION

A. Cure Time. No traffic or other trades shall be allowed on the surface for a period of one week following completion to allow for complete and proper cure of the finish.

B. Other Trades. It is the responsibility of the Contractor to protect the surface from damage by other trades before acceptance by the owner or the owner's authorized agent.

C. Do not allow surrounding sprinkler systems to spray water on the newly applied court surface for a period of one week after completion.

D. Do not place any benches, chairs, ball baskets, or any other type of court equipment on the newly applied court surface for a period of one week after completion.

E. Do not allow black soled shoes, bicycles, rollerblades, etc. on the court surface. Black scuff marks cannot be removed.

F. Erect temporary barriers to protect coatings during drying and curing.

G. Lock gates to prevent use until acceptance by the owner's representative.

3.5 CLEAN UP

A. Remove all containers, surplus materials and debris. Dispose of materials in accordance with local, state and Federal regulations.

B. Leave site in a clean and orderly condition.

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SECTION 32 18 25
SYNTHETIC SURFACE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections include the following:

1. 01 23 00 -- Alternates
2. 32 12 17 – Asphalt for Courts, Play Areas and Tracks
3. See Item 1.9 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. The following specification and qualifications are for the installation of a new all-weather synthetic running surface for field events as noted on the Plans. The specification includes but is not limited to the following:

B. Provide all materials, equipment and labor necessary to complete the work as indicated on the Drawings or as specified herein.

C. Synthetic surface installation for field events as noted on the Plans.

D. Line Marking

E. Special Requirements**:** None.

F. **This item may be affected by Add Alternates – refer to Plans for further information.**

1.3 SUBMITTALS

A. Submit shop drawings and product data on materials and installation procedure to Owner's Representative for approval under provisions of Division 1.

B. Submit current **Certified Track Builder** documentation as provided by the **American Sports Builder Association (ASBA)** as required by track surfacing manufacturer.

C. Submit ASBA line striping Certification for Class 4.

D. Submit Certification that Contractor is an Authorized Applicator of the surfacing system.

E. Any synthetic surface binders submitted shall be produced specifically for use in running track surfacing construction. Written confirmation of this shall be submitted to the Owner and shall include AASTM or IAAF test results for the track system with the stamped certification from the testing laboratory that performed the published tests. Carboxylated Styrene Butadiene Latex shall not be used in the rubber application procedure.
   1. Submit name, contact, telephone number, qualifications and a list of references of track surfacing installations as defined in 1.6 below.

F. Submit to Owner a letter of acceptance of the rubber granules by the binder manufacturer.

G. Submit to the Owner a list per 1.6 A of this specification of existing installations the Contractor has performed including owner representative name, telephone number and surface product used AND line striping completed attesting to the quality and workmanship of the installations.

H. Warranty certificates included in these specifications (including both **Manufacturers** and **Installers** warrantees).

I. Samples:
   1. Synthetic surface not less than 3 by 3 inch for each surface being bid. All samples shall represent the exact surface being bid.

J. Submit name of foreman and a list of previously installed project for owner inspection prior to start of work.

K. Certification Letter: After the installation of the markings, a licensed Professional Engineer or Registered Land Surveyor shall furnish to the Owner a certification letter, attesting to the accuracy of the markings and measurements that they meet the specified requirements. This submittal shall also include copies of the computations, calculations and drawings that were used to obtain this verification. The Engineer or Surveyor shall affix their stamp to the drawing and the certificate.

L. Statement of Supervision: Upon completion of the work, submit a written statement signed by the manufacturer stating that the field supervision of the manufacturer's representative was sufficient to ensure proper application of the materials, that the work was installed in accordance with the Contract Documents and that the installation is acceptable to the manufacturer.

M. Prior to final acceptance, the Contractor shall submit to the Owner three (3) copies of maintenance manuals, which will include all necessary instructions for the proper care and preventative maintenance of a synthetic surface.

N. Contractor is to provide certified statement in writing listing the overall quantity of rubber (total pounds of granules or strands) and tack coat/primer; and binder (total gallons) delivered to the job site and used in this project. Copy of shipping invoices shall be included with this statement.

1.4 PRE-INSTALLATION MEETINGS

A. Prior to the installation of the track system, the Owner and synthetic track surface installer shall meet to establish special requirements, proper sequence and method of installation including method of compaction of all materials to ensure proper installation

and drainage of all surfaces. The track surface installer shall sign-off on the bituminous base prior to the surface installation.

B. Prior to line striping, Contractor shall conduct a meeting, which shall include the Owner, the Contractor and the line striper to confirm all markings.

1.5 REFERENCE STANDARDS

A. The American Sports Builders Association (ASBA), formerly The United States Tennis Court and Track Builders Association (USTC&TBA).

B. The National Federation of State High School Associations.

1.6 QUALITY ASSURANCE

A. Install of synthetic surfacing shall be a current member in good standing with the **American Sports Builders Association** with specific qualifications in building and constructing tennis courts and running tracks. Approved installer of surfacing system shall be fully knowledgeable and completely experienced with the manufacturer and installation of running track surface systems for outdoor use. Installer **must** employ a **Certified Track Builder**, as conferred by the **American Sports Builders Association** as required by track surfacing manufacturer.

B. No part of the surfacing installation will be conducted during rainfall or when rain is imminent. After rainfall, sufficient time shall be given to allow the surface to dry thoroughly. Materials are to be only applied when ambient temperature is 50°F and rising.

1.7 WARRANTY

A. Request, receive and forward to the owner two (2) copies of a written warranty and guarantee from the manufacturer stating that all work executed under this section will be free from defects of material for a period of five (5) years from the date of project completion and that any defects will be remedied on written notice at no additional cost to the owner. This guarantee does not cover items damaged by improper use of vandalism as determined by the owner.
   1. The warranty submitted must have the following characteristics:
      a. Must provide full coverage for five (5) years from the date of substantial completion.
      b. Must warrant materials and workmanship.
      c. Warrantee must be provided by both installer and manufacturer and must ensure that the materials installed meet or exceed the product specifications.
      d. Must have a provision to either make a cash refund or repair or replace such portions.
      e. Guarantee the availability of replacement material for the synthetic surface system.
   2. The contractor shall provide the names of three (3) existing clients for whom significant after the sale service work has been performed or for whom the contractor has performed significant Track Surface Warranty Services.

B. Synthetic Surfacing: finished system shall meet following criteria:

1. Force Reduction: 30 percent to 50 percent, inclusive.
2. Modified Vertical Deformation: 0.6mm to 1.8mm, inclusive.
3. Resistant to scuffing and shedding of granules.

1.8 TESTING

A. The Owner shall reserve the right to request representative samples of the synthetic surfacing to an independent testing lab at any time during the length of the warranty to determine the chemical composition and performance characteristics. Tests will be made to confirm compliance with the project and manufacturer's specification of the synthetic surface system as submitted by the Contractor and accepted by the Owner.

B. The contractor will be responsible for paying for all testing of the synthetic surfacing to prove compliance. Any section of surface found not to be in compliance with the project or manufacturer's specifications shall be removed and replaced at the expense of the Contractor. Further testing of the synthetic surfacing, that has been replaced, will be done by an independent testing lab at the direction of the Owner and at the expense of the Contractor.

C. The samples shall be taken every 1,000 square yards. The sample size shall be approximately 6 by 6 inches. The samples of synthetic surfacing removed from the area for testing shall not be reinstalled. The Contractor shall follow manufacturer's specifications for replacing the surfacing within the core sample areas.

1.9 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
   1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
   1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
   2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
   3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
   4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
   5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
   6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
   7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 SYNTHETIC SURFACE

A. Any manufacturer's names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that "or equivalent" applies to all products denoted herein. It is understood that all manufacturers will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an equivalent. It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

B. The basis of design and acceptable manufacturer of synthetic surface shall be 13mm Polyurethane Basemat (Fisher Track Polymat 5k) with a Red-colored polyurethane and epdm structural spray wearing course (Polymat 10k).

C. All liquid products shall be supplied by one manufacturer. Acceptable equivalent systems include Rekortan BS, Beynon BSS100
   1. Court Patch Binder, shall be a 2-component polyurethane or approved equivalent for use with polyurethane tracks and approved by track surface manufacturer.
   2. Primer- A polyurethane based primer compatible with asphalt and synthetic track surfacing materials applied at .28lbs per square yard.
   3. Binder (Black) The Poly-Mat binding agent shall be a single component; MDI-based, moisture cure polyurethane binder. The polyurethane binder is to be 100% solids. The polyurethane binder shall be compatible with SBR and EPDM rubber granules.
      a. All polyurethane binder will be delivered in new unopened containers, clearly labeled by the manufacturer.
   4. Structural Spray Coating (red) The spray coating shall be, a water-based, pigmented aliphatic polyurethane, specifically formulated for compatibility with EPDM granules. The coating shall be the color red selected by the owner. Pigment intergraded in the field is not be allowed.
   5. Line Paint shall comply with all manufacturer's recommendations.
   6. SBR/EPDM Black Rubber. SBR/EPDM black rubber should be fully cured rubber granules that may either be ambient or cryogenically ground from post- industrial by-products to a size of not less than 1 nor more than 4mm. The general cut of the granules should be cubicle. They should contain less than 4% dust and be free of foreign debris. They should not contain any other color within the granule
   7. Colored EPDM Rubber Granules shall be as recommended and approved by the manufacturer. . Colored EPDM Rubber. Colored EPDM granules should be ground from fully cured virgin slabs of peroxide- or sulfur- cured rubber (the curing process must be compatible with the polyurethane chemicals being used). The EPDM content should be not less than 20%. The general cut of the granules should be cubicle and they should contain less than 4% dust. Colored EPDM Rubber (Structural Spray) red, the gradation of the granules should range from 0.5mm to a maximum of 3mm: Color shall be red.

PART 3 - EXECUTION

3.1 GENERAL

A. Allow asphalt pavement a minimum cure time of 21 days or longer as recommended by

manufacturer prior to installation of primer and synthetic surface over new asphalt pavement.

B. Prior to installation of the synthetic system, the entire base should be checked for planarity and surface tolerance. Any areas that vary +/- 1/4" measured with a 10' straightedge in any direction should be patched with a compound compatible with the asphalt or concrete base and approved by the track manufacturer.

C. After patching, the surface should not allow water to stand greater than 1/16” deep, one hour after rain has ended.

3.2 APPLICATION OF PRIMER

A. After all repairs have completely cured, Primer. Polyurethane surfacing should be the appropriate primer using spray equipment or rollers. Application rates range between 0.18 – 0.27 lbs. per square yard based on manufacturers specifications.

3.3 APPLICATION OF SYNTHETIC SURFACE

A. The rubber will be applied to achieve a dense uniform surface of not less than the specified thickness of ½” or 12.75 mm. The Binder must be evenly distributed amongst the rubber granules upon the application of materials. Coverage rates (measured in accordance with I.A.A.F. standards. The application will consist of specifically graded Black SBR rubber particles, or EPDM rubber particles and polyurethane binder.

B. Mixing. The rubber granules and polyurethane binder should be accurately measured and placed in a clean dry mixer and mixed until all granules are thoroughly coated with the polyurethane binder. No evidence of water may exist during the mixing process. The mixing ratio of rubber to binder should not be less than five (5) parts rubber to one (1) part binder as determined by the weight of the products. The pot life of the mix should not be less than 45 minutes. No agents are to be added to extend pot life.

C. Placement of Base Mat. The prepared material is placed evenly in front of the paving machine. The machine should be operated at a speed and with the screed bar at an angle to provide a tight and smooth surface, free of chatter marks and voids. The screed bars are to be constantly heated and should oscillate. Material should be placed at the specified depth in a single application and allowed to cure.

D. Trowel Work. All seams are to be troweled smooth within the pot life of the material. All edges should be straight and rounded by turning the trowel. All cold dry seams should be cut straight at an inward angle and primed prior to commencing with subsequent work.

3.4 APPLICATION OF ULTRAVIOLET RESISTENT COATING

A. After the appropriate amount of rubber and binder has been applied, Red Polyurethane and EPDM Structural Spray Coating at a total rate consistent with manufacturers recommendations.

3.5 LINE MARKING

A. Wait 48 hours after completion of surfacing before applying line marking.

B. Locate and establish all radius points.

C. Establish and set all necessary control points.

D. Layout all lines and markings to within a 1/2'" tolerances.

E. Provide all computations and measurements in an organized form.

F. Establish all locations on the curves using a transit or Theodolite capable of reading direct to 20 seconds.

G. All lines shall receive sufficient paint to assure opacity and uniformity of color.

H. Paints shall be used directly from original containers and shall be thinned only when hot temperatures dictate thinning for smooth applications.

I. Amount of paint used shall be as recommended by the manufacturer.

J. Competent, experienced and fully qualified personnel shall make all measurements.

K. The paint shall be 100% compatible with the manufacturers system. Line Paint made specifically for the painting of the lines on field events.

L. The markings shall include all events and marks required or recommended by the National Federation of State High Schools (Rhode Island).

3.6 CLEANUP AND MAINTENANCE

A. Upon completion of the work, the contractor shall remove all containers, surplus materials and debris. The site will be left in a clean and orderly manner acceptable to the Owner.

B. Clean entire area daily. All trash and job-related debris shall be removed from the site or stored in an approved dumpster at the end of each day's work. The location of any dumpsters shall be coordinated with the school department. Dumpsters shall be covered at all times other than to provide adequate capacity for job related debris at all times. Storage of job-related debris in locations other than dumpsters or approved staging areas shall not be permitted. Remove and dispose of all demolition materials, trash and debris except materials specifically designed to remain as property of the Owner in strict accordance with Local, State and Federal laws.

3.7 FIELD QUALITY CONTROL

A. The finished synthetic surface shall be tested for compliance with the above specifications. The following method shall be employed:

B. Five 6 by 6-inch test cuts shall be cut out of the finished synthetic surface by the Contractor, in the presence of the Owner.

C. The location of the test cuts shall be selected by the Owner and shall be located not less than 6 inches from the edge of the surface.

D. In the event that the above minimums are not achieved, the Contractor shall install additional materials until said minimums are achieved.

E. The Contractor shall repair the areas where the test cuts were made.

F. The Contractor shall conduct 60 thickness tests during the installation.

G. No part of the construction shall be conducted during rainfall or when rain is imminent.

H. Allow 4-5 hours to cure at least 70F. Lower temperature and higher temperature will increase the drying time.

I. Do not apply when surface temperature is above 130F.

J. Apply only when ambient temperature is 50F and rising.

K. Keep from freezing. Do not store in the hot sun.

L. Allow applications to thoroughly cure prior to subsequent applications.

M. Use caution when applying materials near adjacent areas. Mask of finished work on site when necessary to prevent over spray.

N. Allow new asphalt to cure for a minimum of 21 days.

End of Section

SECTION 32 31 13
CHAIN LINK FENCING AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related sections include the following:
1. Section 03 30 00 – Cast-In-Place Concrete
2. Section 31 00 00 – Earthwork
3. See Item 1.7 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Furnish labor, materials and equipment to include the total chain link fence and gate system of the style, strength, size and color defined herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Installation of fences, gates, framework, fabric, hardware and accessories.
2. Excavation for post bases.

C. This item may be affected by Add Alternates – refer to Plans for further information.

1.3 REFERENCES

A. ASTM Standards:
1. A392 – Zinc coated fence fabric (Class –1)
2. A491 – Aluminum Coated (Table 3)
3. F668 – PVC Coating (Class – 2b)
4. F934 – Color Black

B. Federal Standard (FS) RR-F-191 - Fencing, Wire and Post, Metal.

1.4 QUALITY ASSURANCE

A. Installation: ASTM F567

B. Qualifications: The foreman and laborers shall be thoroughly trained and experienced in the skills required to complete fence and gate, be completely familiar with the design and application of the work, be present at all times during the work and perform the work. The foreman shall have no less than 5 years minimum proven experience in the required installation techniques and desired results. Submit list of installations, indicating location, Owner, Architect/Engineer, date of installation, Contractor, and setting bed, for approval by the Architect.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 for all manufactured/fabricated items. All submittals must be prior to fabrication and/or field

installation work.

1. Shop drawings shall include plans, details, elevations and specifications and shall indicate profiles, sizes, dimensions, connection attachments, size and type of fasteners, accessories, and color and finish as indicated in these specifications and the plans.
2. Submit manufacturers printed product literature, specifications and data sheets.
3. Clearly indicate on the shop drawings any deviations from the plans and specifications.

B. Submit Contractor Qualifications as required under Quality Assurance section stated herein.

C. Submit warranty information of all manufactured/fabricated items as required under Warranty section stated herein.

D. Submit samples showing texture, finish and range of colors of all materials. Samples will establish the standard by which materials provided will be judged. Submit sample of fence post and fabric finish, color and gauges. Sample size to be 6” x 12” minimum.

E. Submit drawings and instructions of manufacturers/fabricators installation requirements.

F. Submit stamped shop drawings by a Structural Engineer currently registered in the state where the project is located for footings for all work in this Section. Drawings shall indicate approved materials in this Section.

G. Submit material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated herein, based on comprehensive testing of current material

H. Sustainable Design Submittals - if applicable

1.6 WARRANTY

A. Warranty shall be a minimum of 15 years. The entire fence system shall have a written 15 Year Warranty against rust and defects in workmanship and materials. In addition, the finish shall be warranted not to crack, chip, peel, or blister for the same period.

1.7 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”

1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:

1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for

requirements for temporary facilities.

4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 – PRODUCTS

2.1 GENERAL

A. Fabric, posts, gate frames, braces, rails, stretcher bars, truss rods, and tension wire shall be of steel. Gate hinges, post caps, stretcher bar bands, and other parts shall be of steel, malleable iron, ductile iron, or equal except that post tops and rails ends may be of aluminum. The manufacturer shall supply a notarized mill certification that all materials used have been tested and fully comply with the guidelines specified herein.

B. Temporary Construction Fence and Tree Protection Fence shall be 6’ ht chain link fence. Poly coating or painting is NOT required.

2.2 FRAMEWORK AND POSTS

A. Framework and posts shall be Deluxe Quality 40 weight round pipe, steel pipe cold-formed and welded per ASTM F1043, Group IC, with a minimum yield strength of 50,000 psi. The external zinc coating shall be Type B, zinc with polymer film, 0.90 oz/sq. ft. minimum zinc coating with a chromate conversion and a verifiable polymer film. The internal coating shall be Type B, zinc 0.90 oz./sq.ft. minimum or Type D, zinc pigmented, 81% nominal coating with 0.30 mils minimum thickness. All gate framework joints shall be welded and PVC fusion bonded. Color of all fence, gate and hardware components shall be Black.

B. Framework and posts shall be sized as follows:
   1. End, Corner, and Pull Post. Galvanized steel, minimum pipe sizes and weights as follows:
      a. Up to 6-foot fabric height: 2.875 – inch OD pipe, 4.64 lbs/lin. Ft. minimum.
      b. 7 and 8-foot fabric heights: 2.875-inch OD pipe, 4.64-lbs/lin. Ft. minimum.
      c. Maximum spacing 10’-0” On Center.
      d. 10-foot to 12-foot heights: 4-inch OD pipe, 6.56 lb/linear foot.
   2. Line Posts. Galvanized steel, minimum pipe sizes and weights as follows:
      a. Up to 6-foot fabric height: 2.375-inch OD steel pipe, 3.12-lbs./lin. Ft. minimum.
      b. 7 and 8- foot fabric height: 2.375-inch OD steel pipe, 3.12 lbs./lin. Ft. minimum
      c. Maximum Spacing 10’-0” On Center.
      d. 10-foot to 12-foot heights: 2.875-inch OD pipe, 4.64 lb/linear foot.
   3. Gate Posts. Galvanized steel, nominal gate widths, minimum pipe sizes and weights as follows:
      a. Up to and including 6 feet height with up to 6 foot gate leaves: 2.875” OD pipe minimum.
      b. Up to and including 6 feet height with over 6 foot gate leaves:

4" OD pipe minimum.

c. Over 6 feet up to 12 feet height with up to 6 foot gate leaves: 2.875" OD pipe minimum.

d. Over 6 feet up to 12 feet height with over 6 feet up to 12 foot gate leaves: 4" OD pipe minimum.

e. Over 6 feet up to 12 feet height with over 12 feet up to 18 foot gate leaves: 6.625" OD pipe minimum.

4. Rails (Top, middle, and bottom rails): galvanized steel, manufacturer's longest lengths joined by seven (7") long sleeves, rail shall run continuously along top of fence. Bottom rail shall be joined at line posts with boulevard clamps. Minimum pipe sizes and weights as follows:
   a. 1.660-inch OD pipe, 1.84 lbs. /lin. Ft. minimum.
5. Backstop Posts – shall be 32' exposed height with 6.5" outside diameter corner posts, 4.5" diameter line posts, 2.5" outside diameter horizontal rails. Refer to Plans.

2.3 FITTINGS

A. All fittings to be PVC fusion bonded color coated having a minimum thickness of 0.006" per ASTM F626. PVC color for all fittings to match fabric and framework. Moveable parts, nuts and bolts to be field coated with PVC liquid touch up after installation.
   1. Couplings: Expansion type, approximately six inches (6") long, install one sleeve for each 500-foot run. Standard couplings are installed at each rail end to form one continuous top rail.
   2. Attaching Devices: Provide fittings for attaching top rail securely to each gate corner pull and end post.
   3. Sleeves: Galvanized steel pipe not less than six inches (6") long and with inside diameter not less than ½ inch greater than outside diameter of the post pipe. Provide steel plate closure welded to bottom of sleeve of width and length not less than one inch (1") greater than outside diameter of sleeve.
   4. Post Brace assembly: Manufacturer's standard adjustable braces at end of gateposts and at both sides of corner and pull posts. Provide horizontal brace located at mid-height of fabric. Use same material as top rail for brace and truss to line posts with 3/8 inch diameter galvanized steel truss rods and adjustable tightener.
   5. Post Caps: Galvanized steel, weather-tight closure cap for each tubular post. Furnish caps with openings to permit passages of top rail.
   6. Rail ends: Galvanized pressed steel per ASTM F626, for connection of rails to post using a brace band.
   7. Tension Bars: galvanized steel, one-piece lengths equal to full height of fabric, with minimum cross-section of 3/16 inch x ¾ inch per ASTM F626. Provide tension bar for each gate and end post, and two for each corner and pull post. Stretcher Bar Bands will be manufacturer's standards.
   8. Gate Cross-Bracing: 3/8-inch diameter galvanized steel truss rods and adjustable tightener.
   9. Wire ties: 6-gauge aluminum tie wire for attachment of fabric to line posts and rails. Pre-formed hog ring ties to be 9 gauge galvanized steel or aluminum for attachment of fabric to tension wire. Tie wire and hog rings PVC coated and in compliance with ASTM F626. Color to match fabric color.
   10. Truss rod assembly: Galvanized steel minimum 5/16" diameter truss rod with pressed steel tightener, in accordance with ASTM F626.
   11. Carriage bolts and nuts: Galvanized of commercial quality.

2.4 FABRIC

A. All general site fence fabric shall consist of No. 9 gauge (0.148 inch core), 1-inch diamond mesh with the following additional requirements:
   1. Field and sporting fence fabric shall be installed on the inside or field side of the posts.
   2. Basketball courts – Fabric shall be installed on the inside or courtside of the posts.

B. All fabric shall receive top and bottom knuckled selvage.
   1. Galvanized/Aluminum Coated Fabric: All materials used shall conform to the requirements of ASTM A 392 Class 2, or ASTM A491. Except aluminum alloy items, shall conform to ASTM-B211, B221 and B429.
   2. Polyvinyl Chloride (PVC) Coated Fabric: Fence fabric shall be zinc coated in accordance ASTM A392 Class 1 or aluminum-coated in accordance with ASTM A 491 (Table 3). PVC coating shall be fusion bonded in accordance with ASTM F668 Class 2b. The color of the fabric shall be black and in accordance with ASTM F934.

2.5 SWING GATES

A. Fabricate chain link swing gates in accordance with ASTM F900. Gate frame to be of welded construction. Weld areas to be protected with zinc-rich paint per ASTM A780 then over coated with liquid PVC to match frame. The gate frame members are to be spaced no greater than 8'-0" apart horizontally or vertically. Exterior members to be 1.660" OD pipe, interior members when required shall be 1.660" OD pipe. Framing and chain link fabric shall match specification of fence system. Fabric to be stretched tightly and secured to vertical outer frame members using tension bar and beveled tension bands spaced 12" on center and tied to the frame members using 6-gauge galvanized steel ties.

B. Hardware
   1. Latch: Egress Panic Hardware with Key Locks: Panic Bar, if applicable, shall include kit including exit bar, adjustable mounting plate, receiver bracket, lock box and keys. Basis of Design: DAC Industries Superior Exit Bar Kit
   2. Self-Closing Hinges: All Hinges shall be capable of supporting gate leaf and allowing opening and closing without binding.
      Hinges, hot dip galvanized pressed steel or malleable iron, non-lift-off type hinge design shall permit gate to swing 180 degrees. Hinges shall be spring loaded. Basis of Design: Hoover Fence Co. Universal Chain Link Fence Gate Spring Hinge meeting gate post and frame size.
   3. Drop Rod for Double Gates: Provide galvanized heavy-duty lockable drop rod with ground sleeve set into concrete flush with surrounding pavements to secure gate in both open and closed position, refer to Detail. Drop rod shall be equipped to set in open or closed position and shall be designed so that it cannot be removed. Basis of Design: Nationwide Industries Commercial Pad Lockable Drop Rod.

C. Keeper to secure open leafs: Provide galvanized gate hold back keeper, <u>if applicable,</u> for each gate leaf over 5' wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full, open position.

D. Latch, hinges, moveable parts may be field coated with liquid PVC.

2.6 CHAIN LINK INTERNAL ALUMINUM CANTILEVER SLIDE GATE (if included)

A. Aluminum cantilever slide gates shall be of the internal roller design per ASTM F1184 Type II Class 2. Cantilever slide gate to be constructed of PVC color coated ASTM B221 aluminum members welded and designed for maximum structural integrity. Vertical external and internal members minimum 2" square spaced maximum 8'-0" on center. Gates having fabric greater than 8'-0" in height require a horizontal member. The top horizontal member shall be a one-piece precision extruded structural member having an integral enclosed track. Bottom horizontal member to be minimum 2" x 4". Adjustable diagonal trusses shall be installed in each gate panel to transfer the alternating forces as the gate slides. The gate opening portion shall be filled with chain link fabric stretched taut and secured to the frame members. Chain link fabric shall match the fence system specification. The overall gate structure shall be a minimum of 40% larger than the gate opening to support the cantilevered portion of the gate in the closed position with minimum deflection per ASTM F1184. The minimum 40% back frame does not require fence fabric. Single leaf cantilever design for openings larger than 30'-0" up to 40'-0" shall be fabricated by welding together two horizontal top structural/track members creating a dual track system. Single track gates up to 30'-0" opening require two support posts and two internal truck assemblies. Dual track gates over 30'-0" up to 40'-0" require two sets of dual posts and four internal truck assemblies.

B. Internal truck assemblies shall be capable of swiveling to accommodate gate movement and ensure full contact of the four support wheels and two guide wheels to the internal track surface. The galvanized steel truck assembly post bracket, truck assembly vertical support axle as well as the support wheels shall be designed to handle static and dynamic forces required to support and operate the gate. The truck assembly, support axle and internal wheels shall be comprised of stainless steel or galvanized steel components.

C. Galvanized steel bottom guide roller brackets containing two 3" rubber wheels shall be supplied to keep the bottom of the gate plumb and in proper alignment.

D. Single gates shall be supplied with a galvanized steel latch mechanism capable of securing the gate with a padlock accessible from either side. Double gates to have galvanized drop rod to hold inactive leaf and a latch mechanism capable of securing the gate with a padlock accessible from either side. Provide drop rod stop pipe or receiver to engage center drop rod.

E. Cantilever gate posts shall be 4" OD PVC coated. Single leaf cantilevers up to 30'-0" require three 4" OD posts, dual track single leaf cantilevers over 30'-0" up to 40'-0" require two sets of pre-fabricated dual 4" OD support posts and a 4" OD latch post. The gate is supported in the center of the dual posts.

2.7 POST SETTING MATERIALS

A. Concrete: As specified in Section 03 30 00.

B. Drive Anchors: Galvanized ASTM A36 steel drive anchor angle blades, 1.25" x1.25" x 30"-long secured to post with a pressed steel galvanized shoe clamp.

PART 3 – EXECUTION

3.1 FENCE INSTALLATION

A. Install new fabric, as indicated on drawings; accessories in accordance with ASTM F567.

B. Provide dimensions as shown and space line posts at intervals indicated.

C. Excavation: Excavate holes for concrete with vertical sides in cylindrical form.

D. Setting Posts:
1. Remove loose and foreign materials from sides and bottom of holes, and moisten soil prior to placing concrete.
2. Center and align posts.
3. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation.
4. Check each post for vertical and top alignment, and hold in position during placement.
5. Trowel tops of footings, and slope or dome to direct water away from posts.
6. Keep exposed concrete surfaces moist for at least seven (7) days after placement.

E. Concrete Strength:
1. Allow concrete to attain at least 75 percent of its minimum 28-day strength before rails, tension wire, and fabric are installed.
2. Do not, in any case, install such items in less than seven (7) days after placement of concrete.
3. Do not stretch and tension fabric and wire until concrete has attained its full design strength.
4. Provide top rail through line post tops and splice with six inch (6”) long rail sleeves.

F. Chain link fence shall have continuous top and bottom rails and middle rails if applicable per plans. Top and bottom edge of fence fabric shall have knuckled edges. Fabric shall be stretched uniformly taunt and tight as possible, true to line and grade and complete in all details. Install tension bars at corners.

G. All chain link fence fabric shall be fastened on the outside of the posts unless directed otherwise by the Owner or otherwise indicated in this specification. The fabric shall be properly stretched and securely fastened to the posts, and between posts the top and bottom of the fabric shall be fastened to end and corner posts with tension bars and stretcher bars bands spaced at twelve-inch (12”) intervals.

H. All fabric shall be aligned so that top row of the fabric mesh is tied to the top rail twelve inches (12”) on center and so that the bottom of the fabric mesh stands two inches (2”) maximum above finish grade or as indicated on plans, and that the bottom row of the fabric mesh is tied to the bottom rail every twelve inches (12”) on center. When applicable, all fabric shall be tied to the middle rail at twelve inches (12”) on center.

I. All fabric shall be fastened to all line posts and horizontal rails with 0.020” thickness, 200/300 series stainless steel ½” wide bands, with a minimum breaking strength of 850 lbs., ½” band capacity ear-lokt design buckles to be manufactured with 0.050” thick material, 201/301 series stainless steel. All bands shall be pulled tight and raw ends of steel bands shall be secured in buckle by folding ear tabs around steel bands as per manufacturer’s recommended installation procedure. No sharp edges shall protrude from band-it buckles. Band will be PVC coated, color to match fabric and framework.

J. Perimeter Fencing and Gates: Install fabric above finished grades per the Plans.

K. Touch up any nicks or scratches of the PVC color coating with liquid PVC paint.

L. Touch up any nicks or scratches on the posts or rails with a manufacturer's approved paint.

3.2 GATE INSTALLATION

A. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.

B. Touch up gate hardware with liquid PVC paint.

End of Section

SECTION 32 33 00
SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification section, apply to work of this section.

B. Related Sections: The following sections contain requirements that relate to this section.
1. Section 03 30 00 – Cast-in-Place Concrete
2. Section 32 13 13 – Concrete Paving
3. See Item 1.7 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. The scope of work includes providing all materials, equipment and labor necessary to complete the work as indicated on the drawings and as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Bike Rack
2. Flag Pole
3. Ornamental Bollard
4. Litter and Recycle Receptacle
5. Outdoor Bench (Type A and Type B)
6. Outdoor Picnic Table
7. Outdoor Gathering Table
8. Shade Structure
9. Rooftop Picnic Table
10. Rooftop Seat (Type A and Type B)
11. Rooftop Planters (Type A and Type B)

C. This item may be affected by Add Alternates – refer to Plans for further information.

1.3 WARRANTY

A. Provide Manufacturer's minimum of a two (2) year warranty against structural failure, material failure and manufacturing defects covering all levels of warranty for the equipment and components.

B. Warranty shall spell out what it does not cover.

1.4 QUALITY ASSURANCE

A. Manufacturer's warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry

standards and inspection requirements.

B. The installation of the Site Furnishings shall be by Contractor with a minimum of five (5) years of experience on similar projects. Evidence of this experience shall be submitted to the Owner's Representative for review and approval.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 for all manufactured/fabricated items. All submittals must be prior to fabrication and/or field installation work.
   1. Shop drawings shall include plans, details, elevations and specifications and shall indicate profiles, sizes, dimensions, connection attachments, size and type of fasteners, accessories, and color and finish as indicated in these specifications and the plans.
   2. Submit manufacturers printed product literature, specifications and data sheets.
   3. Clearly indicate on the shop drawings any deviations from the plans and specifications.

B. Submit Contractor Qualifications as required under Quality Assurance section stated herein.

C. Submit warranty information of all manufactured/fabricated items as required under Warranty section stated herein.

D. Submit samples showing texture, finish and range of colors of all materials. Samples will establish the standard by which materials provided will be judged.

E. Submit drawings and instructions of manufacturers/fabricators installation requirements.

F. Submit stamped shop drawings by a Structural Engineer currently registered in the state where the project is located for footings for all work in this Section. Drawings shall indicate approved materials in this Section.

G. Submit material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated herein, based on comprehensive testing of current materials.

H. Sustainable Submittals if applicable

1.6 DELIVERY, STORAGE AND HANDLING

A. All equipment, unless otherwise indicated, shall be furnished, assembled and installed by the contractor.

B. Deliver to site, store and protect products under provisions of Division 1.

C. Installation Documentation, Packing List and Maintenance Kits shall be supplied by the manufacturer for each component.

D. Do not store paint, paint additives or cleaners at site.

1.7 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
1. The Construction Manager is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 Any manufacturer’s names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that “or equivalent” applies to all products denoted herein. It is understood that all manufacturers will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an equivalent. It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

2.2 BIKE RACK

A. Bike Rack shall be Aluminum frame construction. Installation shall be embedded in-ground. Bike rack shall be powder-coated Hot Sauce Red. Bike rack shall accommodate two bicycles per rack.

B. Acceptable manufacturers include the following:
1. Street Furniture – Linea Bicycle Stand

2. Site Pieces – Monoline Standard Bike Rack, Model No. ML-STAND-19
3. Vestre – Forum, Model No. 2584-904C
4. Or equivalent

2.3 FLAG POLE

A. Flag Pole shall be cast aluminum with a clear anodized aluminum finish. Height shall be 45'. Flagpole shall be fitted with an internal halyard. Flagpole shall be able to withstand a minimum wind speed of 110 MPH without the flag. Pole shall have a seamless joint and a spun aluminum flash collar.

B. Acceptable manufacturers include the following:
1. Concord Industries – Model No. IRW45D82 - ACL
2. American Flagpole – Model No. IWW45D82-02
3. The Flagpole Company – Model No. IW4581882
4. Or equivalent.

2.4 ORNAMENTAL BOLLARD

A. Bollards shall have a steel post of a minimum of 4"-diameter (or square) with (or without) aluminum exterior sleeve. Bollard installation shall be embedded in-ground. Fasteners shall be stainless steel and tamper proof.
Acceptable manufacturers include the following:
1. Site Furniture – Linea Bollard
2. Landscape Forms – Stop Bollard
3. Or equivalent.

2.5 LITTER and RECYCLE RECEPTACLE

A. Litter and Recycle Receptacle shall be a dual receptacle. Receptacle shall be aluminum frame construction with minimum 18-gallon capacity for litter and recycle each. Receptacle shall have plastic liner included, keyed-cam lock, heavy-duty door hinge with swing limiter, and rain bonnet. Color and finish shall be Midnight Blue Powder-coated. Receptacle shall receive laser-cut patterns with 'RECYCLE' and logo on one side and 'TRASH' with litter logo on the other. Laser-cut insets shall be powder-coated Hot Sauce Red. Owner shall have final approval of colors prior to ordering. Receptacle shall be surface-mounted and all mounting hardware shall be tamper-proof.

B. Acceptable manufacturers include the following:
1. Street Furniture – Escola Bin Enclosure
2. Site Pieces – Monoline Litter Bin, Model No. ML-LGLITTER-DL
3. Forms and Surfaces – Transit Litter & Recycling Receptacle
4. Or equivalent

2.6 OUTDOOR BENCH – TYPE A and B

A. Outdoor Bench Type A shall be a 72" backless aluminum bench with end arms. Slats shall be aluminum with sublimation process and a Dark Walnut Finish. Frame shall be cast aluminum and shall be powder-coated Midnight Blue. Owner shall have final approval of colors prior to ordering. Bench shall be surface mounted

using tamper-proof stainless-steel hardware.

1. Acceptable manufacturers include the following:
    a. Street Furniture - Linea Bench
    b. Site Pieces – Monoline Flat Bench, Model No. ML-FLAT
    c. Landscape Forms - Austin Bench
    d. Forms and Surfaces - Cordia Bench
    e. Or equivalent.

B. Outdoor Bench Type B shall be a 72” backed aluminum bench with end arms. Slats shall be aluminum with sublimation process and a Dark Walnut Finish. Frame shall be cast aluminum and shall be powder-coated Hot Sauce Red. Owner shall have final approval of colors prior to ordering. Bench shall be surface mounted using tamper-proof stainless-steel hardware.

1. Acceptable manufacturers include the following:
    a. Street Furniture - Linea Bench
    b. Site Pieces – Monoline Backed Bench, Model No. ML-BENCH
    c. Landscape Forms - Austin Bench
    d. Forms and Surfaces - Cordia Bench
    e. Or equivalent.

C. Outdoor Bench Type C shall be a 72” backless aluminum bench **without** end arms. Outdoor Bench Type C shall be paired with Outdoor Picnic Table. Slats shall be aluminum with sublimation process and a Dark Walnut Finish. Frame shall be cast aluminum and shall be powder-coated Hot Sauce Red. Owner shall have final approval of colors prior to ordering. Bench shall be surface mounted using tamper-proof stainless-steel hardware.

2. Acceptable manufacturers include the following:
    a. Street Furniture - Linea Bench
    b. Site Pieces – Monoline Backed Bench, Model No. ML-BENCH
    c. Landscape Forms - Austin Bench
    d. Forms and Surfaces - Cordia Bench
    e. Or equivalent.

2.7 OUTDOOR PICNIC TABLE

A. Outdoor tables shall be 9’-4” long. Slats for table top shall be aluminum with sublimation process and a Dark Walnut Finish. Frame shall be cast aluminum and shall be powder-coated Midnight Blue. Owner shall have final approval of colors prior to ordering. Bench shall be surface mounted using tamper-proof stainless-steel hardware. Each table shall be installed with two (2) Outdoor Bench Type C. **Two picnic tables shall be Accessible with cantilevered top or shortened benches per Owner.**

B. Acceptable Manufacturers include the following:

1. Street Furniture – Linea Table
2. Site Pieces – Monoline Community Table Model No. ML-CMTADA-112
3. Streetlife – Model - Solid Picnic Set –SOL-PT-10 + SOL-PB-5 - 234
4. Or equivalent.

2.8 OUTDOOR GATHERING TABLE

A. Outdoor Gathering Table shall be Aluminum frame construction, round table top with attached seating. Table top shall be 42" in diameter. Seat slats shall be aluminum with sublimation process and a Dark Walnut Finish. Frame and table top shall be powder-coated Morning Mist Silver. Owner shall have final approval of colors prior to ordering. Bench shall be surface mounted using tamper-proof stainless-steel hardware. **Two picnic tables shall be Accessible with three seats.**

B. Acceptable Manufacturers include the following:
1. Site Pieces – Monoline Carousel Table Model No. ML-CT-4SEAT-RD
   a. ADA version: Site Pieces – Monoline Carousel Table Model No. ML-CT-3SEAT-RD
2. Streetlife – Model - Solid Picnic Set –SOL-PT-10 + SOL-PB-5 – 234
3. Landscape Forms – Carousel
4. Or equivalent.

2.9 SHADE STRUCTURE

A. Shade structure shall include steel post and frames. Roof shall be metal and style shall be sloped and structure shall be hexagonal in shape. Shelter shall have a 24' diameter. Roof shall be a standing seam metal roof, color shall be **Royal Blue** or as selected by owner. Post and frame color shall be **Red Baron** or as selected by owner. Interior of the roof shall be tongue and groove wood. Structure shall be equipped with a gutter system. Shade Structure shall be able to withstand a minimum wind speed of 90 MPH. Base plate covers shall be provided for all posts. A min of (1) post shall be equipped with electrical cutouts and outlets.

B. Acceptable manufacturers include the following:
1. Poligon - Hexagon Model No. HXE 24 with Metal Roof and T&G roof deck, square posts and a Poliguard gutter system.
2. Or Equivalent

C. Contractor shall submit shop drawings showing design, material, hardware, layout and dimensions. Contractor shall submit structural plans for cast in place footings stamped by a current licensed Structural Engineer in the state where the project is located. Upon completion, poles and posts shall be plumb and in proper alignment. Shade structures shall have minimum 5-year warranty.

2.10 ROOFTOP PICNIC TABLE

A. Rooftop Picnic Table shall be Outdoor tables shall be approximately 108" long by 72" wide. Table shall have extended end that can used for ADA accessibility. Rooftop Table shall be free-standing. Frame shall be hot-dipped galvanized steel and shall be powder-coated Gentian Blue. Owner shall have final approval of colors prior to ordering. Top shall be wood with dark brown stain to match a dark walnut color. Wood shall be a minimum of 4.0 on the Brinell Scale.

B. Acceptable Manufacturers include the following:
1. Site Furniture – Linea Table (with Linea benches)
2. Vestre – Stoop Picnic Table Model No. 2422

3. Landscape Forms – Gretchen Picnic Table
4. Or equivalent.

2.11 ROOFTOP SEAT – TYPE A and B

A. Rooftop Seat Type A shall be 40” x 40” square with a height of 16”. Seat shall be aluminum frame construction with thermally modified ash wood top. Seats shall be free-standing and shall come with plastic glides. Frame shall be powder-coated Midnight Blue. Owner shall have final approval of colors prior to ordering.

B. Acceptable Manufacturers include the following:
1. Site Pieces – Monoline Open Stool, Model No. ML-OST-SQ4016
2. Street Furniture – Linea Cube
3. Equiparc - EXA
4. Or equivalent.

C. Rooftop Seat Type A shall be 40” x 20” square with a height of 16”. Seat shall be aluminum frame construction with thermally modified ash wood top. Seats shall be free-standing and shall come with plastic glides. Frame shall be powder-coated Midnight Blue. Owner shall have final approval of colors prior to ordering.

D. Acceptable Manufacturers include the following:
1. Site Pieces – Monoline Open Stool, Model No. ML-OST-RECT4016
2. Street Furniture – Linea Cube
3. Equiparc - EXA
4. Or Equivalent

2.12 ROOFTOP PLANTER – TYPE A and B

A. Rooftop Planter Type A shall be 40” x 40” square with a height of 28.5”. Planter shall be aluminum frame construction. Pre-drilled drainage and irrigation holes shall be provided – this shall not be done by the Contractor and must come pre-drilled by the manufacturer. Planter shall be free-standing and shall be fitted with plastic glides or lockable wheels. Planters shall be powder-coated Hot Sauce Red. Owner shall have final approval of colors prior to ordering.

B. Acceptable Manufacturers include the following:
1. Site Pieces – Monoline Solid Series Planter, Model No. ML-SSPL-SQ4030
2. Street Furniture – Frame Planter
3. Or Equivalent

C. Rooftop Planter Type B shall be 40” x 20” rectangle with a height of 28.5”. Planter shall be aluminum frame construction. Pre-drilled drainage and irrigation holes shall be provided – this shall not be done by the Contractor and must come pre-drilled by the manufacturer. Planter shall be free-standing and shall be fitted with plastic glides or lockable wheels. Planters shall be powder-coated Bright White. Owner shall have final approval of colors prior to ordering.

D. Acceptable Manufacturers include the following:
1. Site Pieces – Monoline Solid Series Planter, Model No. ML-SSPL-

RECT4030
2. Street Furniture – Frame Planter
3. Or Equivalent

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall conform to the lines and dimensions shown on the approved shop drawings, where applicable, and the contract drawings.

B. Field stake locations of all mounted equipment in conformance with the plans for approval by Owner's Representative and the Landscape Architect. Owner's Representative and Landscape Architect may make field changes before approving layout at no additional cost to the Owner.

C. Verify all dimensions in the field and check work by other trades for conformance with the drawings before proceeding with the work. Report any discrepancies to the Owner before proceeding.

D. Deliver to the site all items necessary for completion of installation.

E. All prefabricated site furnishings shall conform to the manufacturers' recommendations for installation unless otherwise indicated.

F. Footings for Flag Pole, Bollards, and Shade Structure shall be cast-in-place concrete and as per the approved shop drawings stamped by a Registered Structural Engineer in the state where the project is located. Upon completion, poles shall be plumb and in proper alignment.

G. Site Furnishings shall be surface mounted, unless otherwise specified herein, to paving using manufacturer's approved anchoring devices. Contractor shall coordinate anchoring devices with pavement surfaces to ensure stable and secure mounting.

H. All furnishings shall be upon completion plumb and in proper alignment with adjacent paving and structures.

End of Section

SECTION 32 91 01
SOIL PREPARATION FOR LAWN ESTABLISHMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 31 00 00 – Earthwork
2. Section 32 92 19 – Seeding for Lawn Areas
3. See Item 1.7 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings or as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Loam from off-site, if on-site is insufficient
2. Loam Testing
3. Grading and Spreading Loam
4. Preparations of Seed Beds
5. Application of Soil Additives
6. Application of Turf Starter Fertilizer

1.3 QUALITY ASSURANCE

A. Contractor shall specialize in work outlined with a minimum of five (5) years of experience on similar projects.

B. Contractor shall not make substitutions without written approval. If specified materials are not available, obtain approval for substitution from the Owner's Representative.

C. All fertilizer applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Contractor shall notify the Owner’s Project Representative at least two weeks prior to scheduled application. A copy of the applicator’s license shall be given to the Owner’s Representative.

D. Pre-Construction Meeting – Contractor shall request in writing an on-site meeting with the Owner’s Representative, the General Contractor and Site Contractor and the Landscape Architect and the Civil Engineer to review the scope of work prior to any work taking place to review the subgrade conditions. Any deficiencies in the subgrade conditions shall be remedied by the contractor and approved by the Owner prior to any loam being spread.

E. Any loam stockpiles sitting beyond one growing season shall be covered. Contractor shall be responsible for complete removal and disposal of any weed seed established on loam stockpiles prior to placement and spreading of loam.

F. The materials shall not be handled or moved when in wet or frozen conditions.

G. Imported loam shall meet LEED Criteria as follows: Imported topsoils or soil blends designed to serve as topsoil may not include the following:
1. Soils defined regionally by the Natural Resources Conservation Service web soil survey (or local equivalent for projects outside the U.S.) as prime farmland, unique farmland, or farmland of statewide or local importance; or
2. Soils from other greenfield sites, unless those soils are a byproduct of a construction process.

1.4 SUBMITTALS

A. Samples shall be as follows:
1. The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard on-site stockpile of existing loam for testing. All stockpile sampling shall be per ASTM D 75 and Appendices.
2. Preparation of Samples: Contractor shall place these soil slices into a large, clean plastic container and mix thoroughly. Contractor shall take one cup of soil mixture and dry it room temperature (do not dry samples in an oven or on a stove or radiator). Once soil is dry, place soil in sandwich size type plastic bag and close. Label each sample on outside of bag, identifying sample by soil type and stockpile location and phase of construction.
3. Loam from off-site, if on-site loam is insufficient: The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard proposed stockpile of loam borrow for testing. All stockpile sampling shall be per ASTM D 75 and Appendices.

B. Contractor shall submit to the Owner’s Representative samples, manufacturer’s product data, source of off-site loam and certified testing of off-site loam at least 60 days prior to delivering material on site.

C. Contractor shall submit to the Owner’s Representative samples and certified test results for on-site loam 60 days prior to using material to allow for reformulation and retesting if test results are rejected.

D. Contractor shall submit to the Owner’s Representative certified test results for loam with added amendments 60 days prior to using material to allow for reformulation and retesting if test results are rejected.

E. Testing: Testing shall be as follows:
1. General
a. On-site stockpiled loam shall be tested at the beginning of each phase of construction prior to its use in its respective phase.
b. Contractor shall provide current certified test results for off-site, imported loam to be used on the project prior to use. Testing date shall be within the current year the loam is to be used on the project.

c. Contractor shall provide current certified test results of all soil amendments including organic compost and soil additives prior to use. Testing date shall be within the current year the loam is to be used on the project.
d. All testing and re-testing shall be at the expense of the Contractor. Contractor shall deliver samples to an independent testing facility such as the University of Mass Experiment Station and have the results forwarded to the Owner's Representative for review and approval prior to using the material.
e. Samples for tests shall be taken from on-site stockpiles in the presence of the Owner's Representative.

2. Testing reports shall include the following tests and recommendations:
a. Percent organic matter by weight as determined by the loss on ignition of samples that have been oven dried to a constant weight at temperature of 105 degrees C.
b. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System.
c. Chemical Analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Lead, Zinc, Soluble Salts, extractable Aluminum, Cadmium, Copper, pH and buffer pH, carbon nitrogen ratio and toxic elements. Except where otherwise noted, nutrient tests shall be for available nutrients.
d. Soil analysis tests shall show recommendations for soil additives to correct soils to meet the specifications and for additives necessary to accomplish lawn and planting work as specified.
e. Certified analysis, manufacturer, labels and source of organic compost and soil additives shall be submitted.

1.5 DEFINITIONS

A. The following definitions shall apply to the work of this section.

The following size distributions of mineral particles by diameter and sieve size shall apply to the following conventional names of soil types:

Conventional Name	Retained on US Sieve No.	Diameter (mm)
Very Coarse Sand	#18	1-2
Coarse Sand	#35	0.5-1
Medium Sand	#60	0.25-0.5
Fine Sand	#140	0.10-0.25
Very Fine Sand	#270	0.05-0.10
Silt	by hydrometer	0.002-0.05
Clay	by hydrometer	Less than 0.002

1.6 PRODUCT DELIVER, STORAGE AND HANDLING

A. Protect all products from weather vandalism or other damaging or deteriorating conditions.

1.7 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."
   1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
   1. Division 01 Section "Substitution Procedures" for NE-CHPS substitution procedures.
   2. Division 01 Section "Submittal Procedures" for NE-CHPS submittal requirements.
   3. Division 01 Section "Construction Controls and Temporary Facilities" for requirements for temporary facilities.
   4. Division 01 Section "Product Requirements" for additional NE-CHPS submittal requirements.
   5. Division 01 Section "Construction Waste Management and Disposal" for waste management, recycling and disposal.
   6. Division 01 Section "Sustainable Design Requirements" for general procedures for compliance with NE-CHPS prerequisites and credits.
   7. Division 01 Section "Construction Indoor Air Quality (IAQ) Management Plan" for material and procedure requirements.

PART 2 - PRODUCTS

2.1 CLEAN SCREENED LOAM

A. Loam shall consist of screened fertile, loose, friable sandy loam with no admixture of refuse or any natural or introduced materials toxic to plant growth and free of subsoil, refuse, stumps, roots, rocks, cobbles, stones, brush, clay lumps, noxious weeds, litter and other deleterious materials. Loam shall not come from USDA-classified prime farmland.

B. Loam shall be one of the following sandy loams: "coarse sandy loam", "sandy loam", "fine sandy loam" based on the USDA Classification System determined by mechanical analysis ASTM D-422. It shall be uniform in composition, without admixture of subsoil. The loam shall possess good filtration and permeability rates, and shall possess a mechanical analysis where:

		Percent Passing	
Millimeter	US Sieve Size	Max.	Min.
	¾"		100
	½"		95
6.35	¼"	100	85
2	#10		70
1	#18		50
0.595	#30		40
0.25	#60		40
0.149	#100	30	25
0.074	#200		<30

0.053	#270	SIlt	<25
.002	2Um	Clay	<20

In addition, soil shall have the following Sand, Silt and Clay content:

Sand (0.05 to 2.0 mm)	60% - 70% with no less than 70% of the sand in the medium through very coarse sand fractions (0.25 – 1 mm)
Silt (0.002 to 0.05 mm)	15%-25%
Clay (< 0.002)	10%-20%
Gravel (> 2.0 mm)	<15%

1. One hundred percent shall pass a 1/2” inch sieve opening.
2. On-site and off-site loam shall be screened to achieve the above specified sieve analysis.
3. Organic matter in approved planting soil shall be between 3% minimum and 5% maximum by weight as determined by the loss on ignition of samples that have been oven dried to a constant weight at temperature of 105 degrees C.
4. Acidity range of planting soil shall be 6 to 7 pH when tested according to methods of testing or A.O.A.C.
   a. When pH of loam borrow is equal to or greater than the maximum use aluminum sulfate to adjust pH to required levels.
   b. When pH of loam borrow is less than the minimum required use either sulfur or ferrous sulfate to adjust pH to required levels.

C. Soluble salt content shall be less than 100 PPM.

D. Loam shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. Topsoil shall not have extractable aluminum greater than 200 parts per million unless otherwise noted. Cation Exchange Capacity (CEC) shall be between 10 and 15.

2.2 ORGANIC COMPOST

A. Organic Compost shall be natural or manufactured mature, composted organic material. Only Federal EPA Class A or Rhode Island Type I compost products shall be used. The following shall be requirements shall be met:

1. Compost shall originate from mature leaf compost, mature composted animal manure, other aged, composted vegetable materials such as brewer’s waste, or chemically tested toxin-free processed sludge products (biosolids).
2. Test results shall indicate maturity and age of organic compost. Raw un-composted or unprocessed or incompletely composted organic matter shall be rejected.
3. Organic matter manufactured from sludge and other biowaste materials or manure, shall be aged for at least one (1) year without exception and shall have no biowaste odor.

4. Compost shall contain no uncomposted bulking agents such as uncomposted wood chips and shall be free from hard lumps and free from seeping water when handled.
5. Compost shall be free from sticks, stones, plastic, debris or other substances which would be injurious to healthy plant growth. 100% of compost material shall pass a ½" sieve.
6. Acidity range shall be pH 6 minimum and 8 maximum when tested according to methods of testing or A.O.A.C.
7. Organic matter shall not be less than 30% as determined by ASTM D2974.
8. Moisture content of 35% to 70%, as determined by ASTM D2974
9. Carbon:Nitrogen ratio of 15:1 to 30:1
10. Solvita intex of 6 to 8
11. Non-phytotoxic
12. There shall be no unpleasant or detectable odor of ammonia or hydrogen sulfide, which would indicate immature compost. Color of compost shall be dark brown.

2.3 SOIL ADDITIVES

A. Limestone for adjustment of soil pH shall be agricultural grade ground dolomitic limestone containing up to 50% magnesium carbonate in a dry, granular form. Limestone shall be ground to such a fineness that at least 50% will pass through a 100-mesh sieve and 90% to 100% will pass through a 20-mesh sieve.

B. Aluminum Sulfate for adjustment of soil pH shall be commercial sulfur, unadulterated, 57% and delivered in containers with the name of the manufacturer, material analysis and net weight appearing on each container.

C. Lawn Starter and Maintenance Fertilizer:
1. Fertilizer shall be a complete commercial product complying with the State and Federal fertilizer laws. Fertilizer shall be pelletized. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. At least 50% by weight of the nitrogen content shall be derived from organic materials. Fertilizer shall contain not less than the percentages of weight of ingredients as follows or as recommended by the soil analysis:

Nitrogen	10%
Phosphorus	20%
Potash	10%

2. Adjust nitrogen type and analysis for spring growth and slow release in fall.

3. Number of Applications and Application Rate: Per manufacturer's instructions and as recommended by soil test results.

D. Sand shall be a coarse sand meeting ASTM D 422.

Sieve size	Percent passing
¼"	100%
#4	99%

#10	65%
#20	35%
#40	<30%
#60	<15%
#100	2-10%
No. 200	1-5%

E. Bone Meal: shall be fine ground, steam cooked, packing house bone with a minimum analysis of 23% phosphoric acid and 4% nitrogen.

F. Gypsum: shall be agricultural grade, granular form. Gradation shall conform to the following:

Sieve Designation	Percent Passing By Weight
No. 8 (2.36mm)	100
No. 16 (1.18mm)	97
No. 30 (0.60mm)	82
No. 50 (0.30mm)	46
No. 100(0.15mm)	21

2.4 WATER

A. Clean, fresh potable water free of salt and other impurities injurious to vegetation.

PART 3 - EXECUTION

3.1 MIXING LOAM AND AMENDMENTS

A. Thoroughly mix the Loam and Compost at a rate yielding an organic content and pH specified in Section 2.1, B. herein.

B. The Loam/Compost mix shall be fully and thoroughly blended.

C. Soil Additives: All required materials shall be spread and distributed into the soil at rates and amounts specified herein.

D. Contractor shall amend loam with organic compost and soil additives to meet requirements in these specifications and only after approval of amended soil test results shall amended loam be spread.

3.2 GRADING AND SPREADING OF LOAM/COMPOST MIX

A. Prior to any spreading of loam, it is the responsibility of the Contractor to request a meeting with the Owner's Representative and the Landscape Architect to review and approve the subgrade condition. Subgrade shall meet the requirements outlined in Section 31 00 00 – Earthwork and the following.

B. Remove all debris and other inorganic materials on any prepared subgrades, and

reshape and dress any damaged or eroded slopes, swales, and other areas. Scarify and loosen subgrade to a friable condition in any areas where compaction may have occurred. Fill all depressions in existing grades with suitable fill material as specified in Section 31 00 00-Earthwork prior to spreading loam, then shape and finish grade to depth of loam required. Loam shall not be placed until subgrade is in suitable condition and free of excessive moisture or frozen materials.

1. Landscape Architect shall review compaction testing of subgrades in all landscape areas. The degree of compaction for subgrade in landscape areas shall be 90%.

C. Loam/Compost shall not be placed until subgrade is in suitable condition and free of excessive moisture or frozen materials.

D. Loam/Compost mix shall be spread as required to produce a total depth of six (6) inches after spreading, raking and rolling for seeded areas at the locations shown on the Plans.

E. Area shall be progressively fine graded and machine and hand raked, with loam added as required to correct depressions and other irregularities, to produce smooth and unbroken finish grades and the depth of loam required.

F. Finish grades shall conform to lines, grades, sections, and shapes of lawn areas as required to meet design intent on Plans. Provide positive drainage. Provide smooth, uniform, rounded transitions at all changes and break in grade.

1. Loam for seeded areas shall be a consistent depth of 1/2" below adjacent pavements surfaces.
2. Loam for sodded areas shall be placed so that top of sod is a consistent depth of ½” below adjacent pavement surfaces.

G. Starter fertilizers: All required materials shall be spread and distributed into the soil at rates and amounts specified herein.

3.3 PREPARATION OF AREAS FOR SEEDING AND SODDING

A. GENERAL DESCRIPTION: This work shall consist of the preparation of the soil bed. Work shall be done as described herein:

1. Areas shall be finely raked to a finished grade. Material ½” or greater in any dimension shall be removed and disposed of per the contract specifications.
2. Where the soil has become compacted, prior to fine raking, areas shall be scarified by discing, york raking, or other approved method to a minimum depth of two (2) inches.
3. Where the soil is loose and soft, prior to fine raking, areas shall be lightly rolled and soil added as required to meet finished grades.
4. No seeding or sodding will be permitted on areas where the soil bed has not been prepared per the specification.
5. Any debris that falls on paved or other hardscape areas shall be removed by the Contractor.
6. Prior to any seeding or sodding operations, it is the responsibility of the Contractor to request in writing a meeting with the Owner’s Representative and the Landscape Architect to review and approve the soil bed.

3.4 APPLICATION OF LIMESTONE

A. When applied dry, limestone shall be spread evenly and incorporated thoroughly

into the soil by discing or other approved means.

B. When applied hydraulically, no discing will be necessary.

C. Granular treatment to be applied at the rate required by soil pH test to produce a pH required per this specification.

3.5 APPLICATION OF STARTER FERTILIZER

A. Application Rate: Refer to Section 2 in this specification.

B. Contractor shall notify the Owner's Project Representative at least two weeks prior to scheduled application. Contractor shall obtain approval in writing by the Owner's Representative.

End of Section

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Section 32 91 02
SOIL PREPARATION FOR RAIN GARDENS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 31 00 00 – Earthwork
2. Section 32 92 20 – Seeding for Non-Lawn Areas
3. Section 32 93 00 – Plants
4. See Item 1.7 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings, or as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Loam from off-site, if on-site is insufficient
2. Loam Testing
3. Mixing of Sand, Loam and Compost
4. Grading and Spreading of Soil Mix

1.3 QUALITY ASSURANCE

A. Contractor shall specialize in work outlined with a minimum of five (5) years of experience on similar projects.

B. Contractor shall not make substitutions without written approval. If specified materials are not available, obtain approval for substitution from the Owner's Representative.

C. Pre-Construction Meeting – Contractor shall request in writing an on-site meeting with the Owner’s Representative, the General Contractor and Site Contractor and the Landscape Architect and the Civil Engineer to review the scope of work prior to any work taking place to review the subgrade conditions. Any deficiencies in the subgrade conditions shall be remedied by the contractor and approved by the Owner prior to any loam being spread.

D. All fertilizer applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Notify the Owner’s Project Representative at least two weeks prior to scheduled application. A copy of the applicator’s license shall be given to the Owner’s Representative.

E. Any loam stockpiles sitting beyond one growing season shall be covered. Contractor shall be responsible for complete removal and disposal of any weed seed established on loam stockpiles prior to placement and spreading of loam.

F. The materials shall not be handled or moved when in wet or frozen conditions.

G. Imported loam shall meet LEED Criteria as follows: Imported topsoils or soil blends designed to serve as topsoil may not include the following:
   1. Soils defined regionally by the Natural Resources Conservation Service web soil survey (or local equivalent for projects outside the U.S.) as prime farmland, unique farmland, or farmland of statewide or local importance; or
   2. Soils from other greenfield sites, unless those soils are a byproduct of a construction process.

1.4 SUBMITTALS

A. Samples shall be as follows:
   1. The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard on-site stockpile of existing loam for testing. All stockpile sampling shall be per ASTM D 75 and Appendices.
   2. Preparation of Samples: Contractor shall place these soil slices into a large, clean plastic container and mix thoroughly. Contractor shall take one cup of soil mixture and dry it room temperature (do not dry samples in an oven or on a stove or radiator). Once soil is dry, place soil in sandwich size type plastic bag and close. Label each sample on outside of bag, identifying sample by soil type and stockpile location and phase of construction.
   3. Loam from off-site, if on-site loam is insufficient: The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard proposed stockpile of loam borrow for testing. All stockpile sampling shall be per ASTM D 75 and Appendices.

B. Contractor shall submit to the Owner's Representative samples, manufacturer's product data, source of off-site loam and certified testing of off-site loam at least 60 days prior to delivering material on site.

C. Contractor shall submit to the Owner's Representative samples and certified test results for on-site loam 60 days prior to using material to allow for reformulation and retesting if test results are rejected.

D. Contractor shall submit to the Owner's Representative certified test results for loam with added amendments 60 days prior to using material to allow for reformulation and retesting if test results are rejected.

E. Testing: Testing shall be as follows:
   1. General
      a. On-site stockpiled loam shall be tested at the beginning of each phase of construction prior to its use in its respective phase.
      b. Contractor shall provide current certified test results for off-site, imported loam to be used on the project prior to use. Testing date shall be within the current year the loam is to be used on the project.
      c. Contractor shall provide current certified test results of all soil amendments including organic compost and soil additives prior

to use. Testing date shall be within the current year the loam is to be used on the project.

d. All testing and re-testing shall be at the expense of the Contractor. Contractor shall deliver samples to an independent testing facility such as the University of Mass Experiment Station and have the results forwarded to the Owner's Representative for review and approval prior to using the material.

e. Samples for tests shall be taken from on-site stockpiles in the presence of the Owner's Representative.

2. Testing reports shall include the following tests and recommendations:

a. Percent organic matter by weight as determined by the loss on ignition of samples that have been oven dried to a constant weight at temperature of 105 degrees C.

b. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System.

c. Chemical Analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Lead, Zinc, Soluble Salts, extractable Aluminum, Cadmium, Copper, pH and buffer pH, carbon:nitrogen ratio and toxic elements. Except where otherwise noted, nutrient tests shall be for available nutrients.

d. Soil analysis tests shall show recommendations for soil additives to correct soils to meet the specifications and for additives necessary to accomplish lawn and planting work as specified.

e. Certified analysis, manufacturer, labels and source of organic compost and soil additives shall be submitted.

1.5 DEFINITIONS

A. The following definitions shall apply to the work of this section.

The following size distributions of mineral particles by diameter and sieve size shall apply to the following conventional names of soil types:

Conventional Name	Retained on US Sieve No.	Diameter (mm)
Very Coarse Sand	#18	1-2
Coarse Sand	#35	0.5-1
Medium Sand	#60	0.25-0.5
Fine Sand	#140	0.10-0.25
Very Fine Sand	#270	0.05-0.10
Silt	by hydrometer	0.002-0.05
Clay	by hydrometer	Less than 0.002

1.6 PRODUCT DELIVER, STORAGE AND HANDLING

A. Protect all products from weather vandalism or other damaging or deteriorating conditions.

1.7 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and

procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."

1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section "Substitution Procedures" for NE-CHPS substitution procedures.
2. Division 01 Section "Submittal Procedures" for NE-CHPS submittal requirements.
3. Division 01 Section "Construction Controls and Temporary Facilities" for requirements for temporary facilities.
4. Division 01 Section "Product Requirements" for additional NE-CHPS submittal requirements.
5. Division 01 Section "Construction Waste Management and Disposal" for waste management, recycling and disposal.
6. Division 01 Section "Sustainable Design Requirements" for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section "Construction Indoor Air Quality (IAQ) Management Plan" for material and procedure requirements.

PART 2 - PRODUCTS

2.1 CLEAN SCREENED LOAM

A. Loam shall consist of screened fertile, loose, friable fine sandy loam or sandy loam free of subsoil, refuse, stamps, roots, rocks, cobbles, stones, brush, noxious weeds, litter and other materials which are larger than one inch (1") in any dimension and which will prevent healthy plant growth.

B. Loam shall be one of the following sandy loams: "coarse sandy loam", "sandy loam", "fine sandy loam" based on the USDA Classification System determined by mechanical analysis ASTM D-422. It shall be uniform in composition, without admixture of subsoil. The loam shall possess good filtration and permeability rates, and shall possess a mechanical analysis where:

		Percent Passing	
Millimeter	US Sieve Size	Max.	Min.
	¾"		100
	½"		95
6.35	¼"	100	85
2	#10		70
1	#18		50
0.595	#30		40
0.25	#60		40
0.149	#100	30	25

0.074	#200		<30
0.053	#270	SIlt	<25
.002	2Um	Clay	<20

1. One hundred percent shall pass a 3/4 inch sieve opening, and the maximum retained on the quarter inch sieve shall be 20 percent by weight of the total sample.
2. On-site and off-site loam shall be screened to achieve the above specified sieve analysis.
3. Organic matter in approved planting soil shall be between 3% minimum and 5% maximum by weight as determined by the loss on ignition of samples that have been oven dried to a constant weight at temperature of 105 degrees C.
4. Acidity range of planting soil shall be 5.5 to 6.5 pH when tested according to methods of testing or A.O.A.C.
   a. When pH of loam borrow is equal to or greater than the maximum use aluminum sulfate to adjust pH to required levels.
   b. When pH of loam borrow is less than the minimum required use either sulfur or ferrous sulfate to adjust pH to required levels.

C. Soluble salt content shall be less than 100 PPM.

D. Loam shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. Topsoil shall not have extractable aluminum greater than 200 parts per million unless otherwise noted. Cation Exchange Capacity (CEC) shall be between 10 and 15.

2.2 ORGANIC COMPOST

A. Organic Compost shall be natural or manufactured mature, composted organic material. Only Federal EPA Class A or Rhode Island Type I compost products shall be used. The following shall be requirements shall be met:
1. Compost shall originate from mature leaf compost, mature composted animal manure, other aged, composted vegetable materials such as brewer's waste, or chemically tested toxin-free processed sludge products (biosolids).
2. Test results shall indicate maturity and age of organic compost. Raw uncomposted or unprocessed or incompletely composted organic matter shall be rejected.
3. Organic matter manufactured from sludge and other biowaste materials or manure, shall be aged for at least one (1) year without exception and shall have no biowaste odor.
4. Compost shall contain no uncomposted bulking agents such as uncomposted wood chips and shall be free from hard lumps and free from seeping water when handled.
5. Compost shall be free from sticks, stones, plastic, debris or other substances which would be injurious to healthy plant growth. 100% of compost material shall pass a ½" sieve.
6. Acidity range shall be pH 6 minimum and 8 maximum when tested according to methods of testing or A.O.A.C.
7. Organic matter shall not be less than 30% as determined by ASTM

D2974.

8. Moisture content of 35% to 70%, as determined by ASTM D2974
9. Carbon:Nitrogen ratio of 15:1 to 30:1
10. Solvita intex of 6 to 8
11. Non-phytotoxic
12. There shall be no unpleasant or detectable odor of ammonia or hydrogen sulfide, which would indicate immature compost. Color of compost shall be dark brown.

2.3 SAND

A. Sand shall be a coarse sand meeting ASTM D 422.

B.

Sieve size	Percent passing
2”	100%
¾”	100%
¼”	50-80%
No. 40	15-40%
No. 200	0-3%

PART 3 - EXECUTION

3.1 MIXING OF LOAM, SAND AND COMPOST

A. Thoroughly mix the Loam, Sand and Compost at the following percentages for Raingardens*)*:

40% Sand
20-30% Loam
30-40% Compost
Percentages are by volume

B. The Loam/Compost mix shall be fully and thoroughly blended.

3.2 GRADING AND SPREADING OF SOIL MIX

A. Prior to any spreading of loam, it is the responsibility of the Contractor to request a meeting with the Owner’s Representative and the Landscape Architect to review and approve the subgrade condition. Subgrade shall meet the requirements outlined in Section 31 00 00 – Earthwork and the following.

B. Remove all debris and other inorganic materials on any prepared subgrades, and reshape and dress any damaged or eroded slopes, swales, and other areas. Scarify and loosen subgrade to a friable condition in any areas where compaction may have occurred. Fill all depressions in existing grades with suitable fill material as specified in Section 31 00 00-Earthwork prior to spreading loam, then shape and finish grade to depth of loam required. Loam shall not be placed until subgrade is in suitable condition and free of excessive moisture or frozen materials.

1. Landscape Architect shall review compaction testing of subgrades in all landscape areas. The degree of compaction for subgrade in landscape areas shall be 90%.

C. Loam/Compost shall not be placed until subgrade is in suitable condition and free

of excessive moisture or frozen materials.

D. Planting mixes for raingarden areas shall be spread to produce a total depth of 12" or as otherwise shown on the plan. Fill all depressions in existing grades with suitable fill material as specified in Section 31 00 00 - Earthwork prior to spreading of loam/compost mix, then shape and finish grade to depth required.

E. Prior to any seeding operations, it is the responsibility of the Contractor to request in writing a meeting with the Owner's Representative and the Landscape Architect to review and approve the soil bed.

F. Any debris that falls on paved or other hardscape areas shall be removed by the Contractor.

End of Section

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Section 32 91 03
SOIL PREPARATION FOR TREES AND PLANTING BEDS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 01 56 39 – Temporary Tree and Plant Protection
2. Section 31 00 00 – Earthwork
3. Section 32 93 00 – Plants
4. See Item 1.7 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings, or as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Loam from off-site, if on-site is insufficient
2. Testing
3. Mixing of Loam and Compost
4. Grading and Spreading of Loam/Compost Mix
5. Application of Limestone
6. Application of Fertilizer
7. Application of Jute Mesh

C. This item may be affected by Add Alternates – refer to Plans for further information.

1.3 QUALITY ASSURANCE

A. Contractor shall specialize in work outlined with a minimum of five (5) years of experience on similar projects.

B. Contractor shall not make substitutions without written approval. If specified materials are not available, obtain approval for substitution from the Owner's Representative.

C. All fertilizer applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Notify the Owner’s Project Representative at least two weeks prior to scheduled application. A copy of the applicator’s license shall be given to the Owner’s Representative.

D. Pre-Construction Meeting – Contractor shall request in writing an on-site meeting with the Owner’s Representative, the General Contractor and Site Contractor and

the Landscape Architect and the Civil Engineer to review the scope of work prior to any work taking place to review the subgrade conditions. Any deficiencies in the subgrade conditions shall be remedied by the contractor and approved by the Owner prior to any loam being spread.

E. Any loam stockpiles sitting beyond one growing season shall be covered. Contractor shall be responsible for complete removal and disposal of any weed seed established on loam stockpiles prior to placement and spreading of loam.

F. The materials shall not be handled or moved when in wet or frozen conditions.

G. Imported loam shall meet LEED Criteria as follows: Imported topsoils or soil blends designed to serve as topsoil may not include the following:
1. Soils defined regionally by the Natural Resources Conservation Service web soil survey (or local equivalent for projects outside the U.S.) as prime farmland, unique farmland, or farmland of statewide or local importance; or
2. Soils from other greenfield sites, unless those soils are a byproduct of a construction process.

1.4 SUBMITTALS

A. Samples shall be as follows:
1. The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard on-site stockpile of existing loam for testing. All stockpile sampling shall be per ASTM D 75 and Appendices.
2. Preparation of Samples: Contractor shall place these soil slices into a large, clean plastic container and mix thoroughly. Contractor shall take one cup of soil mixture and dry it room temperature (do not dry samples in an oven or on a stove or radiator). Once soil is dry, place soil in sandwich size type plastic bag and close. Label each sample on outside of bag, identifying sample by soil type and stockpile location and phase of construction.
3. Loam from off-site, if on-site loam is insufficient: The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard proposed stockpile of loam borrow for testing. All stockpile sampling shall be per ASTM D 75 and Appendices.

B. Contractor shall submit to the Owner’s Representative samples, manufacturer’s product data, source of off-site loam and certified testing of off-site loam at least 60 days prior to delivering material on site.

C. Contractor shall submit to the Owner’s Representative samples and certified test results for on-site loam 60 days prior to using material to allow for reformulation and retesting if test results are rejected.

D. Contractor shall submit to the Owner’s Representative certified test results for loam with added amendments 60 days prior to using material to allow for reformulation and retesting if test results are rejected.

E. Testing: Testing shall be as follows:
1. General

a. On-site stockpiled loam shall be tested at the beginning of each phase of construction prior to its use in its respective phase.
b. Contractor shall provide current certified test results for off-site, imported loam to be used on the project prior to use. Testing date shall be within the current year the loam is to be used on the project.
c. Contractor shall provide current certified test results of all soil amendments including organic compost and soil additives prior to use.
d. All testing and re-testing shall be at the expense of the Contractor. Contractor shall deliver samples to an independent testing facility such as the University of Mass Experiment Station and have the results forwarded to the Owner's Representative for review and approval prior to using the material.
e. Samples for tests shall be taken from on-site stockpiles in the presence of the Owner's Representative.

2. Testing reports shall include the following tests and recommendations:
a. Percent organic matter by weight as determined by the loss on ignition of samples that have been oven dried to a constant weight at temperature of 105 degrees C.
b. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System.
c. Chemical Analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Lead, Zinc, Soluble Salts, extractable Aluminum, Cadmium, Copper, pH and buffer pH, carbon:nitrogen ratio and toxic elements. Except where otherwise noted, nutrient tests shall be for available nutrients.
d. Soil analysis tests shall show recommendations for soil additives to correct soils to meet the specifications and for additives necessary to accomplish lawn and planting work as specified.
e. Certified analysis, manufacturer, labels and source of organic compost and soil additives to be provided.

1.5 DEFINITIONS

A. The following definitions shall apply to the work of this section:

The following size distributions of mineral particles by diameter and sieve size shall apply to the following conventional names of soil types:

Conventional Name	Retained on US Sieve No.	Diameter (mm)
Very Coarse Sand	#18	1-2
Coarse Sand	#35	0.5-1
Medium Sand	#60	0.25-0.5
Fine Sand	#140	0.10-0.25
Very Fine Sand	#270	0.05-0.10
Silt	by hydrometer	0.002-0.05
Clay	by hydrometer	Less than 0.002

1.6 PRODUCT DELIVER, STORAGE AND HANDLING

A. Protect all products from weather vandalism or other damaging or deteriorating conditions.

1.7 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 CLEAN SCREENED LOAM

F. Loam shall consist of screened fertile, loose, friable sandy loam with no admixture of refuse or any natural or introduced materials toxic to plant growth and free of subsoil, refuse, stumps, roots, rocks, cobbles, stones, brush, clay lumps, noxious weeds, litter and other deleterious materials. Loam shall not come from USDA-classified prime farmland.

G. Loam shall be one of the following sandy loams: “coarse sandy loam”, “sandy loam”, “fine sandy loam” based on the USDA Classification System determined by mechanical analysis ASTM D-422. It shall be uniform in composition, without admixture of subsoil. The loam shall possess good filtration and permeability rates, and shall possess a mechanical analysis where:

		Percent Passing	
Millimeter	US Sieve Size	Max.	Min.

	¾"			100
	½"			100
6.35	¼"		100	85
2	#10			70
1	#18			50
0.595	#30			40
0.25	#60			40
0.149	#100			25
0.074	#200			<30
0.053	#270	SIlt		<25
.002	2Um	Clay		<20

In addition, soil shall have the following Sand, Silt and Clay content:

Sand (0.05 to 2.0 mm)	60% - 70% with no less than 70% of the sand in the medium through very coarse sand fractions (0.25 – 1 mm)
Silt (0.002 to 0.05 mm)	15%-25%
Clay (< 0.002)	10%-20%
Gravel (> 2.0 mm)	<15%

1. One hundred percent shall pass a 3/4" sieve opening.
2. On-site and off-site loam shall be screened to achieve the above specified sieve analysis.
3. Organic matter in approved planting soil shall be between 3% minimum and 5% maximum by weight as determined by the loss on ignition of samples that have been oven dried to a constant weight at temperature of 105 degrees C.
4. Acidity range of planting soil shall be 5.5 to 6.5 pH when tested according to methods of testing or A.O.A.C.
   a. When pH of loam borrow is equal to or greater than the maximum use aluminum sulfate to adjust pH to required levels.
   b. When pH of loam borrow is less than the minimum required use either sulfur or ferrous sulfate to adjust pH to required levels.

H. Soluble salt content shall be less than 100 PPM.

I. Loam shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. Topsoil shall not have extractable aluminum greater than 200 parts per million unless otherwise noted. Cation Exchange Capacity (CEC) shall be between 10 and 15.

2.2 ORGANIC COMPOST

A. Organic Compost shall be natural or manufactured mature, composted organic material. Only Federal EPA Class A or Rhode Island Type I compost products shall be used. The following shall be requirements shall be met:
   1. Compost shall originate from mature leaf compost, mature composted animal manure, other aged, composted vegetable materials such as

brewer's waste, or chemically tested toxin-free processed sludge products (biosolids).

2. Test results shall indicate maturity and age of organic compost. Raw un-composted or unprocessed or incompletely composted organic matter shall be rejected.
3. Organic matter manufactured from sludge and other biowaste materials or manure, shall be aged for at least one (1) year without exception and shall have no biowaste odor.
4. Compost shall contain no un-composted bulking agents such as un-composted wood chips and shall be free from hard lumps and free from seeping water when handled.
5. Compost shall be free from sticks, stones, plastic, debris or other substances which would be injurious to healthy plant growth. 100% of compost material shall pass a ½" sieve.
6. Acidity range shall be pH 6 minimum and 8 maximum when tested according to methods of testing or A.O.A.C.
7. Organic matter shall not be less than 30% as determined by ASTM D2974.
8. Moisture content of 35% to 70%, as determined by ASTM D2974
9. Carbon:Nitrogen ratio of 15:1 to 30:1
10. Solvita intex of 6 to 8
11. Non-phytotoxic
12. There shall be no unpleasant or detectable odor of ammonia or hydrogen sulfide, which would indicate immature compost. Color of compost shall be dark brown.

2.3 SOIL ADDITIVES

A. Limestone for adjustment of soil pH shall be agricultural grade ground dolomitic limestone containing up to 50% magnesium carbonate in a dry, granular form. Limestone shall be ground to such a fineness that at least 50% will pass through a 100-mesh sieve and 90% to 100% will pass through a 20-mesh sieve.

B. Aluminum Sulfate for adjustment of soil pH shall be commercial sulfur, unadulterated, 57% and delivered in containers with the name of the manufacturer, material analysis and net weight appearing on each container.

C. Tree and Shrub Fertilizer:
1. Fertilizer shall be a complete commercial product complying with the State and Federal fertilizer laws. Fertilizer shall be slow release fertilizer packets, which are designed and certified by the manufacturer to provide controlled release of nutrients over a minimum three-year period. Packets shall remain sealed at delivery to site and until installation. Each packet shall consist of four (4) ounces of water-soluble fertilizer with a minimum guaranteed analysis of available elements by weight as follows.

Nitrogen	16%
Phosphorus	8%
Potash	16%

2. Number of Applications Application Rate: Per manufacturer's instructions and as recommended by soil test results.

D. Sand shall be a coarse sand meeting ASTM D 422.

Sieve size	Percent passing
¼"	100%
#4	99%
#10	65%
#20	35%
#40	<30%
#60	<15%
#100	2-10%
No. 200	1-5%

E. Bone Meal: shall be fine ground, steam cooked, packing house bone with a minimum analysis of 23% phosphoric acid and 4% nitrogen.

F. Gypsum: shall be agricultural grade, granular form. Gradation shall conform to the following:

Sieve Designation	Percent Passing By Weight
No. 8 (2.36mm)	100
No. 16 (1.18mm)	97
No. 30 (0.60mm)	82
No. 50 (0.30mm)	46
No. 100(0.15mm)	21

G. Jute Mesh: Jute mesh shall be uniform, open, plain weave of undyed and unbleached single jute yarn, a minimum of four (4) feet in width plus or minus one (1) inch. There shall be 78 warp ends per width and 41 weft ends per yard. Weight shall average 1.22 pounds per linear yard, plus or minus 5%. Staples for Erosion Control Materials: 9-gauge staples shall be used with jute mesh: 11 gauge with woven paper.

2.4 WATER

A. Clean, fresh potable water free of salt and other impurities injurious to vegetation.

PART 3 - EXECUTION

3.1 MIXING LOAM AND AMENDMENTS

A. Thoroughly mix the Loam and Compost at a rate yielding an organic content and pH specified in Section 2.1, B. herein.

B. The Loam/Compost mix shall be fully and thoroughly blended.

C. Starter fertilizers and soil additives: All required materials shall be spread and distributed into the soil at rates and amounts specified herein.

D. Contractor shall amend loam with organic compost and soil additives to meet requirements in these specifications and only after approval of the amended soil test results shall amended loam be spread.

3.2 GRADING AND SPREADING OF LOAM/COMPOST MIX

A. Prior to any spreading of loam, it is the responsibility of the Contractor to request a meeting with the Owner's Representative and the Landscape Architect to review and approve the subgrade condition. Subgrade shall meet the requirements outlined in Section 31 00 00 – Earthwork and the following.

B. Remove all debris and other inorganic materials on any prepared subgrades, and reshape and dress any damaged or eroded slopes, swales, and other areas. Scarify and loosen subgrade to a friable condition in any areas where compaction may have occurred. Fill all depressions in existing grades with suitable fill material as specified in Section 31 00 00-Earthwork prior to spreading loam, then shape and finish grade to depth of loam required. Loam shall not be placed until subgrade is in suitable condition and free of excessive moisture or frozen materials.

1. Landscape Architect shall review compaction testing of subgrades in all landscape areas. The degree of compaction for subgrade in landscape areas shall be 90%.

C. Loam/Compost shall not be placed until subgrade is in suitable condition and free of excessive moisture or frozen materials.

D. Loam/Compost mix shall be spread as required to produce a total depth of twelve (12) inches for planting beds at the locations shown on the Plans.

E. Any debris that falls on paved or other hardscape areas shall be removed by the Contractor.

3.3 APPLICATION OF LIMESTONE

A. When applied dry, limestone shall be spread evenly and incorporated thoroughly into the soil by discing or other approved means.

B. When applied hydraulically, no discing will be necessary.

C. Granular treatment to be applied at the rate required by soil pH test to produce a pH required per this specification.

End of Section

SECTION 32 91 04
SOIL PREPARATION FOR ATHLETIC FIELDS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 31 00 00 – Earthwork
2. See Item 1.8 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings or as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Loam from off-site, if on-site is insufficient.
2. Grading and Spreading Loam.
3. Preparations of Areas for Seeding.
4. Application of Limestone.
5. Application of Lawn Starter Fertilizer.
6. Application of Turf Maintenance Fertilizer.
7. Applying Jute Mesh.

1.3 MINIMUM REQUIREMENTS

A. The successful contractor shall meet the following minimum requirements in order to be considered for installation of the athletic fields. All requirements listed in 1.3 MINIMUM REQUIREMENTS shall be documented and submitted to the Landscape Architect for approval prior to commencement of any athletic field work.
1. Selected installer/ base contractor shall employ a person certified by ASBA in the construction of natural grass athletic fields CFB-N. The contractor shall employ and maintain for the term of the contract an ASBA certified natural turf field builder on staff to ensure quality control in all aspects of a project conducted under this solicitation. Failure of the bidder to meet this requirement in its response will be deemed non-responsive.
2. Selected installer must have installed a minimum of ten (10) fields greater than five (5) years old of similar materials and design. Documentation of this shall be furnished per 1.3, A above.
3. Selected installer must install athletic fields using his/her own crews, subcontracting of installation work will not be allowed.
4. Selected installer must have a minimum of ten (10) outdoor fields at over 70,000 square feet each installed in the Northeast United States of similar construction. A list of these installations with owner’s name and phone number shall be furnished per 1.3, A above.
5. Selected installer must have a minimum of five (5) years’ experience in the installation of athletic fields. The crew foreman shall have installed a minimum of five (5) similar installations. A list of previous projects installed by foreman shall be furnished per 1.3, A above.

1.4 QUALITY ASSURANCE

A. The approved contractor shall review all plans and specification including the following prior to the start of construction:
   1. Review the entire system including subgrade, base, utilities, and drainage to ensure all components are complimentary.

B. Installation of the athletic field shall be done only after excavation and construction work which might injure work that has been complete. Damage caused during construction shall be repaired prior to acceptance.

C. Do not make substitutions without written approval. If specified materials are not available, obtain approval for substitution from the Owner's Representative.

1.5 SUBMITTALS

A. At least 30 days to ordering material, the Contractor shall submit to the engineer samples, manufacturer’s product data, source of off-site loam to be provided, and certified test results for materials as specified below. Certification shall list soil additives to loam including rates and type.

B. Existing On-Site loam: Sample and test existing on-site loam. The Contractor shall sample the existing loam soils from the construction site with the following requirements:
   1. The contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard on-site stockpile of existing loam for testing. All stockpile sampling shall be per ASTM D 75 and Appendixes.
   2. Preparation of Samples: Contractor shall place these soil slices into a large, clean plastic container and mix thoroughly. Contractor shall take one cup of soil mixture and dry it room temperature (do not dry samples in an oven or on a stove or radiator). Once soil is dry, place soil in sandwich size type plastic bag and close. Label each sample on outside of bag, identifying sample by soil type and acre.

C. Loam from off-site, if on-site is insufficient: The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard proposed stockpile of loam borrow for testing. All stockpile sampling shall be per ASTM D 75 and Appendixes.

D. All testing shall be at the expense of the contractor. Contractor shall deliver samples to the testing facility and have the results forwarded to the Architect. Perform all tests for gradation, organic content, soil chemistry and Ph. Testing reports shall include the following tests and recommendations:
   1. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System.
   2. Chemical Analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Lead, Zinc, Soluble Salts, extractable Aluminum, Cadmium, Copper, pH and buffer pH. Except where otherwise noted, nutrient tests shall be for available nutrients.
   3. Soil analysis tests shall show recommendations for soil additives to correct soils to meet the specifications and for additives necessary to accomplish lawn work as specified.
   4. Permeability rates for materials.

E. Compost: Submit supplier’s certification of contents.

F. Certification and/or labels of proposed soil additives stating names of each.

1.6 DEFINITIONS

A. The following definitions shall apply to the work of this section.

The following size distributions of mineral particles by diameter and sieve size shall apply to the following conventional names of soil types:

Conventional Name	Retained on US Sieve No.	Diameter (mm)
Very Coarse Sand	#18	1-2
Coarse Sand	#35	0.5-1
Medium Sand	#60	0.25-0.5
Fine Sand	#140	0.10-0.25
Very Fine Sand	#270	0.05-0.10
Silt	by hydrometer	0.002-0.05
Clay	by hydrometer	Less than 0.002

1.7 PRODUCT DELIVER, STORAGE AND HANDLING

A. Protect all products from weather vandalism or other damaging or deteriorating conditions.

1.8 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 CLEAN SCREENED LOAM

A. Loam shall consist of screened fertile, loose, friable fine sandy loam or sandy loam free of subsoil, refuse, stamps, roots, rocks, cobbles, stones, brush, noxious weeds, litter and other materials which are larger than 1/2 inch (1/2") in any dimension and which will prevent healthy plant growth.

B. Loam shall be one of the following sandy loams: "coarse sandy loam", "sandy loam", "fine sandy loam" based on the USDA Classification System determined by mechanical analysis ASTM D-422. It shall be uniform in composition, without admixture of subsoil. The loam shall possess good filtration and permeability rates, and shall possess a mechanical analysis where:

			Percent Passing	
Millimeter	US Sieve Size		Max.	Min.
	¾"			100
	½"			100
6.35	¼"		100	85
2	#10			70
1	#18			50
0.595	#30			40
0.25	#60			40
0.149	#100		30	25
0.074	#200			<30
0.053	#270	Sllt		<25
.002	2Um	Clay		<20

Sand (0.05 to 2.0 mm)	65% - 75% with no less than 70% of the sand in the medium through very coarse sand fractions (0.25 – 2 mm)
Silt (0.002 to 0.05 mm)	15%-25%
Clay (< 0.002)	10%-20%
Gravel (> 2.0 mm)	<15%

Maximum size shall be three eighths (3/8") inches largest diameter.

C. Organic Content and Ph: Loam shall contain not less than 3% or more than 6% organic matter

D. Acidity range shall be pH 6 to 7.5 in seeded areas when tested according to methods of testing or A.O.A.C.
   1. Loam Borrow shall be pH adjusted for particular planting applications and shall be adjusted prior to delivery to the project site.
      a. When pH of loam is equal to or greater than 7.5 use aluminum sulfate to adjust pH to required levels.
      b. When pH of loam is less than 6 use either sulfur or ferrous sulfate to adjust pH to required levels.

E. The loam borrow must not be handled or moved when in wet or frozen conditions.

F. Loam shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. Topsoil shall not have extractable aluminum greater than 200 parts per million unless

otherwise noted. Cation Exchange Capacity (CEC) shall be between 10 and 15.

G. Loam should yield a saturated hydraulic conductivity value of 1 to 2 inches per hour.

H. Contractor is made aware that on-site materials will not likely meet requirements of clean screened loam for use within athletic fields. Contractor shall include imported screened loam for all athletic fields within the Base Bid.

I. Existing loam from on-site shall be screen to remove all stones and debris larger then 3/8". Any additional amending of loam on site shall be done on site with a portable pug mill type plant. Final screened loam shall be tested by third party to meet the minimum requirements of this specification.

2.2 SOIL ADDITIVES

A. Dolomitic Limestone: contain up to 50% magnesium carbonate in a dry, granular form. Limestone shall be ground to such a fineness that at least 50% will pass through a 100-mesh sieve and 90% to 100% will pass through a 20-mesh sieve.

B. Aluminum Sulfate for adjustment of soil pH shall be commercial sulfur, unadulterated, 57% and delivered in containers with the name of the manufacturer, material analysis and net weight appearing on each container.

C. Lawn Starter and Maintenance Fertilizer:
1. Fertilizer shall be Organic-based and be OMRI (Organic Materials Review Institute) Certified

2. Fertilizer shall be a complete commercial product complying with the State and Federal fertilizer laws. Fertilizer shall be pelletized. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. At least 50% by weight of the nitrogen content shall be derived from organic materials. Fertilizer shall contain not less than the percentages of weight of ingredients as follows or as recommended by the soil analysis

Nitrogen 10%

Phosphorus 20%
Potash 10%

3. Adjust nitrogen type and analysis for spring growth and slow release in fall.
4. Number of Applications and Application Rate: Per manufacturer's instructions and as recommended by soil test results.

D. Sand: Shall be clean, course, ungraded material meeting ASTM C33 requirements for masonry sand, with the following addendums:
1. The sand shall have a fineness modulus of 2.5 to 3.2.
2. A coefficient of uniformity (D60/D10) of less than 4.
3. Sand shall be a coarse sand meeting ASTM D 422.

Sieve size	Percent passing
¼"	100%
#4	99%
#10	65%

#20	35%
#40	<30%
#60	<15%
#100	2-10%
No. 200	1-5%

E. Compost: Compost may be used, compost shall be derived from the following:
1. Yard Debris: Compost made from yard trimmings, such as leaves, grass clippings and pruning that have been properly composted, are mature and have been sieved through a ¾ inch screen shall be free of trash and contain no toxic substances harmful to plant growth Compost and/or biosolids compost/compost sludge.
2. Biosolids Compost/Compost Sludge: Compost made from biosolids that are mature and have been sieved through a 1/2 inch screen. The pH range shall be 6.2-7.2
3. All compost provided shall have the following properties:
   a. Organic matter content of no less than 30% as determined by ASTM D2974.
   b. A moisture content of 35%-70%, as determined by ASTM D2974.
   c. A carbon/nitrogen ratio of 15:1 to 30:1.
   d. Soluble salts not to exceed 3 dS/m.
   e. A Solvita Index of 6 to 8.
   f. A pH of 6 to 8.
   g. Non-phytotoxic.

F. Humus: Shall be natural humus, free from excessive amounts of zinc, low in wood content, free from hard lumps and in a shredded or granular form. The acidity range shall be approximately 5.5 pH to 7.5 pH and the organic matter shall not be less than 85% as determined by loss on ignition. The minimum water absorbing ability shall be 200% by weight on an oven-dry basis.

G. Bone Meal: shall be fine ground, steam cooked, packing house bone with a minimum analysis of 23% phosphoric acid and 4% nitrogen.

H. Jute Mesh: Jute mesh shall be uniform, open, plain weave of undyed and unbleached single jute yarn, a minimum of four (4) feet in width plus or minus one (1) inch. There shall be 78 warp ends per width and 41 weft ends per yard. Weight shall average 1.22 pounds per linear yard, plus or minus 5%. Staples for Erosion Control Materials: 9 gauge staples shall be used with jute mesh: 11 gauge with woven paper.

I. Gypsum: shall be agricultural grade, granular form. Gradation shall conform to the following:

Sieve Designation	Percent Passing By Weight
No. 8 (2.36mm)	100
No. 16 (1.18mm)	97
No. 30 (0.60mm)	82
No. 50 (0.30mm)	46
No. 100(0.15mm)	21

2.3 WATER

A. Clean, fresh potable water.

PART 3 - EXECUTION

3.1 GRADING AND SPREADING LOAM

A. Remove all debris and other inorganic materials on any prepared subgrades, and reshape and dress any damaged or eroded slopes, swales, and other areas. Scarify and loosen subgrade to a friable condition in any areas where compaction may have occurred. Loam shall not be placed until subgrade is in suitable condition and free of excessive moisture or frozen materials.

B. Prior to the spreading of any loam the testing and inspection shall be performed to meet the required compaction of 90%. Landscape Architect shall inspect the subgrade and each subsequent layer prior to moving to the layer in the process.

C. Loam shall be spread as specified on all disturbed and bare areas to produce a total depth of 6" as shown on the plan. Fill all depressions in existing grades with suitable fill material as specified in Section 31 00 00 prior to spreading loam, then shape and finish grade to depth of loam required.

D. Area shall be progressively fine graded and machine and hand raked, with loam added to correct depressions and other irregularities, to produce smooth and unbroken finish grades and the depth of loam required.

E. Drawings show grading design intent to achieve a uniform grade not less than 1.25% slope. Finish grades shall conform to lines, grades, sections, and shapes of lawn areas as shown on the plans. Provide positive drainage. Provide smooth, uniform, rounded transitions at all changes and break in grade. Loam is to be consistent depth of 1/2" below adjacent pavements surfaces.

F. FINISH GRADING – of Athletic fields
1. Verify topsoil has been contoured and compacted to within 1/8” in 10 ft.
2. Remove debris, roots, branches or stones in excess of ½” in size. Fine grade to eliminate uneven areas and low spots. Maintain profiles and contours of field sloped at maximum 1.25%.
3. Fine grading on the topsoil MUST be done with laser guided equipment to ensure precise grading of the fields. Equipment shall be equipped with turf-type flotation tires to minimize rutting and compaction.

G. TOLERANCES
1. Subgrade: Plus or minus 0.02 foot (7mm) from design grade.
2. Finish grade of Field and Field Events: Plus or minus 1/8” in 10 ft from required elevations. NO /exceptions will be granted.

H. FIELD QUALITY CONTROL
1. Field inspection and testing will be performed by independent testing agency under provisions of Section 01 4000.
2. Tests and analysis of fill material will be performed by independent testing agency in accordance with ASTM D698 and with Section 01 4000.
3. Compaction testing will be performed by independent testing agency in accordance with ASTM D698 and with Section 01 4000.
4. The Contractor shall provide a topographical of each layer (Subgrade, Sub Base, and Finish Graded Loam) survey shall be by means of a laser and plotted on a 10-foot grid

produced a third-party Massachusetts licensed surveyor. Based upon the inspection of the topographical surveys, the Contractor shall fine grade each layer suitably, including properly rolling and compacting the base to achieve a surface planarity to within 1/8" in 10-feet (+0, -1/8"). PERMISSION SHALL NOT BE PROVIDED TO MOVE FORWARD FOR TOLERANCE TO GRADE WITHOUT REVIEW OF THE CONTRACTOR PROVIDED LASER SURVEY AND APPROVAL BY THE LANDSCAPE FOR EACH LAYER OF BASE WORK INCLUDING SUBGRADE, SUBBASE AND FINISH TOPSOIL. If the topographical survey does not meet tolerances as indicated in this specification, contractor shall repair areas to meet tolerance and resurvey the area repaired at no cost to the Owner.

5. Prior to seeding the contractor shall provide full report of test results for planarity with a 3m straight edge. Testing shall be provided by one of three certified sports field testing laboratories. Deviations shall be marked and the field and reviewed by landscape architect. Contractor is responsible for all testing costs.

Approved Testing Laboratories
FireFly Sports
Sports Labs USA
Labosport

6. If tests OR survey indicate work does not meet specified requirements, remove or repair work, replace, and retest at no cost to Owner.

3.2 PREPARATION OF AREAS FOR SEEDING

A. GENERAL DESCRIPTION: This work shall consist of the preparation of the seed bed. Work shall be done as described herein:

1. Areas shall be finely raked to a finished grade. Substantially, all sticks, litter, wire, weeds, cable or stones larger than one half (3/8") inch in greater dimension shall be removed and disposed of per the contract specifications.
2. Where the soil has become compacted, prior to fine raking, areas to be seeded shall be scarified by discing, york raking, or other approved method to a minimum depth of two (2) inches.
3. No seeding will be permitted on areas where the seed bed has not been properly prepared or where the soil is compacted.
4. Request inspection of the work for approval before proceeding with seeding.

3.3 APPLICATION OF LIMESTONE

A. When applied dry, limestone shall be spread evenly and incorporated thoroughly into the soil by discing or other approved means.

B. When applied hydraulically, no discing will be necessary.

C. Granular treatment to be applied at the rate of 25 to 50 lbs. per 1,000 square feet or as required by soil pH test to produce a pH of 6.0 to 6.5.

3.4 APPLICATION OF STARTER AND MAINTENANCE FERTILIZER

A. One application of turf maintenance fertilizer will be required before final acceptance of seeded areas.

B. Fertilizer shall be Organic-based and be OMRI (Organic Materials Review Institute) Certified

C. Application Rate: Apply 2-3 pounds per 100 square feet.

D. Fertilizer shall be applied at a time, which shall be requested in writing by the Contractor, and approved in writing by the Owner's representative.

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SECTION 32 92 19
SEEDING FOR LAWN AREAS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 32 91 01 - Soil Preparation for Lawn Establishment
2. See Item 1.8 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment, and labor necessary to complete the work as indicated on the drawings or as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Application of seed
2. Application of weed control
3. Maintenance of seeded areas
4. Acceptance of seeding

C. In general, seeded areas shall, at a minimum, include all areas of site within project limit lines that have been disturbed or are barren unless otherwise noted on the plans. Overseeding of established lawn areas, if required on plans, shall also extend to the limit of disturbance (LOD), unless otherwise noted with a different seed mix, refer to Plans.

1.3 QUALITY ASSURANCE

A. Subcontract seeding work to a firm specializing in such work unless Contractor is fully experienced and qualified.

B. Selected installer/ contractor shall employ a person certified by ASBA in the construction of natural grass athletic fields CFB-N. The contractor shall employ and maintain for the term of the contract an ASBA certified natural turf field builder on staff to ensure quality control in all aspects of a project conducted under this solicitation. Failure of the bidder to meet this requirement in its response will be deemed non-responsive. Credentials shall be submitted prior to beginning any work.

C. Each seed bag or container shall display a label which identifies the contents as a true representation of the seed mix and percentages required by specification. No seed shall be applied to a site until display labels are submitted to the Owner's representative and has determined the mixture meets all requirements.

D. Do not make substitutions without written approval. If specified seed mixes are not available, obtain approval for substitution from the Owner's representative.

1.4 SUBMITTALS

A. Certifications and/or blue tag labels of proposed seed mixtures stating common and scientific names of grasses, percentages by weight, and percentages of purity and germination.

B. Product information for all proposed weed control chemicals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect all products from weather or other damaging or deteriorating conditions.

B. Seed mixes which have been damaged or have deteriorated in transit or storage are not acceptable.

C. Seeding Schedule: Prepare a proposed seeding schedule. Schedule dates for each type of landscape work during normal seasons for such work.
1. Seeding:
March 15 - June 30
August 15 - October 15

D. Correlate with specified maintenance periods to provide maintenance to date of acceptance. Once the schedule is accepted, dates shall be revised and submitted in writing for reasons of delay.

1.6 WARRANTY

A. Warranty seeding until final acceptance of grass stand. Final acceptance is defined in Part 3 of this specification.

1.7 MAINTENANCE

A. Maintenance of seeding to be performed by the installer to ensure plant survival and to eliminate undesirable species includes:
1. Watering
2. Mowing
3. Regrading and replanting eroded areas
4. Seeding or patching sparse or bare areas
5. Debris removal
6. Replacement of damaged or dead material
7. Additional fertilizations
8. Additional weed control

B. Maintain seeded areas immediately after placement until seed areas are accepted as outlined in Part 3 of this specification.

1.8 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution

procedures.

2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 MULCH

A. Hydro mulch: Shall be a Bonded Fiber Matrix Hydraulically applied erosion system, consisting of long strand, virgin wood fibers (90% by weight), bound together by a pre-blended, high-strength polysaccharide polymer adhesive (10% by weight). The virgin wood fibers shall be thermo-mechanically defibrated from clean whole wood chips, containing a minimum of 25% of the fibers averaging 10 mm long, with a minimum of 50% or more retained on a #24 mesh screen. The organic binders shall be a high viscosity. Fiber shall not be produced from recycled material such as sawdust, paper or cardboard.

B. The bonded fiber matric shall be of such character that it will disperse uniformly into a slurry when mixed with water. The slurry, when hydraulically applied to the ground, shall form an absorptive mat of mulch. No materials which inhibit growth or germination shall be present in the mixture.

2.2 SEED

A. General: Pure, live, fresh seed from commercial sources meeting and labeled in accordance with State and Federal laws, rules and regulations. All seed to have minimum germination rate of 90%.
   1. Seed mix for all athletic field lawn areas with the limit of disturbance not otherwise noted to receive seed shall conform to the following grass types and percentages:
      a. 25% Improved Perennial Rye
         25% Creeping Red Fescue
         18.5% Turf Type Tall Fescue
         5% Ky Bluegrass 98/85
         1% Red top
         .5% Colonial Bentgrass
         1) Turfgrass Water Conservation Alliance or
         2) Alliance for Low Input Sustainable Turf 'A List'
         Sowing Rate: 5 to 7 pounds per 1,000 sq. ft.
         Overseed Sowing Rate: 2 to 3 pounds for 1,000 sq. ft.

2.3 WEED CONTROL

A. Pre-emergent weed control for Loam and Seed Areas shall be Tenacity or approved equal. Deliver in manufacturer’s fully identified containers and apply according to manufacturer’s directions.

B. Contractor shall notify Owners Project Manager 4 days prior to anticipated application, time, and type of pre-emergent weed control.

2.4 WATER

A. Clean, fresh potable water free of salt and other impurities injurious to vegetation. Site irrigation may be used.

2.5 JUTE MESH

A. Jute mesh shall be uniform, open, plain weave of undyed and unbleached single jute yarn, a minimum of four (4) feet in width plus or minus one (1) inch. There shall be 78 warp ends per width and 41 weft ends per yard. Weight shall average 1.22 pounds per linear yard, plus or minus 5%. Staples for Erosion Control Materials: 9-gauge staples shall be used with jute mesh: 11 gauge with woven paper.

PART 3 - EXECUTION

3.1 GENERAL

A. Seeded areas shall, at a minimum, include all areas of site within project limit lines that have been disturbed or are barren unless otherwise noted on the plans.

B. Any seeded areas that are rutted or eroded due to construction, weather or otherwise damaged shall be the responsibility of the contractor to correct.

C. Multi-phased projects may have different seeding times based on each phase. It is the contractor's responsibility to follow the specifications herein for each phase of construction.

3.2 APPLICATION OF SEED

A. Seeding operations shall not occur until the seed bed has been approved per Specification 32 91 01, Section 3.3, A.

B. The approved seed mixture shall be applied at a rate indicated in Section 2.2, herein, by means of a seeder device capable of penetrating ground to depth of 1". Seeder machine shall be equipped with disc-type penetrating action and seeder tubes which plant seeds. Seeder shall be similar to Jacobson Model 524-100, 548100 or equal.

C. Distribute seed over area in two separate passes, each one perpendicular to the other (north-south, east-west orientation). Each pass shall be in a linear progression, and shall conform to the field direction that permits the longest straight line application procedure.

D. Hydro mulch shall be applied to seeded areas after seeding has occurred on athletic fields.

E. Hydroseeding will be permitted only with permission of Owner's Representative. All requests shall be in writing with detailed and itemized procedure to be followed.

F. Broadcast seeding will be permitted only with permission of Owner's Representative. All requests shall be in writing with detailed and itemized procedure to be followed.

3.3 APPLICATION OF FERTILIZER

A. Complete fertilizer in granular form shall be applied per Specification 32 91 01 – Soil Preparation for Lawn Establishment.

3.4 APPLYING JUTE MESH

A. Jute mesh shall be applied to any slopes 4:1 or steeper.

B. Apply jute mesh loosely but smoothly to fit the contour of the finished grade, parallel to and in same direction as the flow of water. The up-slope end of each separate strip or piece of jute mesh shall be buried in a six (6) inch minimum vertical anchor slot or junction slot with the soil tamped firmly against the mesh. Where more than one width of material is required, edges shall overlap a minimum of twelve (12) inches, and the up-slope section of mesh will be on top. Down-hill ends of the jute mesh shall be folded under approximately four (4) inches and stapled in place. Staples will be inserted through the mesh along edges, overlaps, and in the center of all jute mesh strips at intervals not greater than three (3) feet. All anchor slots, junction slots, check slots, and terminal folds shall have five (5) staples spaced not more than nine (9) inches on center across widths.

C. On seeded banks, jute shall be applied immediately after seeding.

3.5 ACCEPTANCE OF SEEDING FOR GENERAL LAWN AREAS

A. PROVISIONAL APPROVAL FOR GENERAL LAWN AREAS

1. Provisional approval shall be considered after a minimum of **ONE** full growing season per the seeding schedule, Section 1.5, C, herein. In order for provisional approval to be granted, the Contractor shall request in writing to the Owner's Representative that he/she is ready to have the seeded areas reviewed. The following requirements shall be met.
2. Provisional approval will not occur until after one full growing season. The seeded areas must be well established, exhibiting a vigorous growing condition and devoid of bare spots greater than 1 square foot.
3. It will be the contractor's responsibility to maintain seeded areas from the time of seed installation until the date of Final Acceptance. See Section 1.7, herein for maintenance requirements.
4. Provisional approval will not be granted until contractor has obtained, in writing, a statement from the landscape architect indicating that grass is satisfactory under the terms of the provisional approval.

   Following are some examples of delays in provisional approval of seeded areas:

   Improper grading:

   a. Low or high spots on flat or fairly level areas
   b. Improper drainage
   c. Washed out or rilled areas
   d. Exposed debris or other deleterious matter
   e. Compacted soils

   Turf Grass Conditions

   a. Poor or thin stands of lawn
   b. Improper fertilization application
   c. Persistent weeds established in turf areas

3.6 FINAL ACCEPTANCE FOR GENERAL LAWN AREAS

A. In order for final acceptance to be granted, the Contractor shall request in writing to the

Owner's Representative that he/she is ready to have the seeded areas reviewed and the following requirements shall be met.

1. All seeded areas have been maintained by the Contractor for not less than **ONE** growing season from the time provisional approval is granted. Growing season shall be defined as follows:
   a. If provisional approval is received during April, May, June or July, next growing season shall end on October 15.
      1) If provisional approval is received during September, October, November or December, next growing season shall end on June 1.
2. Inspection will be made by the Owner's Representative and the Landscape Architect. Grass areas not demonstrating satisfactory stands as outlined above, (except if damaged by vandalism) as determined, by the L.A. shall be renovated, re-seeded, and maintained meeting all requirements as specified herein. Maintenance period shall extend to the end of the next growing season, see Section 3.5, B,1 herein.
3. After all necessary corrective work has been completed, the Landscape Architect will submit in writing recommending to the Owner's Representative that Final Acceptance shall be granted.
4. One application of turf maintenance fertilizer shall be applied before final acceptance of seeded areas can be granted.
5. Decision of Owner's Representative as to the necessity to replace grass areas or repair any defects in workmanship, or cause of any destruction or loss, impairment or failure to flourish, shall be conclusive and binding upon Contractor. Replacements shall be the same as specified. All replacements shall be planted as specified herein at Contractor's expense.
6. "Vandalism", as noted above, is intended to mean any acts, whether intentional or accidental, by other persons, which clearly result in damage, and which may reasonably be considered to be beyond the Contractor's reasonable control, as determined by the Owner's representative.

3.7 MAINTENANCE FOR GENERAL LAWN AREAS

A. Contractor is responsible for maintaining lawn areas for the growing seasons as outlined in 3.5, A and B herein.

B. Maintain grassed areas by watering, mowing, fertilizing, weeding, debris removal and trimming.

C. The Contractor shall mow all established seeded areas. No mowing shall remove more than one-third of the grass blade length. Heavy mowing, resulting in grass on the surface shall be "doubled mowed" or the contractor shall remove grass on surface. The grass shall be mown to a height of two and one half to three inches (2-2.5" for athletic fields and 2.5-3" for general lawns).

D. The Contractor shall keep all seeded areas watered and in good condition, reseeding if and when necessary to meet the requirements specified herein.

E. Watering of seeded areas.
   1. During this period, water grass as necessary to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of two (2) inches of absorbed water per week that is delivered at weekly intervals in the form of natural rain or is augmented by watering by the contractor.

F. Repair areas damaged by erosion or construction activities by regrading, rolling and replanting.

G. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed and hydro mulch.

End of Section

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SECTION 32 92 20
SEEDING FOR NON-LAWN AREAS

PART 1 – GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Sections
1. Section 32 91 01 – Soil Preparation for Lawn Establishment
2. Section 32 91 02 – Soil Preparation for Raingardens
3. See Item 1.9 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment, and labor necessary to complete the work as indicated on the drawings or as specified herein.

B. The principal work of this section includes, but may not be limited to the following:
1. Application of seed
2. Acceptance of seeding

C. In general, seeding for non-lawn areas shall be located in specific areas as shown on the plans.

D. Chemical application in sensitive areas shall be in accordance with the Town's Outdoor Integrated Pest Management (IPM) Policy and Plan if available, manufacturer's recommendations and as determined by the qualified individual noted herein.

1.3 RESTRICTIONS

A. Prior to seeding, contractor shall clearly and plainly mark his limits as indicated on plans.

B. No work shall be performed prior to field determination and approval from Owner's Representative.

1.4 QUALITY ASSURANCE

A. Subcontract seeding work to a firm specializing in such work unless Contractor is fully experienced and qualified.
1. All work associated with invasive management for raingardens, meadow grass areas and low maintenance areas shall be performed by a qualified individual with demonstrated experienced in the identification and control of invasive vegetation and who also holds a pesticide applicators license in the State of Rhode Island.

B. Each seed bag or container shall display a label which identifies the contents as a true representation of the seed mix and percentages required by specification. No

seed shall be applied to a site until display labels are submitted to the Owner's representative and has determined the mixture meets all requirements.

C. Do not make substitutions without written approval. If specified seed mixes are not available, obtain approval for substitution from the Owner or Owner's Representative.

1.5 SUBMITTALS

A. Certifications and/or labels of proposed seed mixtures stating common and scientific names of plants, percentages by weight, and percentages of purity and germination.

B. Product information for all proposed weed control chemicals.

C. Submit demonstrated experience in the form of a resume and three references of qualified personnel performing invasive monitoring and control.

D. Submit current pesticide applicators license in the State of Rhode Island.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect all products from weather or other damaging or deteriorating conditions.

B. Seed mixes which have been damaged or have deteriorated in transit or storage are not acceptable.

C. Seeding Schedule: Prepare a proposed seeding schedule. Schedule dates for each type of landscape work during normal seasons for such work.

Seeding: March 15 - June 30
August 15 - October 15

Seeding outside of dates above may require additional growing seasons necessary until Provisional and Final Acceptance.

D. Correlate with specified maintenance periods to provide maintenance to date of Final Acceptance. Once the schedule is accepted, revise dates only as approved in writing after documentation of reasons for delays.

1.7 WARRANTY

A. Warranty seeding until final acceptance of seeded areas.

1.8 MAINTENANCE

A. Maintenance of seeding to be performed by the installer includes:
1. Watering
2. Regrading and replanting eroded areas
3. Seeding or patching sparse or bare areas
4. Debris removal
5. Replacement of damaged or dead material
6. Weed removal
7. Trimming

B. Maintain seeded areas immediately after placement until Final Acceptance as outlined in Part 3 of this specification.

1.9 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section “Sustainable Design Requirements.”
1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 – PRODUCTS

2.1 SEED

A. Any manufacturer’s names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that “or equivalent” applies to all products denoted herein. It is understood that all manufacturers will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an equivalent. It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

B. General: Pure, live, fresh seed from commercial sources, meeting and labeled in accordance with State and Federal laws, rules, and regulations. Contractor shall provide labels of all seed used indicating species and percentages. All seed to have minimum germination rate of 85% unless otherwise noted.

C. Seed Mix A (SMA) for Raingardens - as indicated on the Plans shall be “New

England Erosion Control/Restoration Mix for Detention Basins and Moist Sites" as supplied by New England Wetland Plants, Inc. or approved equivalent. Percentages of species shall be per New England Wetland Plants specifications.

Seeding Rate: 35 lbs/acre

2.2 COVER CROP SEEDING

A. Cover crop seeding shall be applied to all non-lawn areas as shown on the Plans.

B. Cover Crop Seed Mix shall be Grain Oats if application is Jan. 1-July 1 or Grain Rye if application is August 1-Dec 31.

C. Cover Crop shall be applied at 30 lbs/acre unless otherwise included in seed mix.

2.3 WATER

A. Clean, fresh potable water free of salt and other impurities injurious to vegetation.

PART 3 – EXECUTION

3.1 GENERAL

A. Seed Mixes shall be placed in areas noted on the plans.

3.2 APPLICATION OF SEED

A. Seeding shall not occur until the seed bed has been approved per Specification 32 91 02, Section 3.2, E.

B. The approved seed mixture shall be applied at a rate specified by each particular type of seeding, by means of a mechanical spreader or by hand on to prepared soil. Seed shall be lightly raked or rolled to ensure soil contact.

C. Distribute seed over area in two separate passes, each one perpendicular to the other (north-south, east-west orientation). Each pass shall be in a linear progression, and shall conform to the field direction that permits the longest straight line application procedure.

D. Hydro mulch shall be applied to seeded areas after seeding has occurred. Hydroseeding shall not be permitted for seeded areas specified herein.

E. Broadcast seeding will be permitted only with permission of Owner or Owner's Representative. All requests shall be in writing with detailed and itemized procedure to be followed.

3.3 CARE OF SEEDED AREAS

A. Watering: Contractor shall water all seeded areas immediately after seeding operations and on a regular basis over the first 2 to 3 weeks until germination is complete.

B. Refer to Section 3.4, C, herein, for additional maintenance requirements.

3.4 ACCEPTANCE OF SEEDING

A. PROVISIONAL APPROVAL
Provisional approval shall be considered after a minimum of **ONE** full growing season after seeding schedule as outlined in Section 1.6 Paragraph C. In order for provisional approval to be granted, the Contractor shall request in writing to the Owner's Representative that he/she is ready to have the seeded areas reviewed. The following requirements shall be met.

1. Provisional approval will not occur until after **ONE** full growing season. The seeded areas are well established, exhibiting a vigorous growing condition and devoid of bare spots greater than 1 square foot.
   a. If seeding operations are completed during March, April, May or June the second growing season shall end June 1 the following Spring.
   b. If seeding operations are completed during August, September or October the second growing season shall end October 1 the following Fall.
2. It will be the contractor's responsibility to maintain seeded areas from the time of seed installation, through Provisional approval until the date of Final Acceptance. See Section 3.4, C. herein for maintenance requirements.
3. Provisional approval will not be granted until contractor has obtained, in writing, a statement from the landscape architect indicating that seeded areas are satisfactory under the terms of the provisional approval.
4. Following are some examples of delays in provisional approval of seeded areas:
   a. Improper grading
   b. Improper drainage
   c. Washed out or rilled areas
   d. Exposed debris
   e. Persistent weeds established
   f. Over mowing
   g. Seeding outside of accepted schedule

B. FINAL ACCEPTANCE
In order for final acceptance to be granted, the Contractor shall request in writing to the Owner's Representative that he/she is ready to have the seeded areas reviewed. The following requirements shall be met.

1. All seeded areas have been maintained by the Contractor for not less than **ONE** growing season from the time provisional approval is granted. Growing season shall be defined as follows:
   a. If provisional approval is received in June, the next growing season shall end on October 15.
   b. If provisional approval is received during October, the next growing season shall end on June 1.
2. Inspection will be made by the Owner's Representative and the Landscape Architect. Seeded areas not demonstrating satisfactory stands as outlined above, (except if damaged by vandalism) as determined, by the L.A. shall be renovated, re-seeded, and maintained meeting all requirements as specified herein. Maintenance period shall extend to the end of the next growing season, see Section 3.4, B,1 herein.

3. After all necessary corrective work has been completed, the Landscape Architect will submit in writing recommending to the Owner's Representative that Final Acceptance shall be granted.
4. Decision of Owner's Representative as to the necessity to replace seeded areas or repair any defects in workmanship, or cause of any destruction or loss, impairment or failure to flourish, shall be conclusive and binding upon Contractor. Replacements shall be the same as specified. All replacements shall be planted as specified herein at Contractor's expense.
5. "Vandalism", as noted above, is intended to mean any acts, whether intentional or accidental, by other persons, which clearly result in damage, and which may reasonably be considered to be beyond the Contractor's reasonable control, as determined by the Owner's representative.

C. MAINTENANCE
1. Contractor shall maintain seeded areas up to provisional approval and a minimum of one full growing season after provisional approval through Final Acceptance.
2. General: The contractor shall maintain seeded areas by watering, weed and invasive species removal, debris removal, repair damaged areas and trimming.
3. Trimming:
   a. Seed Mixes shall be trimmed using a weed-eater set to a height of 6" to 8". Trimming lower than 4" will kill many species in the mixes. Trimming shall occur once in the fall after fall blooming has occurred and once in the spring before May 15th.
4. Watering: The Contractor shall keep all seeded areas watered and in good condition during establishment.
   a. During this period, water seeded areas as necessary to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of two (2) inches of absorbed water per week that is delivered at weekly intervals in the form of natural rain or is augmented by watering by the contractor.
6. Repair: Repair areas damaged by erosion or construction activities by regrading, topdressing and re-seeding until Final Acceptance. Reseed small, sparse vegetated areas. When sparse areas exceed 20 percent of planted area, reseed and water.
7. Invasive Plant Identification: There are a number of invasive species that may potentially colonize the new landscape areas and must be identified and removed. Some include Asiatic Bittersweet (*Celastrus orbiculatus*), Glossy Buckthorn (*Rhamnus frangula*), Japanese Barberry (*Berberis thunbergii*) and Multiflora Rose (*Rosa multiflora*), Autumn Olive (*Elaeagnus umbellata*), Common Reed (*Phragmites australis*), Japanese Knotweed (*Polygonum cuspidatum*), Purple Loosestrife (*Lythrum salicaria*), and Reed Canary Grass (*Phalaris arundinacea*), Tartarian Honeysuckle (*Lonicera tatarica*), Poison Ivy (*Toxicodendron radicans)*. Any and all of these species pose at least a potential threat to colonize the replication areas.
8. Weed and Invasive Removal: Problem weeds and invasives should be hand-pulled including root systems in all non-lawn areas beginning at the completion of seeding operations. Contractor shall inspect all seeded areas once per month after seeding operations are completed for each area through Provisional and Final Acceptance to remove weed and invasive plant growth while seed is establishing.
9. Inspection frequency and maintenance shall occur each month from April through October through Final Acceptance.

10. Reporting: Contractor shall complete an inspection report indicating inspections and work completed each month from April through October during construction until Final Acceptance. Monthly Reporting shall include update on watering, trimming, repair, weed and invasive removal.
    a. Sample Inspection Report included herein.

End of Section

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SECTION 32 93 00
PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 32 91 03 – Soil Preparation for Planting Beds
2. See Item 1.10 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings or as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Layout and Excavation of Plant Holes
2. Planting Installation
3. Backfill with approved planting soil
4. Watering
5. Mulching
6. Fertilizing
7. Pruning
8. Staking and Guying
9. Antidessicant Application
10. Tags and Labels
11. Maintenance
12. Plant Replacement Guarantee

C. This item may be affected by Add Alternates – refer to Plans for further information.

1.3 REFERENCES

A. ANLA: American Nursery and Landscape Association, “American Standard for Nursery Stock”, ANSI Z60.1-2004, or latest edition.

B. AJCHN: American Joint Committee on Horticultural Nomenclature.

C. AOAC: Association of Official Agricultural Chemists.

D. USDA: United States Department of Agriculture, Agricultural Research Service,

"USDA Plant Hardiness Zone Map".

E. TCIA: Tree Care Industry Association (formerly the National Arborist Association), "Standards for Pruning Shade Trees" latest edition as published by American National Standards Institute.

1.4 QUALITY ASSURANCE

A. Contractor shall specialize in work outlined with a minimum of five (5) years of landscape work similar in materials, design and extent to that indicated for this project and with a record of successful landscape establishment. Installer shall maintain an experienced supervisor on the project site during all times that landscape construction is in progress. Contractor shall provide written qualification data for firms and persons to be responsible for Work, to demonstrate their capabilities and experience. Include lists of completed projects, with project names, addresses, phone numbers, and names and address of client.

B. Chemicals including but not limited to pesticides, fertilizers, herbicides, pre-emergents, fungicides shall be applied by a licensed professional with a current Pesticide Applicator's License in the state the work is being performed.

C. Contractor shall provide quality, size, genus, species and variety of plants indicated on the plans, complying with applicable requirements of ANLA and AJCHN. All plants shall be nursery grown, not collected from natural vegetated areas.

D. Do not make substitutions without written approval. If specified landscape material is not available, obtain approval for substitution from the Owner or Owner's Representative.

E. Where formal planting arrangements are shown, select stock with uniform height and spread, and label with numbers to assure symmetry in planting.

F. The Owner's Representative reserves the right to inspect all plant materials for compliance with specifications, and to reject unsatisfactory or defective work at any time during progress of work.

1.5 SUBMITTALS

A. Qualification data listed in 1.4, A herein.

B. At least three (3) shrubs of each variety and all trees shall be tagged with a waterproof tag bearing legible designation of botanical and common names, and all other standard products, labels and nursery certificates substantiating that plants comply with specified requirements set by ANLA were grown within USDA hardiness zones specified. All documentation shall be submitted to the Owner's Representative.

C. Certifications and/or labels of proposed plant materials or substitutions, listing common and scientific names of each.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Contractor shall deliver packaged materials in containers with identifying labels indicating product data and manufacturer. Protect materials from damage during delivery and while stored on site.

B. Plant material delivered by truck requiring storage on site shall be properly wrapped and covered during delivery to prevent drying of branches, leaves or buds. Plant root balls shall be firmly bound, unbroken and reasonably moist to indicate watering prior to delivery and during storage. Furthermore, Contractor shall protect bark, branches, and root systems from sunscald, drying, whipping, and other handling and tying damage during delivery. Contractor shall keep plants moist, fresh, and protected against exposure to sun, wind, and freezing temperatures whether in the receiving yard, in transit, while being handled, or at the job site awaiting planting.

C. Contractor shall deliver trees, shrubs and groundcover after preparations for planting have been completed and plant immediately. Contractor shall be present at the time of delivery of all plants to the site. Contractor shall remove all tree trunk wrapping at delivery and inspect tree trunks for damage. All plant material shall be handled by the root ball or container and not by the trunk or branches.

D. Plants which have been damaged or have deteriorated in transit or storage will be rejected. Trunks showing fresh scars and damage in delivery and handling operations will be rejected. Plant material from cold storage will be rejected.

E. If planting is delayed more than six (6) hours after delivery to the site, set plants vertically in their natural growing orientation in shade, protect from weather, dust and mechanical damage, and keep roots moist. Set balled stock on ground or heeled into the ground and cover ball with soil or mulch. Water root systems as often as necessary to keep root systems moist during storage and planting. Storage on site for more than two (2) weeks shall not be allowed without permission from the Landscape Architect and Owner's Representative. Plant damage due to Contractor's planting delay shall be the responsibility of the Contractor.

F. Planting Dates: Contractor shall submit in writing a proposed planting installation schedule. Contractor shall schedule dates for each type of landscape work during normal seasons for such work. Once the schedule is accepted, dates shall be revised and submitted in writing if there are reasons of delay.

Planting Deciduous material:	Spring	March 1 to June 15
	Fall	September 1 to December 15
Evergreen material:	Spring	March 15 to May 30
	Fall	August 15 to November 15
Perennials and Groundcovers:	Spring	April 15 to June 1
	Fall	September 15 to November 15

G. Contractor shall correlate planting schedule with specified maintenance periods in writing to the Landscape Architect in order to ensure maintenance coverage to date of acceptance.

H. Coordination with Lawns and other finished surfaces and structures: Plant trees, shrubs, and groundcover after final grades are established and prior to planting of lawns, unless otherwise acceptable to Owner's Representative. If planting of trees

and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations. Planting operations shall not occur until adjacent sidewalks, roads, curbs and any other building elements have been completed. Contractor shall coordinate work with other disciplines including work on adjacent building. If scaffolding, lifts or other mechanical equipment is in the way or if adjacent building work is incomplete, the Contractor shall immediately notify the Owner's Representative and the Landscape Architect.

I. Any debris that falls on paved or other hardscape areas shall be removed and paved surfaces cleaned by the Contractor.

1.7 SPECIAL CONDITIONS

A. Should discrepancies exist between plant quantities shown in the Plant List and on the Plan, quantities shown on the Plan shall govern. Contractor shall then install all plants as shown on the plan at no additional cost to the owner.

1.8 PLANT REPLACEMENT GUARANTEE

A. Contractor shall provide a guarantee covering all new plants from death or unhealthy conditions for a minimum of one (1) year including one continuous growing season.

B. Guarantee period shall commence on the date identified as the Provisional Acceptance of project or phase of project as outlined in Section 3.15, herein.

C. Contractor shall guarantee that all plantings conform to requirements of contract documents and that all plants except transplant materials are healthy and will remain so for the guarantee period outlined herein.

1.9 MAINTENANCE

A. Maintenance of all planting shall occur from time of planting through Final Acceptance. Refer to Section 3.15 for definition of Final Acceptance.

B. Maintenance shall consist of keeping trees, shrub and groundcover plantings in healthy growing condition. Maintenance performed by the Contractor shall include:
1. Watering all plantings to ensure survival and healthy growth
2. Weeding, raking and removal of weeds, weed roots and old mulch from plant beds and individual tree plantings
3. Light re-mulching of planting beds and individual plants
4. Tightening guy webbing and repairing of stakes
5. Removal of trash within planting areas
6. Pruning dead, dying or errant branches
7. Replacement of dead material
8. Resetting plants to proper grades, or to upright position

C. Chemicals, pesticides, fungicides, insecticides or herbicides within planted areas shall be applied by personnel licensed to do so in the State where the project is

located and only after obtaining written permission from the Owner's Representative. Contractor shall indicate the materials and dispensing methods, dates, time and weather conditions under which procedures will occur and traffic control including pedestrian protection.

1.10 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."
   1. The General Contractor is responsible to coordinate with the work of other Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
   1. Division 01 Section "Substitution Procedures" for NE-CHPS substitution procedures.
   2. Division 01 Section "Submittal Procedures" for NE-CHPS submittal requirements.
   3. Division 01 Section "Construction Controls and Temporary Facilities" for requirements for temporary facilities.
   4. Division 01 Section "Product Requirements" for additional NE-CHPS submittal requirements.
   5. Division 01 Section "Construction Waste Management and Disposal" for waste management, recycling and disposal.
   6. Division 01 Section "Sustainable Design Requirements" for general procedures for compliance with NE-CHPS prerequisites and credits.
   7. Division 01 Section "Construction Indoor Air Quality (IAQ) Management Plan" for material and procedure requirements.

PART 2 - PRODUCTS

2.1 LOAM COMPOST MIX

A. For Loam Compost Mix, refer to Section 32 93 00, "Part 2 – Products".

2.2 ANTIDESSICANT

A. Emulsion which permits transpiration while retarding excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix according to manufacturer's direction. Use "Wiltproof" or approved equivalent.

2.3 TREE, SHRUB AND GROUNDCOVER FERTILIZER

A. For complete fertilizer per specification Section 32 93 00, "Part 2-Products".

2.4 STAKE AND GUYING MATERIALS

A. Guy web: Shall be a low abrasion woven fiber webbing with a break strength of 900 pounds or better. The width of the webbing shall be no less than 5/8 inch nor greater than ¾ inch. The length shall be sufficient enough to be attached to the tree trunk and stake. Cable encased in hose shall not be used.

B. Stakes: Shall be from a hardwood source, free of knots, insects and fungi. Stakes shall be of uniform size and shape and shall be a minimum of two inches (2") square. Stakes shall be pointed with a taper of no less than four inches (4").

C. The above ground stake height shall be eight inches (8") above the point of attachment. The type of stakes shall be uniform throughout the job.

2.5 TREE PAINT/TREE WOUND DRESSING

A. Tree paint or tree wound dressing of any type shall not be used on the tree wounds. Allow wound to heal and weather naturally, after trace cutting ragged or loose damaged bark back to live cambium.

2.6 TREE WRAP

A. Tree wrap may be used to protect tree trunks from damage during digging at the nursery, transport to the site or during planting operations, but the use of tree wrap of any type shall not be allowed on tree trunks and branches after trees are planted.

2.7 MULCH

A. Mulch shall be shredded hardwood mulch shall be derived from hardwood aged to a minimum of six months and no more than eighteen months. The bark shall be shredded so that the resulting pieces are no more than ¼ inch thick and no longer than three inches (3"). The mulch shall be free of stringy material and shall not contain an excess of fine particles. The mulch shall be brown in color, free of dye, leaves, twigs, sod, weeds, shavings and other foreign materials which are injurious to health plant growth. Mulch shall not have an excess of fine particles, overly composted or soggy compost material. Mulch shall not have an unpleasant odor nor have any evidence of fungus growth.

B. Straw mulch shall be weed free, organic straw derived from harvested rice, oat, alfalfa, wheat or other cereal crops. Straw mulch made from meadow hay will not be accepted.

2.8 JUTE MESH

A. Jute mesh shall be uniform, open, plain weave of undyed and unbleached single jute yarn, a minimum of four (4) feet in width plus or minus one (1) inch. There shall be 78 warp ends per width and 41 weft ends per yard. Weight shall average 1.22 pounds per linear yard, plus or minus 5%. Staples for Erosion Control Materials: 9-gauge staples shall be used with jute mesh: 11 gauge with woven paper.

2.9 WATER

A. Clean, fresh potable water free of salt and other impurities injurious to vegetation.

2.10 PLANT MATERIALS

A. Contractor shall secure plant material indicated on the Plans. Any plant substitutions shall be immediately brought to the attention of the Landscape Architect after all sourcing efforts have been exhausted. All plant material shall comply with the state and federal laws with respect to importing clean out of state nursery stock inspected for harmful insects, plant diseases and fungal infestations.

B. The Contractor shall notify the Landscape Architect by written request **at least** one (1) month prior to the expected planting date to schedule the tree tagging. The Landscape Architect's time and expenses spent to locate plant material shall be paid for by the Contractor only if the Landscape Architect is sent to a site where satisfactory plant materials are not located and to nurseries not located within 100 miles of the project site. At the approval of the Landscape Architect, the contractor may send photos of plant material to the Landscape Architect if tagging is prohibitive. Photos shall indicate typical size, form and species specified.

C. Each tree shall be labeled with securely attached, waterproof label bearing legible designation of botanical and common name according to AJCHN. Tagged plants shall bear information regarding project name. No plant material tagged by the Landscape Architect shall be delivered to the project site without these tags.

D. The Landscape Architect's tagging exercise shall not impair the right of inspection and rejection upon delivery at the site or during the progress of work. Contractor shall be responsible for the replacement of materials rejected by the Landscape Architect at the site.

E. Only plant stock obtained from and grown between latitudes 40-49 degrees north and USDA hardiness Zones 1 through 6 will be accepted.

F. Plants shall be in accordance with ANLA as a minimum requirement for measuring height, caliper and root ball for acceptance. Plants shall be typical of their species or variety, have a normal habit of growth, and meet the size and form requirements indicated by the Landscape Architect. The trunk of each tree shall be a single trunk growing from a single intact crown of roots. Trees indicated as "multi-stemmed" in the Plant Lists shall have three (3) stems, typical. Lateral branching of deciduous trees located near sidewalks or roadways shall begin no less than seven (7) feet height.

G. Tree species designated as "Fall Digging Hazard", such as some species of Oak, Birch, Beech, Dogwood, Redbud and Maple among other species shall not be approved for planting installation in the fall season unless approved at the discretion of the Landscape Architect and provided the Contractor obtains written certification from the nursery that these trees have been dug in the previous spring season. If fall digging hazard plants have not been previously dug, then they shall be planted during the following spring season, regardless of other project schedules. Plant substitutions shall not be made on the sole reason that the plants are a fall digging hazard.

H. Replacement plants larger in size than existing may be used if approved by the Landscape Architect provided use of larger plants does not increase Contract price.

I. If use of larger plants is approved, increased root ball shall be in proportion to size of plant based on ANLA minimum requirements. In no instance shall root balls be cut or otherwise reduced in size to fit limited planting areas.

J. Planting stock with root balls cracked or broken before or during planting operation will be cause for rejection by the Landscape Architect or Owner's Representative.

K. Landscape plugs – Plants noted as "Plugs" on the plans shall meet the following criteria:
1. Plugs shall be 5" deep by 2" wide minimum
2. Deep root establishment
3. Healthy, vigorous vegetative growth

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall conduct a pre-landscape construction conference at the project site with the Landscape Architect and the Owner's Representative prior to beginning landscape work to review landscape construction procedures, site conditions and submittal requirements for landscape work. This includes reviewing the requirements for the planting soil mix.

3.2 PLANTING

A. Layout: **Determine location of underground utilities/drainage and layout plants so as to avoid possible damage to such structures. Determine locations of security cameras and layout plants so as to avoid blocking camera views.** Plant pits and bed locations as shown graphically and/or verbally on plans, shall be staked on ground by Contractor and approved by the Landscape Architect prior to excavation. Should discrepancies exist between plant quantities in Planting Schedule and Planting Plan, quantities shown on the Planting Plan shall govern. Adjustments in locations and planting bed outline shall be made as directed in field by the Landscape Architect. The Landscape Architect reserves the right to determine the exact location of every plant and to change the location of plants to an area of similar conditions. Labor, equipment, and stakes are to be furnished by the Contractor for this purpose.

B. Planting Beds: Fill entire planting bed area to depths indicated on the Plans with approved planting soil mix, according to requirements in Section 32 91 03.

C. Contractor shall place jute mesh on all planting slopes 3:1 or greater.
1. Apply jute mesh loosely but smoothly to fit the contour of the finished grade, parallel to and in same direction as the flow of water. The up-slope end of each separate strip or piece of jute mesh shall be buried in a six (6) inch minimum vertical anchor slot of junction slot with the soil tamped firmly against the mesh. Where more than one width of material is required, edges shall overlap a minimum of twelve (12) inches, and the up-slope section of mesh will be on top. Down-hill ends of the jute mesh shall be folded under approximately four (4) inches and stapled in place.

Staples will be inserted through the mesh along edges, overlaps, and in the center of all jute mesh strips at intervals not greater than three (3) feet. All anchor slots, junction slots, check slots, and terminal folds shall have five (5) staples spaced not more than nine (9) inches on center across widths.

2. On shrub banks 3:1 and steeper OR as directed by the Landscape Architect, apply jute after finished grading. Slice "X" openings with sharp tool in mesh and peel back mesh for each plant and plant and mulch as specified.

D. Tree Excavation: Planting beds and individual tree pits shall conform to the approved staked locations and outlines. Holes dug for plantings shall in all cases be large enough to include the complete root system of the tree, shrub, and groundcover to be received and also sufficient amounts of approved planting backfill mix around the periphery of the rootball. All sod, weeds, roots, cobbles, and stones and other objectionable materials excavated from the plant holes which is unsuitable for backfill shall be removed from the site immediately and legally disposed of.

E. Plant Hole Size: The minimum plant hole size, unless otherwise specified, shown on the plans or directed by the Landscape Architect shall be as follows:

1. Trees and Shrubs - The planting hole shall be three (3) times the diameter of the rootball in width and no deeper than two inches (2") less than the distance from the bottom of the rootball to the root collar (i.e. a 12" distance between the bottom of the rootball and the root caller will require a 10" deep hole). Any excavation in excess of that required shall be replaced and compacted to eighty-five percent (85%) of maximum density.
2. Landscape Plugs and Groundcover – Contractor shall outline area for plugs and layout shall be approved by the Landscape Architect. The planting hole may be dug with auger, trowel, space, dibble or shovel. The hole shall be made in the plant bed prepared meeting the requirements of Section 32 93 00 and the depth for each plug or groundcover shall equal the depth of the root mass. Any excavation in excess of that required shall be replaced and compacted to eighty-five percent (85%) of maximum density.
3. Any rocks or underground obstructions shall be removed to a depth necessary for planting as specified, unless alternate locations for the planting are approved by the Owner's Representative. If removal of obstructions results in a deeper hole than specified for planting, backfill material shall be added and compacted to eighty-five percent (85%) of maximum density to the correct depth.
4. Scarify soils on sides of pit to facilitate integration of planting backfill mix with existing soil for better root penetration as plants grow.

F. Planting Backfill Mix: Planting Backfill Mix shall be existing suitable soil excavated from the planting hole and Loam/Compost Mix as defined in Section 32 93 00 to create "Planting Backfill Mix" for planting pits. Planting backfill mix shall be at least fifty percent (50%) loam/compost mix.

3.3 SETTING PLANTS

A. Plants shall be handled in such a manner that the soil of the rootball will not be

loosened from the roots. Carefully place plant into the prepared hole. Trees shall be set so that the root flare or collar is 2" above finished grade. Contractor shall remove all burlap and wire basket in its entirety from the root ball once the tree is set plumb. Fill in around the rootball to one half (1/2) the depth of the hole with planting backfill mix. Thoroughly tamp the backfill mix to eighty-five percent (85%) of maximum dry density, removing air pockets.

1. Contractor shall use leveling bed of compacted planting backfill mix to set ball if top of rootball needs to be raised to conform to proposed finished grade.
2. Contractor shall judge planting height to allow for settling, to meet grade after settlement.

B. Fill remaining area of planting hole with water. Cut broken or frayed roots cleanly.

C. Fill remaining area of hole with planting backfill mix and thoroughly tamp to eighty-five percent (85%) of maximum dry density. Form a saucer around the edge of the backfill hole by constructing a berm. The finish height of the compacted berm shall be three inches (3"). No excess soil shall be allowed to remain within the plant saucer. Fill saucer with water.

1. Do not over-compact planting areas. The Landscape Architect reserves the right to reject over-compacted soil installation and may request removal and replacement of soil and plants.

3.4 PRUNING OF NEW PLANT MATERIAL

A. Any plants with major damage to root ball, trunk, branches or central leader shall be replaced as directed by the Landscape Architect at no additional cost to the Owner. Trees which have had their leaders cut or abrasion of bark or so damaged that cutting is necessary, will not be accepted. There shall be no abrasion of bark, nor fresh cuts of limbs over one (1) inch.

B. Contractor shall prune only dead wood, damaged branches, crossed branches, and suckering shoots, in accordance with TCIA standards, minimizing amount of live growth removed and preserving natural character of plant. Shape trees only if additional direction is given by the Landscape Architect, maintaining natural form.

C. Perform all pruning with sharp tools, with cuts flush and clean.

D. Contractor shall not apply tree wound dressing of any type.

3.5 WATERING

A. Contractor shall water all plants immediately following planting to thoroughly moisten the rootball.

B. Contractor shall soak the root balls thoroughly again within a twenty-four (24) hour period after the initial planting. Contractor shall inspect planting areas to confirm that all planting areas are draining properly. If surface water or excessively saturated plant pit soils exist, Contractor shall immediately notify the Landscape Architect.

C. Contractor shall inspect the plants weekly and additional watering shall be done to provide adequate moisture for healthy plant establishment and growth. Contractor shall be responsible for watering as required through Final Acceptance.

3.6 FERTILIZING

A. During backfill operations, place fertilizer in upper foot of back fill around perimeters. Application rate shall be as follows unless otherwise determined by manufacturer's instructions and as recommended by soil test results.

Type of Plant	Rate
Deciduous Shade Tree	One packet for each inch of caliper or four (4) packets, minimum for 3 ½-4inch caliper tree
Shrub	One packet for every 12 inches of height

3.7 MULCHING PLANTS

A. Application of mulch should only occur after planting operations have been completed and initial watering has taken place.

B. Prior to the placement of mulch, the contractor shall apply a pre-emergent weed control within the entire area to be mulched. Pre-emergent weed control shall be applied by a licensed commercial applicator at a rate in accordance with the manufacturer's installation.

C. Contractor shall mulch tree, shrub and groundcover beds within one day of planting at the locations and depths indicated on the plans.

D. Trees - Mulch shall be spread to a depth of one (1) inch within a 4" diameter of the tree trunk and 2" deep around remaining bed. In no instance shall mulch be placed to cover root flare of any tree plantings. Mulch shall be pulled back from root flare to create a saucer.

E. Shrubs - Mulch shall be applied a minimum of tw0 (2) inches in depth for all shrub planting beds, as indicated graphically or as noted on the drawings. Mulch shall be pulled back from shrub or groundcover centers as necessary to create a saucer and provide air movement at the base of the plant.

F. Where mulch abuts seeded lawn areas or other finish grade materials, edge of planting bed shall be cut smooth and cleanly. Mulch shall be placed carefully so as not to spill into adjacent areas. Any excess or spilled mulch shall be promptly removed from the project area.

G. Contractor shall mulch plug planting areas with a maximum depth of one (1) inch of straw mulch.

3.8 GUYING AND STAKING

A. Immediately after planting, stake trees as indicated on detail drawing or as directed by Owner or Owner's Representative.

B. Place stakes outside of the planting pit exercising care not to damage the soil berm.

C. Guy all trees with a caliper of two inch (2") or greater and all evergreen trees greater than four feet (4'). Guy webbing shall be attached at a point no higher than one half (1/2) the height of the tree or lower than one-third (1/3) the height of the tree.

D. Guy trees to each stake near top of stake and intertwine webbing at tree trunk. The guy webbing shall lay flat against the trunk. Draw guy webbing tight enough to remove slack but shall not cause deflation or strain to the plant.

3.9 TRUNK WRAPPING

A. Contractor shall remove all trunk wrap and trunk protection devices prior to staking and guying operations.

3.10 ANTIDESSICANT SPRAYING

A. Contractor shall spray antidessicant as directed by the manufacturer's recommendation.

3.11 TAGS AND LABELS

A. Contractor shall leave all tree tag and label seals unbroken and visible on plant material until Provisional Acceptance. Remove all seals immediately after Provisional Acceptance has been granted.

3.12 MAINTENANCE

A. Contractor is responsible for protection and maintenance of all work prior to Final Acceptance of the project or phase of project. No plants will be accepted unless they show a healthy and satisfactory condition conforming to requirements of contract documents.

B. Maintenance work for all plantings shall be as listed in Section 1.9 herein.

3.13 CLEAN UP AND PROTECTION

A. Contractor shall protect work from damage due to landscape operations, operations by other contractors and trades, and trespassers. Contractor shall maintain protection during installation and maintenance periods. Contractor shall treat, repair or replace damaged work as directed by the Landscape Architect and/or Owner's Representative.

B. Contractor shall remove excess planting soil, waste material, and excess subsoil, unsuitable soil, wrappings, binding material, containers, trash and debris and legally dispose of material off site.

C. Contractor shall take care not to disturb any adjacent site improvements. If, in the opinion of the Landscape Architect or Owner's Representative, any damage to adjacent materials occurs as a result of planting operations, the Contractor shall repair damage to site or structures to restore them to their original condition at no

cost to the Owner.

3.14 PLANT REPLACEMENT GUARANTEE

A. Refer to Section 1.8 herein for Guarantee definition.

B. Replacements: Plants of same size and species as specified in the Plans, planted during the next growing season, with a new guarantee and maintenance service commencing on date of replacement.

C. At any time within period of guarantee, the Landscape Architect may direct the Contractor to replace any plantings which for any reason, other than vandalism, has died or is in a dying condition, or which has failed to flourish in such a manner or to such a degree that its usefulness or appearance has been impaired.

D. "Vandalism", is intended to mean any acts, whether intentional or accidental, by other persons occurring following final acceptance, which clearly result in breakage or other damage to individual plants or plant beds, and which may reasonable be considered to be beyond Contractor's reasonable control, as determined by the Owner's representative.

3.15 ACCEPTANCE OF TREES, SHRUBS AND GROUNDCOVER

A. PROVISIONAL APPROVAL
1. Provisional approval shall be considered after planting is completed for the project or phase of a project. In order for provisional approval to be granted, the Contractor shall request in writing to the Owner’s Representative that he/she is ready to have the planting reviewed. The following requirements shall be met:
2. Planting per the quantities and locations on the contract documents shall be installed and mulched.
3. A clear line defines a planting bed vs. lawn or other surface.
4. The following examples of delays in provisional approval of planting:
   a) Improper grading
   b) Incorrect depth of planting soil mix
   c) Tree root flares are below finished grade
   d) Trees planted too deep
   e) Mulch is piled around root flare
   f) Missing plants, incorrect locations, improper planting techniques
   g) Improperly pruned material
   h) Plants that in the opinion of the Landscape Architect are not showing vigorous and thriving growing conditions.

B. FINAL ACCEPTANCE
1. In order for final acceptance to be granted, the Contractor shall request in writing to the Owner’s Representative at the end of the one-year plant guarantee and the following requirements shall be met.
2. Contractor shall meet obligations of the Plant Replacement Guarantee and Maintenance as defined in Section 1.8 and Section 1.9 herein prior to Final Acceptance.
3. Inspection will be made by the Owner’s Representative and the Landscape Architect. Planting not demonstrating satisfactory growth, except if

damaged by vandalism, as determined, by the Landscape Architect shall be replaced and maintained meeting all requirements as specified herein. Plant Replacement Guarantee shall extend one year for new replacements.

4. After all necessary corrective work has been completed, the Landscape Architect will submit in writing recommending to the Owner's Representative that Final Acceptance shall be granted with documentation information indicating which replacement plants remain under guarantee and when guarantee period ends.
5. Decision of Owner’s Representative as to the necessity to replace plants or repair any defects in workmanship, or cause of any destruction or loss, impairment or failure to flourish, shall be conclusive and binding upon Contractor. Replacements shall be the same as specified. All replacements shall be planted as specified herein at Contractor's expense.
6. The Owner shall not maintain plantings until after Final Acceptance of the project or phase of project. Contractor shall not have any claim that materials have failed to flourish as a result of Owner's maintenance operations, or lack of maintenance, and shall abide by terms stated herein for guarantee and replacement of plant materials.

End of Section

SECTION 32 94 34
PLANTER SOIL MIX

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 32 33 00 – Site Furnishings
2. See Item 1.6 for Sustainable Requirements

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment and labor necessary to complete the work as indicated on the drawings or as specified herein.

B. The principal work of this section includes, but may not be limited to, the following:
1. Planter Soil Mix

1.3 QUALITY ASSURANCE

A. Contractor shall specialize in work outlined with a minimum of five (5) years' experience on similar projects.

B. Do not make substitutions without written approval. If specified materials are not available, obtain approval for substitution from the Owner's Representative.

1.4 SUBMITTALS

A. Certification and/or labels of proposed soil additives stating names of each and percentages by weight of each.

1.5 PRODUCT DELIVER, STORAGE AND HANDLING

A. Protect all products from weather vandalism or other damaging or deteriorating conditions.

1.6 NE-CHPS GENERAL REQUIREMENTS

A. The work of this Section is required to comply with general requirements and procedures for compliance with certain prerequisites and credits needed for the Project to obtain CHPS Verified certification based on Northeast Collaborative for High Performance Schools Criteria Version 3.2 (NE-CHPS) and as outlined in Division 01 Section "Sustainable Design Requirements."
1. The General Contractor is responsible to coordinate with the work of other

Sections and comply with all NE-CHPS requirements in accordance with the Contract Documents such that the work carried out by this Section does not compromise the achievement of any other NE-CHPS prerequisites and credits applicable to the entire Project.

B. Related Sections for Sustainable Design Requirements:
1. Division 01 Section “Substitution Procedures” for NE-CHPS substitution procedures.
2. Division 01 Section “Submittal Procedures” for NE-CHPS submittal requirements.
3. Division 01 Section “Construction Controls and Temporary Facilities” for requirements for temporary facilities.
4. Division 01 Section “Product Requirements” for additional NE-CHPS submittal requirements.
5. Division 01 Section “Construction Waste Management and Disposal” for waste management, recycling and disposal.
6. Division 01 Section “Sustainable Design Requirements” for general procedures for compliance with NE-CHPS prerequisites and credits.
7. Division 01 Section “Construction Indoor Air Quality (IAQ) Management Plan” for material and procedure requirements.

PART 2 - PRODUCTS

2.1 CLEAN SCREENED LOAM – Refer to Specification 32 93 00 – Soil Preparation for Trees and Planting Beds.

2.2 NORLITE

A. Norlite, a lightweight, porous ceramic material, as manufactured by Norlite Corporation, Cohoes, New York, or approved equivalent.

2.3 COMPOST

A. Organic Compost shall be natural or manufactured mature, composted organic material. Only Federal EPA Class A or Rhode Island Type I compost products shall be used. The following shall be requirements shall be met:
1. Compost shall originate from mature leaf compost, mature composted animal manure, other aged, composted vegetable materials such as brewer’s waste, or chemically tested toxin-free processed sludge products (biosolids).
2. Test results shall indicate maturity and age of organic compost. Raw un-composted or unprocessed or incompletely composted organic matter shall be rejected.
3. Organic matter manufactured from sludge and other biowaste materials or manure, shall be aged for at least one (1) year without exception and shall have no biowaste odor.
4. Compost shall contain no un-composted bulking agents such as un-composted wood chips and shall be free from hard lumps and free from seeping water when handled.
5. Compost shall be free from sticks, stones, plastic, debris or other substances which would be injurious to healthy plant growth. 100% of

compost material shall pass a ½" sieve.

6. Acidity range shall be pH 6 minimum and 8 maximum when tested according to methods of testing or A.O.A.C.
7. Organic matter shall not be less than 30% as determined by ASTM D2974.
8. Moisture content of 35% to 70%, as determined by ASTM D2974
9. Carbon:Nitrogen ratio of 15:1 to 30:1
10. Solvita intex of 6 to 8
11. Non-phytotoxic
12. There shall be no unpleasant or detectable odor of ammonia or hydrogen sulfide, which would indicate immature compost. Color of compost shall be dark brown.

PART 3 - EXECUTION

3.1 MIXING LOAM, COMPOST AND NORLITE

A. The Contractor shall thoroughly blend in 20% compost and 20% Loam and 60% Norlite to result a planting mix. Planting mix shall be placed at the location and depth shown on the Plans.

B. Planting mix shall be used in all school garden planters. Planters shall be filled 4" from the top with soil mix.

End of Section

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Section 33 05 13

DRAINAGE MANHOLES AND CATCH BASINS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby, made a part of this Section of the Specifications.

1.2 WORK TO BE PERFORMED

A. The work covered in this Section of the Specifications includes construction and placement of all precast reinforced concrete drainage manholes, catch basins, castings for drain covers and frames, rungs and all appurtenant and incidental work, complete, in strict accordance with the Specifications and the applicable Drawings.

1.3 REFERENCES

A. All work specified in this Section shall conform to the standard requirements of the City of Central Falls and the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, hereinafter referred to as the Standard Specification, and dated December 2022 or latest revision, herein referred to as “State Standards”.

B. American Society for Testing and Materials Standards.

1. All gray iron castings shall conform to the requirements of AASHTO Designation M105, Class 30 and ASTM A48-74. Test both cover and frame, for H-20 Highway Loading.
2. Ductile iron castings shall conform to ASTM A 536. Grade 60-40-18 unless otherwise specified.
3. Cast steel shall conform to ASTM A27. Grade 70-36 and shall be thoroughly annealed.

1.4 SUBMITTALS

A. Submittals for the following items shall be made in accordance with the requirements as specified in Section 01 33 00, SUBMITTAL PROCEDURES.

1. The drawings shall show the setting plans, exact profile of each units, openings required, all inserts and other items which are to be embedded in the units.
2. Shop drawings showing details of manhole cover and frame, catch basin frame and grate, manhole step castings, construction details, tolerances and other information as required.
3. Shop Drawings showing roof drain connectors and/or adapters.
4. Conformance Certificate: Each shipment of castings and concrete manholes and catch basins shall be accompanied with the manufacturer’s notarized certification that materials meet specified requirements.

1.5 QUALITY CONTROL

A. Provide the following:

1. All pre-cast concrete shall be the product of a manufacturer who has demonstrated capability to produce pre-cast concrete products of the quality specified. A manufacturer must be able to show that he has experienced personnel, physical facilities, established quality control procedures, and a management capability sufficient to execute the work of this contract. When requested by the Architect, the Contractor shall submit written evidence of the above requirements.
2. Experienced plant personnel shall closely supervise the manufacturing process, and daily records of concrete strength shall be kept and submitted to the Architect for control.
3. Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly trained and experienced in the installation of the pre-cast concrete structures and shall direct all work performed under this Section.

1.6 PRODUCT HANDLING

A. Materials and equipment shall be progressively delivered at the site so that there will be neither delay in the progress of the work nor an accumulation of materials that is not to be used within a reasonable time. Materials shall be so stored as to assure the preservation of their quality and fitness for the work.

B. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection.

C. Private property shall not be used for storage purposes without written permission of the owner or lessee, and if requested by the Architect copies of such written permission shall be furnished to him/her. All storage sites shall be restored to their original condition by the Contractor at his expense

1. Avoid damage to castings from impact, abrasion, or corrosion during handling and storage.
2. Use all means necessary to protect pre-cast concrete units and materials before, during and after installation and to protect the installed work and materials for all other trades.
3. In case of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at the Contractor’s expense.

PART 2 - MATERIALS

2.1 GENERAL

A. Cement shall be Portland cement conforming to ASTM C150, Type III, high early strength and comply with the Standard Specifications.

B. Aggregate: shall conform to ASTM C330 and shall be graded, crushed stone with a resulting unit weight of concrete of up to one hundred fifty five (155) pounds per cubic foot, and a minimum unit weight of not less than one hundred forty-eight (148) pounds.

C. Water: shall be clear and free of injurious and deleterious substances.

D. Concrete: shall have a minimum strength of 5000 psi at twenty-eight (28) days and strength of 3000 psi at the time of form release.

1. During the process of manufacturing of the units not less than two (2) test cylinders shall be tested at time release of the form and two (2) at age twenty-eight (28) days.
2. All compression test cylinders shall be made, cured and stored in accordance with ASTM C31. Cylinders shall be tested in accordance with ASTM C39.
3. All concrete shall contain three (3) to five- (5) percent air entrainment.

E. Admixtures shall only be used after prior approval of the Architect.

F. All reinforcing bars shall conform to the requirements of ASTM designation: A615, Grade 60 and comply with Section 901.61 of the Standard Specification.

G. Welded wire fabric shall conform to the requirements of ASTM designation: A185.

H. All frames and grates shall be H-20.

2.2 PRECAST CONCRETE MANHOLES, CATCH BASINS AND BRICK

A. Precast Concrete Manhole and Catch Basin Sections shall be similar or equal to that shown on the Drawings and shall conform to ASTM Specifications C-478 and C-76 Class IV Wall "B". The horizontal joints between Sections shall be sealed using a flexible butyl resin sealant and shall conform to AASHTO M-198B. In addition, the horizontal joints on the inside and outside of the manhole and catch basin shall be sealed with a "Quick Plug" as manufactured by Parson or equal.

B. Brick shall conform to ASTM Specification C-32 for sewer brick, except that the table therein is amended to provide that the required minimum compressive strength in pounds per square inch shall be for any individual brick 3,000 or 5,000 for the average of five bricks selected at random. The maximum absorption of water by five-hour boiling test shall not exceed 16% for any individual brick or 12% for the average of any five bricks selected at random.

C. Mortar for all brickwork shall be composed of Portland cement and sand in the proportions of 1:2. No mortar cement or lime shall be used. Cement shall be type II Portland Cement as specified for concrete masonry.

D. The dome of the manholes shall be a precast concrete Section. The top 6-inches of the dome, not to exceed 12 inches, shall be built of brick and mortar to permit adjustment of the frame to meet the ground surface.

E. Openings for pipe insertions shall be round and shall be precast or cored only. The diameter of the opening shall be adequate to install a rubber boot seal. The cored or precast opening shall maintain a minimum undisturbed distance of 6” from manhole Section joints. Flexible rubber boot shall be neoprene with stainless steel clamps and bands.

F. The precast bases shall be supported on a compacted level foundation of crushed stone at least 6-inches thick.

G. The barrel shall be at least 48 inches inside diameter with not less than 5 inch thick wall.

H. Sections shall be steam cured and shall not be shipped until at least 5 days after having been cast.

I. The date of manufacture and the name of trademark of the manufacturer shall be clearly marked on the inside of the barrel.

J. The top conical Section shall have a wall thickness not less than 5-inches at the bottom and wall thickness of 8 inches at the top. The conical Section shall taper from a minimum of 48 inches diameter to 36 inches diameter at the top.

2.3 DRAINAGE MANHOLE FRAMES AND COVERS

A. Manhole Frames and Covers shall have a hot-dipped bituminous coating and form to the details on the Drawings. Cast iron shall conform to ASTM A-48, Class 25. The underside of the cover and upper side of lip frame must present parallel plane surfaces, and at these points of contact, the frames and covers shall be machined to prevent covers from rocking in the frames under traffic.

B. Covers shall bear evenly in the frame and both frame seats and covers shall be accurately fabricated so that covers are interchangeable for use with any and all frames. Where indicated, frames and covers shall be watertight, and locked. The sizes and weights (medium duty, heavy duty) are shown on the detail sheets for special manholes.

C. Mortar shall consist of one-part cement and two parts clean sand. No lime shall be used.

D. Covers shall have a non-slip surface and shall have the word “DRAIN”, as applicable, inscribed.

E. Frames and covers shall be installed on the manholes as indicated on the Drawings. They shall be well bedded and encased in cement mortar and accurately set to the grades indicated. Red clay brick with cement mortar shall be used to adjust grade of frame and cover. One half inch of cement mortar plaster cast shall be applied to exterior of red clay bricks.

F. All frames shall be designed for H-20 wheel loading.

G. Manhole frames and covers shall be specified by the City of Central Falls.

2.4 CATCH BASINS FRAMES AND GRATES

A. Catch Basin Frames and Grates shall have a hot-dipped bituminous coating and conform to the details on the drawings. Cast iron shall conform to ASTM A-48, Class 25. The underside of the grate and upper side of lip frame must present parallel plane surfaces, and at these points of contact, the frames and grates shall be machined to prevent grates from rocking in the frames under traffic.

B. Grate shall bear evenly in the frame and both frame seats and grates shall be accurately fabricated so that grate is interchangeable for use with any and all catch basin frames. The sizes and weights (medium duty, heavy duty) are shown on the detail sheets.

C. Mortar shall consist of one-part cement and two-part clean sand. No lime shall be used.

D. Gratings shall have a non-slip surface.

E. Gratings shall be installed on the catch basins as indicated on the Drawings. They shall be well bedded and encased in cement mortar and accurately set to the grades indicated. Red clay brick with cement mortar shall be used to adjust frame and grate. One half inch of cement mortar plaster cast shall be applied to exterior of red clay bricks.

F. Catch basin frames and grates shall be as specified by the City of Central Falls or equal.

2.5 MANHOLE STEPS

A. Steps shall conform to ASTM C-478.

B. The capacity of each step shall be 1000 lb. At 6-inch distance from wall, 1500 lb. At 4-inch distance from wall.

C. Steps shall measure 12 inches wide (min.) and extend 6 inches from wall.

D. Manhole steps shall be provided in each base, riser and top Section and shall be integrally cast in each; 12 inches O.C.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the substrate and conditions under which work of this Section is to be performed, and correct unsatisfactory conditions that would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

1. Examine castings for blowholes, porosity, hard spots, shrinkage, distortion, or other defects. Check coating for smoothness and tenacity.

B. The installation of all pipes of various materials, structures, and connections to existing pipes/structures shall be made at the locations and elevations as shown on the drawings.

C. All materials and each part of detail of the work shall be subject to inspection by the Architect. The Architect shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the contractor as is required to make a complete and detailed inspection, (such assistance may include furnishing labor, tools, and equipment, at no expense to the Architect.)

D. If the Architect so requests, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering or the removing and the replacing of the covering or making good of the parts removed, will be at the Contractor’s expense.

E. Any work done or materials used without authorization by the Architect may be ordered removed and replaced at the Contractor’s expense. The Contractor shall

furnish written information to the Architect stating the original sources of supply of all materials manufactured away from the actual site of the work. In order to ensure a proper time sequence for required inspection and approval this information shall be furnished at least two weeks in advance of the incorporation in the work of any such materials.

F. For the purpose of observing work that affects their respective properties, inspectors for the municipalities, public agencies and the utility companies shall be permitted access to the work, but all official orders and directives to the Contractor will be issued by the Architect.

G. The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill the terms of the Contract a herein prescribed by the plans and specifications.

H. Failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor obligate the Owner to make final acceptance.

I. The Contractor shall give prior notice to the Architect when work on the various items is to be performed by him or his Subcontractors. If work is suspended on any item, prior notice shall be given to the Architect before resumption of such work.

3.2 GENERAL

A. Excavation and backfilling requirements for installation of manhole and catch basin structures shall be in accordance with the requirements as specified in Section 31 00 00, Earthwork.

B. Manhole and catch basin barrel and cone Sections shall be set so as to be vertical and in true alignment.

C. Where required for future connections, openings shall be cast in the manholes and catch basins at the proper location and shall be sealed with watertight brick bulkheads or plugs.

D. Drop manholes shall be built in accordance with the details shown on the Drawings and as specified herein.

E. The inverts of all manholes shall be constructed of brick and formed to the details shown on the Drawings.

3.3 CONSTRUCTION AND INSTALLATION

A. Bottom riser Sections of reinforced concrete manholes and catch basins may be either cast-in-place or precast concrete. The top edges, of cast-in-place bottom Sections, shall be formed with a removable steel ring template designed to fit the tongue end of the precast riser Sections.

B. Inverts: Where pipe alignment permits, and where directed by the Architect, the pipe shall be continued through the manhole and the top half carefully and evenly cut away. Where changes in alignment occur, unless otherwise authorized by the Architect, inverts shall be constructed of brick and mortar with a smooth flow line and an even curve in accordance with the plans.

C. Joints: Pipe joints into manholes and catch basins shall be constructed in accordance with the details shown on the plans. Complete details of the boot manufacture and installation shall be submitted for approval. All areas around pipes passing through walls of manholes and catch basins shall be completely filled with waterproof cement mortar to tightly fill any space through which water can pass. All manhole and catch basin joints between Sections shall also be completely filled with waterproof mortar, both inside and outside, and coated with epoxy sealer inside and out.

D. Bricks shall be laid in a workmanlike manner, true to line, and the joints shall be carefully struck and pointed on the inside. Bricks shall be thoroughly wet when laid and each brick shall be laid in mortar so as to form full bed, end and side joints in one operation. The outside of the brickwork shall be neatly plastered with ½" layer of cement mortar as the work progresses. The brickwork shall be satisfactorily bonded to the concrete and cast-iron frame. No brick masonry shall be laid in water, or any water allowed to rise on the brickwork until the masonry has set for at least 24 hours.

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Section 33 10 00
WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to the Pawtucket Water Supply Board standards.

B. American Water Works Association (AWWA):
1. AWWA C104: Standard for Cement Mortar Lining.
2. AWWA C111: Standard for Rubber Gasket Joints.
3. AWWA C150: Standard for the Thickness Design of Ductile Iron Pipe.
4. AWWA C151: Standard for Ductile Iron Pipe, Centrifugally Cast.
5. AWWA C153: Standard for Ductile Iron Compact Fittings.
6. AWWA C600: Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.
7. AWWA C651: Standard for Disinfecting Water Mains.

1.3 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service mains.

B. This Section specifies requirements for furnishing and installing ductile iron pipelines complete and in place for water services.

C. The Contractor shall pay for all costs and fees related to the construction of new water system components and connecting the new water system components to the existing water system including all tap-in and inspection fees and shall file all applications, details and drawings required by the local authority having jurisdiction.

D. The installation of fire main/hydrant system must comply with NFPA-24, 2014 and the RI State Fire Code.

1.4 SUBMITTALS

A. Product Data and Shop Drawings: For each type of product indicated. Submitted and approved by the Architect.

B. Field quality-control test reports and disinfection notification: The Contractor shall initially notify and subsequently provide the test reports to the Architect upon completion of the disinfection and pressure testing.

C. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

D. A copy of any permits required by local authorities having jurisdiction shall be submitted to the Owner prior to commencing work on the water system.

E. Certificate of Compliance:

1. Each shipment of piping, valves, or appurtenances shall be accompanied with the manufacturer's notarized certificate certifying conformance with the requirements of the Specifications.

1.5 PERMIT

A. The Contractor shall maintain a copy of Pawtucket Water Supply Board permit and associated documents at the site at all times during the work of this Contract.

B. The Contractor shall obtain all permits required to perform work on the water system without expense to the Owner.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with applicable requirements of the Pawtucket Water Supply Board including requirements pertaining to the tapping of water mains and backflow prevention.
2. Comply with applicable Pawtucket Water Supply Board standards for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with Pawtucket Water Supply Board requirements for water distribution systems.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. All water pipe and appurtenances shall be “American Made”.

1.7 DELIVERY, STORAGE AND HANDLING

A. All delivery, storage, and handling of pipe, valves, hydrants, and appurtenances shall be in accordance with manufacturer's recommendations.

B. Preparation for Transport: Prepare valves according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

C. During Storage: Use precautions for valves, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

D. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

E. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

F. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

G. Protect flanges, fittings, and specialties from moisture and dirt. Piping or materials damaged during delivery storage or handling shall be replaced at the expense of the Contractor.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
   1. Notify Owner in writing no fewer than 2 weeks in advance of proposed interruption of service.
   2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.9 COORDINATION

A. The Contractor shall contact "Dig Safe" at 1-888-Dig-Safe to verify locations of existing underground utilities in areas of proposed excavation prior to commencing any excavation effort.

B. The Contractor shall coordinate any work on the water system with the Pawtucket Water Supply Board prior to commencing any work on the existing and proposed water system.

C. The installed work will be subject to a final inspection by representatives of the Pawtucket Water Supply Board.

1.10 MARKING

A. Marking of all pipe shall conform to the requirements of AWWA C151, latest revision, and marking of all fittings shall conform to the requirements of AWWA C153, latest revision.

1.11 MANUFACTURERS REPRESENTATIVE

A. The Contractor shall furnish at no additional expense to the Owner, the services of pipe manufacturer's representatives for instruction of the Contractor's personnel who will be installing the pipe. The instruction shall include proper handling, installation, and jointing and other construction areas, and shall be for such lengths of time required to fully familiarize the Contractor's personnel with the proper techniques.

PART 2 - PRODUCTS

2.1 GENERAL

A. All water appurtenances are to be American made.

B. All materials shall be reviewed and approved prior to installation by the Architect.

C. Refer to the Pawtucket Water Supply Board requirements for a list of approved materials and manufacturers.

2.2 DUCTILE IRON PIPE

A. Ductile iron pipe shall be cement-lined, Class 52, and shall conform to AWWA specifications C150 and C151, latest revision. Ductile iron pipe shall have push-on type joints with the exception that mechanical joints shall be used at all fittings and along straight pipe sections where mechanical joint restraint is required. All pipe shall have a bituminous seal coating on all exterior surfaces.

2.3 FITTINGS

A. Fittings and plugs for use with the ductile iron pipe specified shall be ductile iron, cement lined, bituminous coated with a working pressure rating of not less than 250 psi, conforming to AWWA C153, latest revision, and shall have mechanical joints.

B. The exterior of all fittings, plugs, bolts, and nuts shall be coated with two (2) coats of heavy-duty epoxy protective asphaltic coating after assembly.

C. Bolts and nuts shall be rustproof steel.

2.4 JOINTS

A. Push-on and mechanical type joints for pipe as specified above shall conform to AWWA C111, latest revision. Gasket material for all jointing requirements shall be styrene butadiene (SBR).

B. Lubrication Material is to be food grade quality, kept in original container, and stored according to manufacturer's recommendations.

2.5 CEMENT MORTAR LINING

A. Interior pipe and fitting surfaces shall be covered with a double cement-mortar continuous lining not less than 1/16" thick, of materials, and applied in accordance with AWWA/ANSI C104/A21.4, latest revision.

2.6 STORAGE OF MATERIALS

A. Pipe and related materials shall be stored in locations and in a manner approved by the Architect. The locations and manner of storage shall be as to minimize handling of the materials.

B. Gaskets are to be stored out of direct sunlight in their original packaging and protected from temperature extremes.

C. The Contractor shall, at all times, be solely responsible for the safe storage of all materials.

2.7 TESTING

A. Manufacturer Testing:

1. Testing of ductile iron pipe shall be done in accordance with AWWA C151, latest revision.
2. Testing of ductile iron fittings shall be done in accordance with AWWA C153, latest revision.
3. Testing of jointing material shall be done in accordance with AWWA C111, latest revision.
4. Testing of the interior coating shall be done in accordance with AWWA C104, latest revision.
5. Certified test reports shall be submitted by the pipe manufacturer.
6. The Architect shall be notified at least ten (10) days in advance of the date and location of the testing in order to witness the tests.
7. The Contractor shall furnish to the Architect notarized test reports by an independent testing laboratory, which show compliance of all materials furnished to the requirements specified herein. The test reports shall indicate results and methods employed.

B. Field Testing.

1. Field testing of ductile iron pipe installed for water service shall be performed according to the requirements as specified in Section 3.8 of this specification.

2.8 JOINT RESTRAINT

A. Thrust Blocks are to be designed appropriately for the soils, pipe sizes, and pressures encountered at the job site and are to be installed square and plumb against undisturbed soil so that the joint itself, including any bolts, is accessible. Concrete is to be a minimum compressive strength of 2,000 psi and installed to industry standards.

B. Restraining devices shall be utilized on all mains under the following conditions:
   1. Pipeline direction changes (tees, bends).
   2. Dead end lines (caps, plugs, valves).
   3. Transition pieces (reducers).

C. Thrust restraint may be provided via restrained joint, ductile iron pipe meeting ANSI/AWWA C153, AWWA C151/A21.512, AWWA C111/A21.11, and be approved for use by the Pawtucket Water Supply Board. Restrained joint pipe lengths (restrained length) shall be sufficient to restrain thrust imparted by 1½ times the anticipated working pressure but not less than 250 psi and may be more than one full length of pipe.

D. Thrust restraint utilizing tie-rods may be used alone or in combination with other restraint systems and are to be installed as directed by the Pawtucket Water Supply Board. All rods shall be protected from corrosion with two coats of bituminous paint or epoxy prior to backfilling.

2.9 TAPPING SLEEVES AND TAPPING VALVES

A. All tapping sleeves shall comply in all respects to AWWA Standard C-110 and the following design standards:
   1. Tapping sleeve shall be installed at the location of the existing water main as shown on the plans and details.
   2. The tapping sleeve shall be a mechanical type joint to provide pressure - tight installation and be suitable for use with the existing pressurized pipe material. Outlet flange shall be Class 125C, ANSI B16.1.
   3. Mechanical joint tapping sleeves shall have totally confined end gaskets and be designed to withstand a minimum of 250 p.s.i. working pressure.
   4. Tapping valves shall comply with Section 2.10 - Gate Valves except one end shall be flanged and the other mechanical.
   5. Tapping valves shall be provided with an oversized opening to allow the use of full size cutters.

2.10 GATE VALVES

A. Resilient seated gate valves shall meet AWWA C-509 and be UL listed and FM approved. This valve shall be iron-body, bronze mounted, nonrising stem, 4 inch through 12 inch in diameter as shown on the plans and details. All valves to open as designated by Pawtucket Water Supply Board and the City of Central Falls. All valves to be mechanical joint.

B. Sizes 4 inch through 12 inch shall be suitable for a test pressure of 250-psi.

C. Valve shall have a minimum of two O-ring stem seals.

D. Bonnet and gland bolts and nuts shall be stainless steel for corrosion resistance.

E. The interior and exterior of valves shall be fully epoxy coated 8 mils thick.

F. Gate valves shall be as manufactured by Mueller or equal.

G. Gate valves shall be iron-body, bronze-mounted solid-wedge gate valves, with bell or mechanical joint ends. Valves shall conform to AWWA Standard Specification for Gate Valves, three (3) inch through forty-eight (48) inch for water and other liquids, Designation C500. They shall be double disk type.

H. Buried valves shall be inside-screw, non-rising stem, having bell or mechanical-joint ends and two (2) inch square operating nuts.

I. Bronze gate-rings shall be fitted into grooves of dovetail or similar shape in the gates. For grooves of other shapes, the rings shall be firmly attached to the dates with bronze rivets.

J. Operating nuts shall be turned to the right (clockwise) to close all valves.

K. O-ring stuffing boxes shall be used.

L. The T-handle wrenches shall be furnished with each gate valve which shall permit operation from a standing position.

M. All valve boxes shall be adjusted to the final grade.

2.11 STRAIGHT AND TRANSITION PIPE COUPLINGS

A. The center sleeve and end rings of couplings shall be made of ductile iron, meeting or exceeding ASTM A536. The coupling shall accommodate the entire O.D. range in the specified size by use of interchangeable color-coded end rings and gaskets.

B. The coupling gasket shall be made of virgin rubber compound for water use. The SBR shall meet or exceed ASTM D2000-3-BA715. The gasket shall have raised lettering, sizing, and state the proper color code for the appropriate end ring.

C. The coupling shall be equipped with stainless steel bolts, washers, and nuts and conform to the latest edition of the AWWA specification designation C-111 and C-219-06.

D. Straight couplings shall be as manufactured by Ford Model FC1-SH, Smith Blair Model 441, Romac Model 501, Cascade Waterworks Model CDC, or equal.

E. Transitional couplings shall be as manufactured by Ford Model FC2A-SH, Smith Blair Model 441, Romac Model 501, Cascade Waterworks Model CTC, or equal.

F. Straight connections between two ductile iron pipe sections shall be made by ductile iron solid sleeves.

2.12 VALVE BOXES AND COVERS

A. Cast iron valve boxes shall be two-piece adjustable style, sliding type. Barrel inside diameter shall be 5¼ inches with 26-inch top section and 48 inch bottom section lengths adjusted to finish grade.

B. Covers shall be cast iron, 5¼ inch, with the word "WATER" and a direction to open arrow imprinted thereon. Covers shall be the heavy, non-tilting 2” drop style recessed in the top to prevent plow breakage. The boxes and covers shall be compatible with the valves to which they attach.

C. An approved operating key shall be provided to the Owner.

2.13 LIQUID CHLORINE

A. Liquid chlorine shall conform to AWWA Standard B301, current edition. Liquid chlorine shall be NSF 60 certified for potable water use.

2.14 HYPOCHLORITE

A. Hypochlorite shall conform to AWWA Standard B300, current edition. Hypochlorite shall be NSF 60 certified for potable water use.

2.15 BACKFLOW PREVENTER

A. Backflow prevention device used temporarily for any connection between the existing water system and new water pipes prior to acceptance of pressure test, disinfections and flushing, shall be of the appropriate size and shall be double check-reduced pressure type as manufactured by Watts, Febco, Hersey or equivalent. Permanent backflow prevention devices to be installed as part of this project are specified in the plumbing specifications of this Contract.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 00 00 - Earthwork for excavating, trenching, and backfilling.

3.2 INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of Pawtucket Water Supply Board standards and of size and in location indicated.

B. The installation of fire main/hydrant system must comply with NFPA-24, 2014 and the RI State Fire Code.

C. Pipe, valves, sleeves, hydrants, accessories, and appurtenances shall be new and unused, and shall be of the types and materials specified, as indicated or as directed.

D. The interior of pipe and fittings shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations.

E. Piping, valves, sleeves and other appurtenances shall be constructed in dry trenches and shall not be laid when the conditions of the trench or the weather is unsuitable for such work.

F. The trench bottom and bedding shall be shaped and compacted to give substantially uniform unyielding circumferential support to the lower fourth of the full length of each pipe.

G. Holes for the bells shall be excavated so that after placement the pipe and coupling receives uniform bearing pressure from the trench bottom.

H. Each pipe shall be laid to the line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the

flow line. Joint deflections are limited to 80% of the values specified in AWWA C600-99 Table 3 and 4.

I. As the work progresses, the interior and exterior of the pipes and couplings shall be cleaned of all dirt and superfluous material of every description. Any damage to bituminous coating shall be repaired prior to backfill.

J. When required to keep interior of pipe clean, a suitable drag shall be kept in the pipe and pulled forward past each joint immediately after the jointing has been completed.

K. At times when work is not in progress, open ends of pipe and fittings shall be securely closed with a watertight plug so that no trench water, earth or other substance will enter the pipe or fitting.

L. Any pipe, valve, sleeve, or appurtenance that has been disturbed after laying shall be taken up and re-laid.

M. All materials found to be defective during the progress of the work will be rejected by the Architect and the Contractor shall promptly remove such defective material from the site of the work and replace with new material at no additional expense to the Owner.

N. The Contractor shall be responsible for the safe storage and proper handling of all materials.

O. No shims or mounds of earth shall be used to raise the pipe to grade.

P. All pipes, valves, sleeves, and appurtenances shall be maintained accurately to the required line and grade.

Q. No pipe, valves, sleeves, and appurtenances shall be covered until the Pawtucket Water Supply Board has inspected the joints.

R. The pipeline shall not be used to convey trench drainage during construction.

S. Pipes shall be protected at all times during construction against flotation. They shall be thoroughly secured, properly supported and bedded to prevent settlement or disturbance. Compaction of bedding and backfill material shall be in strict accordance with Section 31 00 00 - EARTHWORK.

T. Bends, crosses, tees, caps, plugs, valves, and other appurtenances shall be strapped and clamped where indicated. Steel bars, rods and plates shall be of structural steel. Straps, bridle rods, clamps, anchors and such other parts shall be provided to the details. After installation, all parts of the strapping and clamping devices shall be given two (2) heavy coats of an approved coal-tar base protective coating.

U. All lumps, burrs, excessive coatings, and irregularities on the plain and socket ends of the pipe, valves, sleeves, and appurtenances shall be removed.

V. Field cutting of the pipe is to be square and free of any burrs and defects.

W. Water shall be laid with a minimum horizontal separation of 5’ from all utilities and 10’ from sewer lines. Sewer lines crossing over water lines shall be sleeved

for 10 feet on either side of crossing regardless of vertical separation distance. Sewer lines crossing under water lines shall be constructed with a minimum vertical separation of 18" or the sewer shall be constructed of ductile iron or encased in concrete for 10 feet on either side of crossing.

X. Bury piping with depth of cover over top at least 54 inches.

Y. Connect to water-supply source and construct water-service piping to a point 5 feet from the outside face of the building wall in locations and pipe sizes indicated on Drawings. It is the responsibility of the plumber to construct the required piping from this point through the building wall.

Z. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

AA. Valves shall be set in the pipeline as directed. Blocking or supports of a permanent nature shall be placed under each valve to ensure against settlement.

BB. Each valve shall be tightly closed before being placed in the line and shall remain so until the joints on each side are completely tightened.

CC. General:

1. All tapping sleeves, valves and accessories shall be carefully inspected by the contractor for defects before installation and all defective, unsound or damaged materials shall be rejected.
2. The Owner will make such additional inspections as he deems necessary and the Contractor shall furnish all necessary assistance for such inspection.
3. Proper implements, tools and facilities satisfactory to the Owner shall be provided by the Contractor for the proper and satisfactory execution of the work.

DD. All work shall be completed in conformance with the Pawtucket Water Supply Board requirements.

EE. Tapping sleeves and valves shall be constructed in dry trenches and shall not be laid when the conditions of the trench or the weather is unsuitable for such work.

FF. Tapping sleeves, valves and couplings shall be laid to the line and grade in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line.

GG. Any tapping sleeves or valves that have been disturbed after laying shall be taken up and relayed.

HH. All materials found to be defective during the progress of the work will be rejected by the Owner and the Contractor shall promptly remove such defective material from the site of the work and replace with new material at no additional expense to the Owner.

II. The Contractor shall be responsible for the safe storage and proper handling of all materials.

JJ. Tapping sleeves shall be installed where indicated or as directed by the Owner and shall be installed according to the manufacturer's recommended procedures.

KK. Valves and joint restraints shall be installed where indicated or as directed by the Owner and shall be installed according to the manufacturer's recommended procedures.

3.3 INSPECTION

A. General

1. All pipe shall be installed in accordance with AWWA C600, latest revision and manufacturer requirements, and in accordance with the Pawtucket Water Supply Board requirements.
2. All pipe and accessories shall be carefully inspected by the Contractor for defects before installation and all defective unsound or damaged materials shall be rejected.
3. The Architect will make such additional inspections as he deems necessary and the Contractor shall furnish all necessary assistance for such inspection.
4. Proper implements, tools, and facilities satisfactory to the Architect shall be provided by the Contractor for the proper and satisfactory execution of the work.
5. The workmanship, materials, and installation are subject to inspection and approval by Pawtucket Water Supply Board. No installation shall be backfilled prior to inspection.
6. The Pawtucket Water Supply Board reserves the right to stop work on any water main installation for failure to abide by Pawtucket Water Supply Board standards until deficiencies are corrected.

3.4 JOINTING

A. No pipes shall be jointed until couplings and ends of pipe have been inspected to determine that the joint surfaces are free from any defects in materials or workmanship, and free from dirt or other foreign matter.

B. Pipe, pipe fittings and accessories shall be stored, installed, joined and protected by the Contractor in strict accordance with the printed recommendations of the manufacturer of the piping material.

C. Field assembled joints shall be checked with a suitable gauge as recommended by the manufacturer to ensure that the rubber rings are properly located.

D. If inspection indicates that the rings are improperly located, the Contractor shall disassemble, and properly reinstall the pipe.

E. Pipe stoppers shall be installed, sealed and blocked in such a manner as to prevent any leakage and so as to withstand an internal hydrostatic pressure of not less than 5 psi.

1. Timber blocking shall be of adequate size and arrangement to prevent the stopper from being blown off the line.
2. Timber bracing shall extend back to the undisturbed end of the trench.

3.5 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping.

3.6 RECORD DRAWINGS

A. All installed underground utilities shall be designated on as-built drawings by the contractor of record and provided to the Owner and Architect in AutoCAD format prior to completion of the project. All as-built drawings, (underground and above ground) shall be dimensioned from permanent benchmarks such as existing buildings and include depths at various points throughout the extent of the work, and invert elevations at all structures.

3.7 SETTING VALVES AND VALVE BOXES

A. Valves shall be set in the pipelines as directed. Blocking or supports of a permanent nature shall be placed under each valve to ensure against settlement.

B. Maximum spacing between valves shall be 600 feet.

C. Each valve shall be tightly closed before being placed in the line and shall remain so until the joints on each side are completely tightened.

D. Valve boxes shall be set for all valves. They shall be carefully fitted together and to the valve and securely held during backfilling. They shall be centered over the valve-operating nut. The bedding material around them shall be thoroughly tamped in placed and the box cover set to the finished grade.

3.8 TESTING

A. Alignment Tests: Each section of pipe will be checked by the Owner or the Architect in order to determine whether any displacement of the pipe has occurred. The Contractor shall provide suitable assistance to the Owner or the Architect. The Contractor shall repair any poor alignment, displaced pipe or other defects discovered, as directed by the Architect.

B. Hydrostatic Tests: After the pipe has been laid and the trench has been backfilled, all newly laid pipe or any valve section thereof, shall be subjected to a pressure and leakage test in accordance with AWWA C600-latest edition and as approved by the Architect. The Contractor shall provide all pumps, pipe, connections, gages, measuring devices, and all other apparatus necessary for the test and shall conduct the test in the presence of and to the satisfaction of the Architect. The Owner will supply water to the Contractor for testing purposes at no expense to the Contractor.

1. Test Pressure - The required minimum test pressure shall be 1-1/2 times the working pressure measured at the point of lowest elevation of the pipeline and corrected to the elevation of the test gage, but shall not be less than 150 psi. Test pressures shall not vary by more than plus or minus 5 psi for the duration of the test.
2. Duration of Test - two (2) hours minimum.
3. Air Removal - Prior to performance of the test the pipeline shall be completely filled with water for a period of 72 hours. Expel air by means of air relief valves, hydrants or other means as required. If permanent air vents or taps

are not located at all high points, the Contractor shall install corporation stops at such points so air can be expelled. After the tests are completed, plug all temporary taps.

4. Allowable Leakage:
   a) Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valve section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
   b) No pipe installation will be accepted if the leakage is greater than that determined by the following formula in which "L" is the allowable leakage in gallons per hour; "S" is the length of pipe tested in feet; "P" is the average test pressure during the leakage test in pounds per square inch (gauge); and "D" as the nominal diameter of the pipe in inches.

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

5. Repair of Leaks - If the test discloses leakage greater than the allowable leakage the Contractor shall, at his own expense, locate and repair the defective joints until leakage is within the specified allowable. The Contractor shall repair any specific leaks regardless of the test results if, in the opinion of the Architect, they are serious enough to endanger the future serviceability of the pipeline.

C. All materials found to be defective during testing shall be replaced with new and approved material at no additional expense to the Owner.

3.9 DISINFECTION OF POTABLE WATER LINES

A. General
1. Flushing and disinfections of potable waterlines shall be done in accordance with the procedure set forth in AWWA C651 - Disinfecting Water Mains, latest edition, and shall be witnessed by the Architect unless otherwise approved. The Contractor shall provide all temporary blowoffs, pumps, chlorination equipment, chlorine and all other necessary apparatus required. The Owner will supply water to the Contractor for disinfection purposes at no expense to the Contractor.
2. All valves on the new piping shall be operated during the disinfection procedure in order to ensure complete disinfections.
3. The form of chlorine proposed by the Contractor for disinfection shall be approved by the Architect.
4. The Contractor shall take adequate measures to prevent backflow of flushing water and chlorinated water into the existing water distribution system.
5. Contractor shall not make physical connection to the existing water main prior to satisfactory results of chlorination. An approved backflow prevention device shall be utilized to transfer water from the existing system to the new piping network.

B. Pipe Cleaning

1. If the pipe contains dirt or heavy encrusted matter that, in the opinion of the Architect, will not be removed during the flushing operation, the Contractor shall clean and swab the interior of the pipe with a one (1) percent hypochlorite disinfecting solution.
2. The pipeline shall be flushed to remove all remaining foreign material prior to disinfections, except when the tablet method is used. The flushing operation shall develop a minimum velocity of 2.5 ft/sec. It will be the Contractor's responsibility to properly size and locate corporations within test sections to adequately flush all piping at least 2 times its volume at the desired velocity.
3. Main line valves shall not be utilized to fill, flush, test or chlorinate water mains unless authorized and supervised by the Architect.

C. Chlorine Application

1. In general, chlorine shall be applied using the continuous feed method, as specified in AWWA C651.
2. Introduce water into the line at a constant rate while adding chlorine to the water at a constant rate, such that the water will have not less than 25 mg/L free chlorine. Maintain the chlorinated water in the pipeline for a minimum of 24 hours, after which period the treated water shall have a free chlorine residual of not less than 10 mg/L throughout the entire length. Repeat the above procedure if the residual, at the end of the 24 hours, fails to meet the minimum concentration. Chlorinated water, above the normal system prevailing concentration, shall not be allowed to remain in the pipeline for a period longer than 5 days.
3. Fire hydrants may not be used for sampling points but may be utilized as a feed source if properly flushed and the Owner’s required temporary piping system installed.

D. Final Flushing

1. After the required retention period, flush all heavily chlorinated water from the main until the chlorine concentration is no higher than that prevailing in the system, or is acceptable for domestic use. The Contractor shall be responsible for satisfactory disposal of all flushing water and chlorinated water at no additional expense to the Owner.
2. Prior to discharging, a reducing agent shall be applied to the water to be wasted, to neutralize thoroughly the chlorine residual remaining in the water. (See Appendix B of AWWA C651 for neutralizing chemicals.)

E. Analytical Tests

1. After completion of the final flushing and prior to placing the pipeline in service, two (2) consecutive sets of acceptable samples taken at least 24 hours apart shall be collected. Each sample shall be analyzed for total coliforms. All samples shall be collected by a qualified individual and will be witnessed by the Architect, who will be given the opportunity to split all samples.
2. All samples shall be collected in laboratory-provided glassware with appropriate preservatives. The laboratory used for testing shall be certified in the State of Rhode Island.
3. Sampling locations shall be subject to approval by the Architect and the Pawtucket Water Supply Board.

4. The results of the sampling and analysis shall be reported to Owner and Architect.

F. Repetition of Procedure - If the original disinfection fails to produce satisfactory bacteriological samples, repeat the disinfection procedure until satisfactory results are obtained at no additional expense to the Owner.

3.10 TEST REPORTS AND CERTIFICATES

A. In addition to other requirements specified herein, the Contractor shall furnish to the Owner notarized test reports and methods of test by an approved independent testing laboratory to show compliance of all materials furnished under this Section of the Specifications with all the requirements herein.

B. Each shipment of pipe, tapping sleeves, valves, and appurtenances shall be accompanied by the manufacturer's notarized certificate of conformance certifying that materials to be furnished under these items meet all requirements herein.

C. All testing of materials furnished under this Section of the Specifications shall be provided by the Contractor at no additional expense to the Owner.

End of Section

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Section 33 30 01
SANITARY SEWER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to the standard requirements of the City of Central Falls, the Narragansett Bay Commission, and the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, hereinafter referred to as the Standard Specification, dated December 2022 or latest revision.

B. All sanitary sewers and appurtenances shall be designed and constructed in accordance with TR-16, “Design and Construction of Sanitary and Storm Sewers” as prepared by the Technical Advisory Board of the New England Interstate Water Pollution Control Commission.

C. All work shall conform to the following standards
   1. ASTM D 3034 Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
   2. ASTM D 3212 Joints for Sewer Pipes using Flexible Elastomeric Seals Federal Specification.
   3. SS-S-210 Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.
   4. ASTM C 923 Standard Specification for resilient connectors between reinforced concrete manhole structures, pipes, and laterals.

1.3 SUMMARY

A. This Section includes gravity-flow, non-pressure and pressurized sanitary sewer outside the buildings, with the following components:
   1. Manholes
   2. SDR-35 PVC Gravity Sewer Pipe
   3. Cleanouts

1.4 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. SDR: Standard Dimension Ratio

1.5 PERFORMANCE REQUIREMENTS

A. Pipe used for gravity flow sanitary sewers shall be SDR-35 PVC unless specified otherwise on the Drawings.

1.6 SUBMITTALS

A. Provide Shop Drawings for the following:

1. Pipe: Include specifications on pipe materials, dimensions, fittings and joint details, construction details, tolerance and physical characteristics.
2. Manholes: Include plans, elevations, Sections, details of structures, frames, and covers. Include design calculations, reinforcement product information, and concrete design-mix report.
3. Rubber Boot Connections: Provide product specifications, materials, manufacturer's information, and recommended installation procedure.
4. Cleanouts: Include frame and covers specifications and loading criteria.

B. Conformance Certificates: Each shipment of castings, pipe, pipe fittings, and appurtenances, shall be accompanied by the manufacturer's notarized certification and cylinder testing that materials meet specified requirements.

C. Guarantee: The Contractor shall furnish to the Architect a written guarantee signed by the manufacturer of the pipe and pipe fittings which he proposes to furnish, which shall warrant and guarantee that the pipe and pipe fittings meet all requirements of the specifications and that the pipe and fittings shall not fail or be injured as a result of conveying sewage, drainage, industrial wastes or groundwater. The form of guarantee shall, in all respects, be satisfactory to the Architect.

D. Permits

1. Provide Architect and Owner's Representative with copy of all permits required prior to commencing work.

E. Field quality-control test reports for field manhole and pipe testing.

F. Record Drawings (see specification Section 029500 Site As-built Survey).

1.7 DELIVERY, STORAGE AND HANDLING

A. Store pipe on flat surface which provides even support for the pipe barrel with bell ends overhanging. Do not stack pipe higher than 5 feet. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Deliveries shall be scheduled so that the progress of the work is at no time delayed and so that large quantities of products shall not be stored for excessive lengths of time in crowded locations or in locations where large storage areas might be considered objectionable.

D. Avoid damage to pipe from impact, bending, compression or abrasion during handling and storage.

E. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.

F. Use only nylon-protected slings to handle pipe. The use of hooks or bare cables will not be permitted.

G. The Contractor shall dispose of pipe damaged during delivery, handling, or storage and replace at no cost to the Owner.

H. Handle manholes according to manufacturer's written rigging instructions.

I. Use all means necessary to protect precast concrete units and materials before, during, and after installation and to protect the installed work and materials for all other trades.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewage Service: Do not interrupt service to facilities occupied by Owner or others anytime.

B. Provide bypass system to maintain service to Owner's or others facilities at no additional expense to the Owner.

1. All equipment and materials required to construct bypass system shall be purchased at the Contractor's expense.

1.9 PERMITS

A. The Contractor shall obtain any permits required by the local authority prior to commencing with work affecting the sanitary sewer system.

B. No work shall commence until the Contractor has acquired all required permits and receives authorization from the Owner.

C. All required permits shall be obtained by the Contractor at no additional expense to the Owner.

1.10 MARKINGS

A. Mark pipe with the following information applied at intervals of not more than 5 feet:

1. Manufacturer's name or trademark.
2. Nominal pipe size;
3. Pipe classification;
4. Applicable dimension ratio;
5. Date and location of manufacturer;
6. Applicable standard designation number.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Underground-Type Line Markers for Non-Metallic Pipelines: Manufacturer's standard permanent detection tape, bright-colored, continuous printed polyethylene tape with a metallic core for detection of non-metallic underground installations, intended for direct-burial service; not less than 6" wide x 4 mils. thick. Provide green detection tape with black printing reading "CAUTION SEWER LINE BURIED BELOW."

2.2 POLYVINYL CHLORIDE GRAVITY SEWER PIPE

A. PVC sewer pipe for gravity sewers and service connections shall conform to ASTM D 1784 and D-3034-SDR 35 with a minimum stiffness of 46 pounds per square inch, and shall meet the following specific requirements and exceptions:

1. The pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusion or other injurious defects. The pipe shall be as uniform as commercially practical in color, capacity, density and other physical properties.
2. Joints shall be bell and spigot. The bell shall consist of an integral wall Section with a solid cross Section rubber ring gasket factory-assembled, securely locked in place to prevent displacement. Joints shall conform to ASTM Standard D 3212.
3. All fittings and accessories shall have dimensions as recommended by the manufacturer and have bell and/or spigot configurations compatible with that of the pipe. Fittings and accessories shall have integral wall Section with a solid cross Section rubber ring set in place to prevent dislocation.
4. Pipe shall pass impact resistance test in accordance with ASTM D 2444 and minimum pipe stiffness test at 5% deflection in accordance with ASTM D 2412.
5. The normal length of 12-inch size and smaller pipe shall be 12.5 feet and 15-inch size shall be no longer than 20 feet.
6. Pipe and fittings shall be manufactured in the United States of America and shall be accompanied by the manufacturer's certificate of compliance, in addition to meeting the performance tests specified hereinafter.
7. If requested by the Architect, six specimen lengths each 6-inches long of each size pipe shall be furnished by the Contractor for impact resistance test and three specimen lengths each 6-inches long of each size pipe for pipe stiffness test. These tests are to be made in accordance with ASTM D 2444 and ASTM D 2412, respectively, at the expense of the Contractor. No pipe shall be accepted if the tests do not meet the test requirements.

2.3 NON PRESSURE-TYPE PIPE COUPLINGS

A. Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end as manufactured by Fernco. Inc or equivalent.

2.4 POLYVINYL CHLORIDE PRESSURIZED SEWER FORCE MAIN PIPE

A. All force main pipe shall conform to ASTM D2241.

B. The pipe shall be homogenous throughout and free of cracks, holes, foreign inclusion, or other injurious defects. The pipe shall be as uniform as commercially practical in color, capacity, density, and other physical properties.

C. Joints shall be bell and spigot. The bell shall consist of an integral wall section with a solid cross section rubber ring factory-assembled, securely locked in place to prevent displacement. Joints shall conform to ASTM Standard D 1869 and F 477.

D. Pipe shall pass impact resistance test in accordance with ASTM D 2444 and minimum pipe stiffness test at 5% deflection in accordance with ASTM D 2412.

E. All fittings and accessories shall have dimensions as recommended by the manufacturer. All fittings shall be ductile iron mechanical joint with gasket compatible for SDR-21 PVC pipe

2.5 CLEANOUTS

A. Gravity Sewer Cleanouts: PVC body with PVC threaded cap and cast-iron frame and cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Frame and cover shall be Cast-Iron and shall be able to withstand H20-44 loading criteria.

2.6 MANHOLE MATERIALS

A. Cement shall be Portland cement conforming to ASTM C150, Type III, high early strength.

B. Aggregate shall conform to ASTM C330 and shall be graded, crushed stone with a resulting unit weight of concrete of up to one hundred fifty five (155) pounds per cubic foot, and a minimum unit weight of not less than one hundred forty-eight (148) pounds.

C. Water shall be clear and free of injurious and deleterious substances.

D. Concrete: shall have a minimum strength of 4000 psi at twenty eight (28) days and a strength of 2400 psi at seven (7) days.

1. During the process of manufacturing of the units not less than two (2) test cylinders shall be tested at time release of the form and two (2) at age twenty-eight (28) days.
2. All compression test cylinders shall be made, cured and stored in accordance with ASTM C31. Cylinders shall be tested in accordance with ASTM C39.
3. All concrete shall be air entrained as specified per RIDOT Standard Specifications.

E. Admixtures shall only be used after prior approval of the Owner’s Representative.

F. All reinforcing bars shall conform to the requirements of ASTM designation: A615, Grade 60.

G. Welded wire fabric shall conform to the requirements of ASTM designation: A185.

2.7 PRECAST CONCRETE MANHOLES AND BRICK

A. Precast Concrete Manhole sections shall be equal to that shown on the drawings and shall conform to ASTM Specifications C-478 and C-76 Class IV Wall "B". The horizontal joints between sections shall be sealed using a flexible butyl resin sealant and shall conform to Federal Specifications SS-S-210A and AASHTO M-198B. In addition, the horizontal joints on the inside and outside of the manhole and catch basin shall be sealed with a "Quick Plug" as manufactured by Parson or approved equivalent.

B. Brick shall conform to ASTM Specification C-32 for sewer brick, except that the table therein is amended to provide that the required minimum compressive strength in pounds per square inch shall be for any individual brick 3,000 or 5,000

for the average of five bricks selected at random. The maximum absorption of water by five-hour boiling test shall not exceed 16% for any individual brick or 12% for the average of any five bricks selected at random.

C. Unless otherwise noted on the Drawings, sanitary manholes less than or equal to ten (10) feet deep shall have an interior diameter of 48 inches. Manholes greater than ten (10) feet shall have an interior diameter of 60 inches unless otherwise noted. All manholes with interior drops shall have an interior diameter of 60 inches unless otherwise noted. Manholes with a depth greater than 12 feet shall have an interior diameter of 72 inches unless otherwise noted.

D. Openings for pipe insertions shall be round and shall be precast or cored only. The diameter of the opening shall be adequate to install a rubber boot seal. The cored or precast opening shall maintain a minimum undisturbed distance of 6” from manhole section joints. Flexible rubber boot shall be neoprene with stainless steel clamps and bands.

2.8 MANHOLE FRAMES AND COVERS

A. Manhole Frames and Covers shall be cast iron and conform to the details on the drawings. Cast iron shall conform to ASTM A-48, Class 30. The underside of the cover and upper side of lip frame must present parallel plane surfaces, and at these points of contact, the frames and covers shall be machined to prevent covers from rocking in the frames under traffic.

B. Frame and covers shall be capable of withstanding H-20 highway loading.

C. Covers shall bear evenly in the frame and both frame seats and covers shall be accurately fabricated so that covers are interchangeable for use with any and all frames. Where indicated, frames and covers shall be watertight, and locked. The sizes and weights (medium duty, heavy duty) are shown on the detail sheets for special manholes.

D. Mortar shall consist of one part cement and two parts clean sand. No lime shall be used.

E. Covers shall have a non-slip surface and shall have the word “SEWER” inscribed.

F. Frames and covers shall be installed on the manholes as indicated on the drawings. They shall be well bedded and encased in cement mortar and accurately set to the grades indicated or as directed. Red clay brick with cement mortar shall be used to adjust grade of frame and cover. One half inch of cement mortar plaster cast shall be applied to exterior of red clay bricks.

2.9 MANHOLE STEPS

A. Manhole steps shall be manufactured of Copolymer Polypropylene plastic with ½” grade 50 steel reinforcement.

B. Steps shall conform to ASTM C-478 and Fed. Spec. FS RR-F-621.

C. The capacity of each step shall be 1000 lb. at 6-inch distance from wall and 1500 lb. at 4-inch distance from wall.

D. Steps shall measure 12 inches wide (min.) and extend 5 1/8 inches from wall.

E. Manhole steps shall be provided in each base, riser and top Section and shall be integrally cast in each; 12 inches O.C.

2.10 WATER PROOFING FOR UNDERGROUND STRUCTURES

A. Bitumastic asphalt shall conform to ASTM D449, Type A.

2.11 RUBBER BOOT

A. Rubber boot shall comply with ASTM C 923.

2.12 THRUST RESTRAINT

A. Thrust restraint shall be provided for all bends, endcaps and changes in direction on the pressure sewer. Concrete thrust blocks shall be utilized for thrust restraint.

B. The bearing strength area of soil shall be sufficient to support 1½ times the anticipated working pressure in the pipeline but not less than 200 psi.

C. Thrust blocks shall be installed against undisturbed soil.

PART 3 - EXECUTION

3.1 GENERAL

A. At no time shall the installed sanitary sewer piping be used to convey stormwater from dewatering operations or runoff.

B. Excavating, trenching, and backfilling are specified in Section 310000 - EARTHWORK.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. All lines, grades, measurements, layout staking and reference staking necessary for the proper location and satisfactory completion of the pipeline, appurtenances and other construction, shall be the responsibility of the Contractor.

C. All stakes, references and batter boards including original, additional or replacement, which may be required for the construction operations, shall be furnished, set and properly referenced by the Contractor. The Contractor shall be solely and completely responsible for the accuracy of the line and grade of all features of the work. Any errors or apparent discrepancies found in previous surveys, plans, specifications or special provisions shall be called to the Architect's attention by the Contractor for correction or interpretation prior to proceeding with the work.

D. Upon request of the Architect, the Contractor shall furnish copies of all data used in setting and referencing all stakes and other layout markings used by the Contractor.

E. Gravity-Flow and Force Main Pressure Piping shall use the following pipe materials as applicable: Use the following pipe materials as specified on the Drawings:

1. SDR 35, sewer pipe and fittings; gaskets; and gasketed joints (used for gravity sewer).
2. SDR 21, sewer pipe and fittings, gasket joints, and factory specific lubricant. (used for force main).

F. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

G. Install gravity-flow, non-pressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, to the slope indicated on the Drawings. An even alignment of the pipe shall be maintained.
2. Install piping with 36-inch minimum cover unless specified otherwise on the Drawings
3. The Contractor shall excavate around the bell portion of the pipe so the pipe barrel bears on the prepared bed.
4. Blocking is not permitted.
5. All pipes shall be clean and free of dirt before laying and open ends shall be kept covered and free of dirt during construction.
6. The work shall be conducted in such a manner that no loose excavation or other foreign material can enter the pipes.
7. Each pipe shall be held firmly in position by carefully and thoroughly tamping backfill material around the barrel of the pipe.
8. Where new pipes are to adjoin existing structures, extreme care shall be taken in coring into existing structure. Tight waterproof connections shall be made without interrupting service.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

I. Where installing pipe below standing water table trench shall be dry and free of water and pipe bedding. Below bottom of pipe can be replaced with 1 ½” crushed stone.

J. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place watertight plug in end of incomplete piping at end of day and when work stops.

K. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and fitting shall be laid accurately to the required lines and grades using laser beam techniques and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed to permit making the joints. The pipe shall be bedded and backfilled in accordance with the details. Additionally, installation of the sanitary sewer below the water table may be expected and the installation of pumps, wells, or other work required to lower the water table to install

sanitary sewer piping or structures shall be completed at no additional cost to the Owner.

L. The bell and rubber ring must be clean with no foreign material that could interfere with the proper assembly of the pipe spigot.

M. The pipe end must be clean. Wipe with a clean, dry cloth around the entire circumference from the end to one inch beyond the reference mark.

N. Lubricate the spigot end of the pipe, using only the factory specified lubricant supplied. Be sure to cover the entire spigot end circumference. The coating should be the equivalent of a brush coat of enamel paint. It can be applied by hand, cloth, pad, sponge, or glove.

O. Insert the spigot end into the bell so that it is in contact with the rubber ring. Keep the pipe lengths in proper alignment. Brace the bell while the spigot end is pushed in under the rubber ring, so that previously completed joints in the line will not be closed up. Push the spigot end in until the reference mark on the spigot end is flush with the end of the bell.

P. Pipe may be easily assembled by hand and/or bar and block. Stabbing is not allowed and shall be avoided. The Contractor shall not push on the end of the pipe with a machine.

Q. When the pipe laying is not in progress, the pipe shall be protected in such a way to prevent flotation. Any pipe, which has floated shall be removed from the trench and re-laid to the satisfaction of the Owner's Representative at the Contractor's expense.

R. The Contractor shall install piping as specified to within 5 feet of the building foundation. The Plumbing Contractor shall make the connection to the sanitary sewer from this point.

S. Where installing pipe below standing water table the trench shall be dry and free of water and pipe bedding. Trenching below bottom of pipe can be replaced with 1 ½" crushed stone.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints and manufacturer's recommendations.

B. Machinery shall not be used to push the pipe into place. The pipe shall be pushed into place by hand. The use of a hammer or mallet is permitted, with the use of a board to shield the end of the pipe being struck by the hammer. The pipe shall not be directly contacted with a hammer or mallet.

3.4 MANHOLES

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Form continuous concrete or brick channels and benches between inlets and outlet as specified on Drawings.

C. Install precast concrete manhole sections with sealants according to ASTM C 891.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

E. Inverts: Where pipe alignment permits, and where directed by the Architect, the pipe shall be continued through the manhole and the top half carefully and evenly cut away. Where changes in alignment occur, unless otherwise authorized by the Architect, inverts shall be constructed of brick and mortar with a smooth flow line and an even curve in accordance with the plans.

F. Joints: Pipe joints into manholes shall be constructed in accordance with the details shown on the plans. Complete details of the boot manufacture and installation shall be submitted for approval. All areas around pipes passing through walls of manholes and catch basins shall be completely filled with waterproof cement mortar to tightly fill any space through which water can pass.

G. Bricks shall be laid in a workmanlike manner, true to line, and the joints shall be carefully struck and pointed on the inside. Bricks shall be thoroughly wet when laid and each brick shall be laid in mortar so as to form full bed, end and side joints in one operation. The outside of the brickwork shall be neatly plastered with ½" layer of cement mortar as the work progresses. The brickwork shall be satisfactorily bonded to the concrete and cast iron frame. No brick masonry shall be laid in water, or any water allowed to rise on the brickwork until the masonry has set for at least 24 hours.

H. Rubber Boot: Connections shall be installed in accordance with the manufacturer's recommendation. The connection must pass the testing procedure described below.

I. Waterproofing: All exterior surfaces of underground manholes shall receive one coat of bitumastic asphalt waterproofing.

3.5 IDENTIFICATION

A. Materials and their installation are specified in Section 31 00 00 - Earthwork. Arrange for installation of detectable green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over all piping and over edges of underground manholes.

3.6 FIELD QUALITY CONTROL

A. Testing shall be completed in accordance with the City of Central Falls requirements. At a minimum, the testing procedures below shall be completed.

B. Contract the Owner's Representative a minimum of 72 hours prior to testing. Provide results to Owner's Representative.

C. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: To be determined by the Mandrel Test.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

2. The Contractor shall repair any defects or corrections required by the Architect.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified at no expense to the Owner.
4. Re-inspect and repeat procedure until results are satisfactory at no expense to the Owner.

D. Testing Manholes

1. All sanitary manholes affected by the work shall be vacuum tested prior to backfilling, including existing manholes to which new connections are made. A minimum waiting period of thirty days after installation is required for all testing.
2. Install vacuum tester and inflate compression band to affect a seal between the vacuum base and the new manhole, connect vacuum pump to the outlet part with the valve open, draw a vacuum of 10 inches of mercury, (HG), and close the valve.
3. The manhole shall pass the test if the vacuum remains at 10 inches of HG in a time greater than 60 seconds for a 48-inch diameter manhole, time greater than 75 seconds for 60-inch diameter manhole and time greater than 90 seconds for 72-inch diameter manhole.
4. If the manhole fails the initial test, the Contractor shall make proper repairs or replace the manhole and re-test at no additional compensation.

E. Testing Gravity Sewers

1. Low Pressure Air Test
   a. The Contractor shall, at his expense, conduct a line acceptance test. The test shall be performed according to stated procedures and in the presence of the Architect. A minimum waiting period of thirty days after installation is required for all testing. The line shall be flushed and cleaned prior to testing.
   b. All pneumatic plugs shall be seal-tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
   c. After a manhole-to-manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average

backpressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

d. After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable". If the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) shall not be less than 5 minutes.

e. If the installation fails the air test, the Contractor shall, at his expense determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship to Architect's satisfaction and the pipeline shall be re-tested, all performed at no additional compensation to the Contractor.

2. Infiltration Test

a. The infiltration test shall be conducted at such time as the ground water level is at a height of not less than one foot above the top of the pipe for the full length of the Section of sewer being tested.

b. Each manhole-to-manhole reach shall be tested separately. At no time will the Contractor be allowed to test more than one manhole-to-manhole reach.

c. The Contractor shall construct such weirs or other means of measurement as shall be required and shall do such pumping as shall be necessary to enable the tests to be made satisfactorily.

d. The groundwater leakage into the pipes will be measured by the Owner or Architect after a minimum of one hour and the infiltration rate shall not exceed 50 gallons per day per mile per inch-diameter.

F. Pipe Deflection

1. Pipe provided shall be so installed that there be a maximum deflection of 5 percent determined by the Mandrel Test. Such deflection shall be computed by multiplying the amount of deflection (nominal diameter of the pipe less minimum diameter when measured) by 100 and dividing by the nominal pipe diameter.

2. The Contractor shall measure the amount of deflection by pulling a specially designed gauge assembly through the completed Section after 120 days of installation. The gauge assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the Architect.

3. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem as the Architect may require without additional compensation.

4. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

5. Leaks and loss in test pressure constitute defects that must be repaired. All repairs shall be at the expense of the Contractor.

3.7 CLEANING

A. Interior of piping and manholes shall be cleaned of dirt and superfluous material prior to acceptance of sanitary sewer.

3.8 RECORDS DRAWINGS

A. All installed underground utilities shall be designated on as-built drawings by the contractor of record and provided to the Owner and Architect in AutoCad format prior to completion of the project. All as-built drawings, (underground and above ground) shall be dimensioned from permanent benchmarks such as existing buildings and include depths at various points throughout the extent of the work, and invert elevations at all structures.

3.9 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use heavy-duty cleanout frames and covers capable of withstanding HS-20-44 loading criteria in all areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 12 by 12 by 8 inches deep. Top of concrete block shall be laid 3” below finished grade. Top of frame shall be set flush with finish grade.

C. Set cleanout frames and covers in bituminous concrete and concrete pavement with top of frame flush with pavement surface. Top of concrete block shall be laid at the bottom of the bituminous binder course.

3.10 CLOSING ABANDONED SANITARY SEWER SYSTEMS:

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole and use either procedure below:

1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 60 inches below final grade

3.11 TESTING SEWER FORCE MAIN

A. Leakage Tests

1. The contractor shall furnish all materials and equipment, install necessary pipe plugs, install necessary temporary pipe taps and make leakage tests; water used shall be fresh potable water supplied by the Contractor.
2. Leakage tests shall be conducted by maintaining the pipe under a pressure, as measured at the point of lowest elevation, of 150 psi or 1-½ times for at least 2-hours. Care should be taken to expel all air from the pipes when filling with water.
3. The quantity of water measured to maintain the test pressure shall not exceed 0.09 gallons per inch of diameter per 24-hours per joint.

B. If the leakage exceeds this rate, the Contractor must repair, replace or relay sections of pipe and repeat the tests until satisfactory to the Owner's Representative at no additional cost to the Owner.

3.12 CLEANING

A. Interior of piping and manholes shall be cleaned of dirt and superfluous material prior to acceptance of sanitary sewer.

End of Section

Section 33 40 00
STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 WORK TO BE PERFORMED

A. Work under this Section includes furnishing all plant labor, equipment, appliances and materials, and performing all operations in connection with the construction of stormwater collection systems at the locations and to the lines and grades indicated on contract drawings and/or directed.

B. Any manufacturer's names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is NOT a proprietary specification and it should be noted that "Or equal" applies to all products denoted herein. It is understood that all manufactures will have minor variations in configuration, appearance, and product specifications and such minor variations shall not eliminate such manufacturers as an equal". It is the intent of this specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

C. Related Sections:

1. Division 31 Section 31 00 00 – "Earthwork", for excavating, compacting, and grading the subgrade; for excavating and backfilling the anchor trench; for protecting the earthwork; for adding requirements for the earth cover; and for the filter fabric and other geotextiles.
2. Division 31 Section 31 23 19 – "Dewatering and Drainage", for removing ground water from subgrade to the extent required by liner manufacturer.

1.2 DEFINITIONS

A. Plastic Terminology: See ASTM D 1600 for definitions of abbreviated terms for plastics not otherwise defined in this section.

B. EPDM: Ethylene-propylene-diene terpolymer

1.3 REFERENCES

A. All work specified in this Section shall conform to the standard requirements of the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, hereinafter referred to as the Standard Specification, and dated December 2022 and the RI Stormwater Design and Installation Manual, latest revision.

B. ASTM C891, Standard Practice for Installation of Underground Pre-cast Utility Structures.

1.4 SUBMITTALS

A. Refer to SECTION 013300 – SUBMITTAL PROCEDURES for submittal provisions and procedures.

B. The Contractor shall submit for approval, manufacturer's printed recommendations for the storage, protection, handling, installation and testing of storm water piping, fittings and appurtenances, which shall be strictly adhered to by the Contractor.

C. Manufacturer testing results indicating compliance with the specifications herein.

D. Licenses required by the municipality or state government to install storm drainage systems shall be submitted prior to the commencement of any work on the storm water collection system.

E. It is required to have the Installer maintain an experienced full-time supervisor on Project site when earthwork is in progress.

F. Submit shop drawings including plans, sections, and testing documentation for all products and calculations for underground stormwater systems and hydrodynamic separator.

G. Geomembrane liners:

1. Product Data: For each type of product indicated. Include the following:
   a. Sheets for geomembrane liners.
   b. Seaming adhesives, solvents, and extrusions.
   c. Penetration assemblies.
2. Shop Drawings: Show fabrication and installation details for geomembrane liners. Show panel layout, seams, penetrations, perimeter anchorage, and methods of attachment and sealing to other construction. Differentiate between factory and field seams and joints.
3. Samples: For the following products, in sizes indicated:
   a. Geomembrane Panels: For each type, not less than one 12-inch seam length for factory-bonded sheets and one 12-inch seam length for field-bonded sheets.
4. Qualification Data: For qualified testing agency.
5. Product Certificates: For each type of geomembrane liner, from manufacturer.
6. Product Test Reports: For each geomembrane sheet, based on evaluation of comprehensive tests performed by a qualified testing agency.
7. Source quality-control reports.
8. Field quality-control reports.
9. Maintenance Data: For geomembrane liner to include in maintenance manuals.
10. Warranty: Special warranty specified in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Pipes shall be handled with care and in strict accordance with manufacturer's recommendations.

B. Materials and equipment shall be progressively delivered at the site so that there will be neither delay in the progress of the work nor an accumulation of materials that is not to be used within a reasonable time. Materials shall be so stored as to assure the preservation of their quality and fitness for the work.

C. Contractor will be responsible for unloading delivered treebox filter products.

D. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection.

E. Private property shall not be used for storage purposes without written permission of the owner or lessee, and if requested by the Architect copies of such written permission shall be furnished to him/her. All storage sites shall be restored to their original condition by the Contractor at his expense.

F. Care shall be taken during transportation of the pipe such that it is not damaged.

G. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe.

H. Prevent damage to the interior and exterior walls of the pipe. Raising pipes with hooks, dropping or placing large stones against pipe, rolling over stones or sharp objects/edges and dropping pipe are prohibited. All damaged pipe and fitting shall be removed from the project site and replaced at no additional expense to the Architect.

1.6 GUARANTEE / WARRANTY

A. Material Guaranty: Before any contract is awarded, the Bidder may be required to furnish without expense to the owner complete statement of the origin, composition and manufacture of any or all materials proposed to be used in the construction of the work, together with samples, which may be subjected to the tests required by the owner to determine the quality and fitness of the material.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products as specified herein shall be new, unused and purchased specifically for this Contract.

2.2 HIGH DENSITY POLYETHYLENE PIPE (HDPE):

A. High-Density Polyethylene Pipe and fittings shall be ADS N-12 IB ST Smooth Interior Pipe, ADS N-12 IB ST High Capacity Large Diameter Pipe or approved equivalent. Joints shall be soil-tight and include a rubber gasket on the spigot end of the pipe. When installed into the bell end, the joint shall be sealed.

B. Pipe shall conform to AASHTO M294 (Type ‘S’) for the specified diameters and strength classes.

C. Pipe shall be rated to withstand H-20 Loading Criteria with 18” of cover.

2.3 REINFORCED CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Pipe and Fittings: ASTM C 76 (ASTM C 76M), with bell-and-spigot ends and sealant joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant.

B. Pipe shall conform to AASHTO M170 for the specified diameters and strength classes. The minimum cement content shall be 564 pounds per cubic yard.

C. Strength class of reinforced concrete pipe shall be Class III unless specified otherwise on the drawings. Reinforced concrete pipe located less than six inches below vehicular pavement subgrade shall be Class V.

D. Joint of reinforced concrete pipe shall be made with flexible watertight rubber gaskets and the remaining exterior void of the joint shall be sealed with Portland cement mortar.

2.4 PVC PIPE AND FITTINGS

A. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends.

B. The pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusion or other injurious defects. The pipe shall be as uniform as commercially practical in color, capacity, density and other physical properties.

C. Joints shall be bell and spigot. For SDR-35 PVC pipe, the bell shall consist of an integral wall section with a solid cross section rubber ring factory-assembled, securely locked in place to prevent displacement. Joints shall conform to ASTM Standard D 3212. For SCH 40 PVC piping, joints shall be glued with PVC cement approved by the manufacturer.

D. All fittings and accessories shall have dimensions as recommended by the manufacturer and have bell and/or spigot configurations compatible with that of the pipe.

E. Pipe shall pass impact resistance test in accordance with ASTM D 2444 and minimum pipe stiffness test at 5% deflection in accordance with ASTM D 2412.

F. The normal length of 12-inch size and smaller pipe shall be 12.5 feet.

G. Pipe and fittings shall be manufactured in the United States of America and shall be accompanied by the manufacturer's certificate of compliance, in addition to meeting the performance tests specified hereinafter.

H. PVC pipe shall be SCH 40 where pipe has less than 2 feet of cover or as indicated on the plans.

I. PVC perforated pipe shall conform to ASTM/ANSI D 2759 or ASTMF 810. Perforations shall be 5/8” holes on 5” centers.

2.5 MANHOLES, CATCH BASINS AND CASTINGS

A. Precast concrete drainage manholes and catch basins, and castings for manhole covers, catch basin grates and frames shall be in accordance with Section 33 05 13, Manholes and Catch Basins.

2.6 CATCH BASIN HOODS

A. All catch basin outlet pipes on new catch basins and all outlet pipes on existing catch basins shall be fitted with a catch basin hood.

2.7 OUTLET CONTROL STRUCTURES

A. Provide precast control structures, outlet structures shall conform to the dimensions shown on the plans and details and shall include a including galvanized steel bar grate fastened to the top of the unit. Outlet control structures shall be precast concrete units designed for AASHTO HS20-44 loading, with openings as shown on the detail drawings.

2.8 STORMWATER HYDRODYNAMIC SEPERATOR

A. Acceptable suppliers may be CDS/Stormceptor/Vortsentry by Contech Stormwater Solutions, BaySeperator/Barracuda by Bay Saver, Downstream Defender by Hydro International, or approved equivalent.

B. Materials and Design

1. Concrete for precast stormwater treatment systems shall conform to ASTM C857 and C478 and meet the following additional requirements:
   a. In all cases the wall thickness shall be no less than the minimum thickness necessary to sustain HS20 loading requirements.
   b. Sections shall have tongue and groove or ship-lap joints with a butyl mastic sealant conforming to ASTMT C990.
   c. Cement shall be Type I, II, or III Portland cement conforming to ASTM C150.
   d. All sections shall be cured by an approved method. Sections shall not be shipped until the concrete has attained a compressive strength of 4,000 psi (28 MPa) or other designate suitable handling strength.
   e. Pipe openings shall be sized to accept pipes of the specified size(s) and material(s), and shall be sealed by the Contractor with a hydraulic cement conforming to ASTM C595M.

C. Performance

1. Each stormwater treatment system shall have treatment, sediment storage, and oil storage capacities equal to or greater than that shown on the table below. For the purpose of determining equivalency, the treatment capacity shall be defined as the flow rate at which the stormwater treatment system removes 80% of an unground silica sample having an average particle size equal to or less than 240 microns. Treatment capacity shall be additionally defined as the maximum flow rate prior to which bypass of any flow occurs. Calculations must be provided to show the criteria shown on the plans are met with the shop drawing for the treatment system submitted.
2. Each stormwater treatment system shall provide documented full-scale testing that corroborates the capacities listed on the plans. Said documentation shall include at a minimum testing for removal capabilities and sediment wash-out characteristics at the treatment capacities listed in table above.
3. Each stormwater treatment system shall have the capability of bypassing high flow internally as well as controlling through the treatment chamber so as to avoid wash-out of previously captured pollutants under high flow conditions.
4. Each stormwater treatment system shall include a circular chamber with a tangential inlet to induce a swirling flow pattern within the treatment chamber. The outlet from the treatment chamber shall be located in the center of the chamber so as to maximize the particle flow path within the treatment system.

5. Each stormwater treatment system shall be of a hydraulic design that includes flow controls designed and certified by a professional engineer using accepted principles of fluid mechanics that raise the water surface inside the tank to a pre-determined level in order to prevent the re-entrainment of trapped floating contaminants.
6. Each stormwater treatment system shall be designed to not allow surcharge of the upstream network during dry weather conditions.
7. Each stormwater treatment system shall be contained within one concrete manhole structure.

2.9 UNDERGROUND INFILTRATION & DETENTION SYSTEMS

A. Acceptable manufacturers include Recharger by Cultec, Stormtech by ADS, and ChamberMaxx by Contech, or approved equivalent.

B. The chamber shall be constructed of injection molded polypropylene impact copolymer formulated for high impact and stress cracking resistance and sustained structural performance during high temperatures. The chamber shall be in accordance with ASTM F2418-05 standards.

C. The chamber shall be designed to AASHTO LRFD Bridge Design Specifications (Section 12), as applied to material and performance requirements for buried thermoplastic pipes. Design live load shall be the AASHTO HS-25 or HS-20 truck and applies to chamber spacing of 5” (127 mm) or greater.

D. The chamber system shall be comprised of three chamber configurations. The MIDDLE chambers shall be open-ended to allow unobstructed hydraulic flow, inspection, and maintenance. The START and END chambers shall each have an integral end wall designed to resist loading at the start and end of the chamber rows. The chambers within a row shall be installed with overlapping and corrugations.

E. Refer to the project plans for typical dimensions and sizing criteria.

F. The chamber shall have a continuously-curved, arch-shaped section profile.

G. The START and END chamber integral end wall shall be structurally suitable for cutting and inserting inlet pipes and shall provide a range of pipe diameter indicants up to 24” (610 mm) diameter as cutting templates.

H. The chamber shall be a corrugated, open-bottom design with 0.4” (10 mm) wide x 1.5” (38 mm) tall slotted side wall openings for lateral flow and top vent orifices for hydraulic pressure equalization. Corrugation valleys and crests shall be sub-corrugated to increase stiffness.

I. The chamber shall have a circular cut line for an optional reinforced inspection or cleanout port configured to accept a 4” (102 mm) Schedule 40 pipe.

J. The END chambers shall be capable of being cut to shorter lengths to accommodate site specific requirements.

K. The chamber shall be supported by integral structural footings comprised of load dispersing toe ribs and longitudinally aligned stiffening ribs.

2.10 CONCRETE VAULT SYSTEM

A. Manufacturer shall be StormTrap or approved equivalent.

B. Concrete chamber designed for AASHTO HS-20 Highway Loading Min Soil Pressure 3000 PSF.

C. The system shall be per the dimension shown on the plans.

D. The system shall be water tight.

E. Contractor shall submit calculations showing the system is not buoyant.

2.11 WATER QUALITY SWALES

A. Water quality swales shall have a media bed depth as shown on the plans and with a media comprised of 50% sand and 50% loam and a 6” gravel depth. Sand, loam, and gravel shall conform to materials outlined in section 31 00 00.

2.12 AREA DRAINS

A. PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications.

B. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer.

C. Drain basins grates in hardscaped areas shall be ADA compliant. Drain basin grates in landscaped areas shall be standard grates.

D. The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.

E. The grates and frames furnished for all surface drainage inlets shall be ductile iron and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting various wheel loads as specified. Ductile iron used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05. Grates and covers shall be provided painted black.

2.13 TRENCH DRAINS

A. Acceptable products for this application include Poly drain by ABT Inc., ACO, Duraslope by NDS, or approved equivalent.

2.14 EPDM SHEET MATERIALS

A. EPDM Sheet: Formulated from EPDM, compounded for use in hydraulic structures and formed into uniform, flexible sheets.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Firestone Building Products.
    b. Raven Industries, Inc.
    c. Yunker Plastics, Inc.
2. Reinforcing Scrim: One-ply polyester fabric totally encapsulated between two sheets.
    a. Construction: 10 x 10 - 1000 d.
3. Nominal Thickness: 45-mil- thick sheet per ASTM D 5199 or ASTM D 751, Optical Method.
4. Breaking Strength: Not less than 190 lbf minimum average per ASTM D 882, ASTM D 7004, or ASTM D 751, Procedure A.
5. Tear Resistance: Not less than 130 lb minimum average per ASTM D 1004.
6. Puncture Strength: Not less than 60 lbf minimum average per ASTM D 4833.

B. Fabrication:

1. Fabricate geomembrane liner panels from sheets in sizes as large as possible with factory-sealed seams, consistent with limitations of weight and installation procedures. Minimize field seaming.

C. Source Quality Control:

1. Testing Agency: Engage a qualified testing agency to evaluate geomembrane seams.
2. Destructive Testing: Test for bonded seam strength and peel adhesion every 3000 feet or once per panel, whichever is more frequent.
3. EPDM Liner: Test and inspect factory seams, according to ASTM D 4545, for peel adhesion not less than 10 lbf/in. of seam width and for bonded seam strength not less than 160 lbf/in. of seam width for seams constructed from two scrim-reinforced sheets, each with nominal sheet thickness of not less than 45 mils.

2.15 MISCELLANEOUS MATERIALS

A. Adhesives: Provide types of adhesive primers, compounds, solvents, and tapes recommended in writing by geomembrane liner manufacturer for bonding to structures (if required), for sealing of seams in geomembrane liner, and for sealing penetrations through geomembrane liner.

B. Penetration assemblies in first paragraph below include pipes, ventilation assemblies, access hatches in cover, and structural members.

C. Penetration Assemblies: Provide manufacturer's standard factory-fabricated assemblies for sealing penetrations. Include joint sealant recommended in writing by geomembrane liner manufacturer and compatible with geomembrane liner, containment conditions, and materials.

D. Battens: Long-length strips of material indicated, size as shown on Drawings. Fabricate battens with sharp projections removed and edges eased and then predrilled or punched for anchors. Provide anchors, or other type of attachment, of type and spacing recommended in writing by geomembrane liner manufacturer for attaching geomembrane liner system to substrate and as indicated.

1. Batten Material: Liner manufacturer's standard system.
2. Batten Material: Aluminum; with stainless-steel anchors, complete with gasket and sealant compatible with geomembrane liner, containment conditions, and materials.
3. Batten Material: Stainless steel; with stainless-steel anchors, complete with gasket and sealant compatible with geomembrane liner, containment conditions, and materials.
4. Batten Material: Plastic compatible with geomembrane liner, cast in place or fastened with stainless-steel anchors, designed to continuously seal geomembrane liner to batten.

PART 3 - EXECUTION

3.1 GENERAL

A. The installation of all pipes of various materials, structures, and connections to existing pipes/structures shall be made at the locations and elevations as shown on the drawings.

B. All materials and each part of detail of the work shall be subject to inspection by the Architect. The Architect shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the contractor as is required to make a complete and detailed inspection, (such assistance may include furnishing labor, tools and equipment at no expense to Architect.)

C. If the Architect so requests, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering or

the removing and the replacing of the covering or making good of the parts removed, will be at the Contractor's expense.

D. Any work done or materials used without authorization by the Architect may be ordered removed and replaced at the Contractor's expense. The Contractor shall furnish written information to the Architect stating the original sources of supply of all materials manufactured away from the actual site of the work. In order to ensure a proper time sequence for required inspection and approval this information shall be furnished at least two weeks in advance of the incorporation in the work of any such materials.

E. The Contractor shall give prior notice to the Architect when work on the various items is to be performed by him or his Subcontractors. If work is suspended on any item, prior notice shall be given to the Architect before resumption of such work.

3.2 TRENCH EXCAVATION AND BACKFILL

A. Excavation and backfill of piping shall be performed as specified in Section 31 00 00, EARTHWORK.

B. Pipe bedding shall be placed as specified in Section 31 00 00, EARTHWORK.

3.3 PIPE INSTALLATION

A. Use only nylon-protected slings to handle pipe. The use of hooks or bare cables will not be permitted.

B. PVC Piping: No machinery shall directly contact the PVC pipe to push the pipe into place. The pipe shall be pushed into place by hand. The use of a hammer or mallet is permitted, with the use of a board to shield the end of the pipe being struck by the hammer. The pipe shall not be directly contacted with a hammer or mallet. Any pipe damaged while being pushed into place or while being laid in the trench shall be removed from the site and replaced at the expense of the Contractor.

C. HDPE Piping: An elastomeric rubber gasket supplied by the manufacturer shall be installed at each HDPE pipe joint to ensure that each joint is silt tight.

D. Pipe shall be inspected before any backfill is placed. Any pipe determined by the Engineer to be out of alignment, unduly settled, or damaged shall be taken up and re-laid or replaced at no additional cost to Owner.

E. General Locations and Arrangements: Drawing plans and details indicate location and arrangement of underground storm drainage piping. Install piping as indicated, following piping manufacturer's written instructions.

F. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

G. If conflicts between utilities, the Contractor shall stop work on the utilities, contact the Architect, and await direction from the Architect.

H. Install piping with 36-inch minimum cover unless otherwise specified on the Drawings.

I. Install piping with a minimum slope as specified on Drawings.

J. Install PVC piping according to ASTM D 2321, ASTM F 1668, and manufacturer's recommendations.

3.4 STORMWATER HYDRODYNAMIC SEPERATOR INSTALLATION

A. The stormwater treatment system shall be installed in strict accordance with the manufacturer's recommendations.

B. Excavation, bedding, backfill and compaction for the structure shall be as specified in Section 31 00 00, EARTHWORK.

C. The structure shall be watertight upon the completion of the installation.

3.5 CHAMBER INSTALLATION

A. Refer to Manufacturer's Installation Guide for proper procedure required to maintain structural integrity and functionality of the chamber system.

3.6 AREA DRAIN INSTALLATION

A. Install Area Drain System according to manufacturer's requirements and specifications.

B. Set tops of grating frames and grates flush with finished surface, unless otherwise indicated.

C. The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures.

D. The backfill material shall be crushed stone or other granular material meeting the requirements of class 1 or class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be well placed and compacted uniformly in accordance with ASTM D2321.

E. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height.

F. For load rated installations, a concrete slab shall be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors.

3.7 TRENCH DRAIN SYSTEM INSTALLATION

A. Install Trench Drain System at elevations indicated.

B. Install Trench Drain System according to manufacturer's requirements and specifications.

C. Set tops of grating frames and grates flush with finished surface, unless otherwise indicated.

3.8 GEOMEMBRANE PREPARATION AND INSTALLATION

A. Examination

1. Examine substrates, with Installer present, for compliance with requirements for soil compaction and grading; for subgrade free from angular rocks, rubble, roots, vegetation, debris, voids, protrusions, and ground water; and for other conditions affecting performance of geomembrane liner.
2. Examine anchor trench excavation, where geomembrane liner will be secured, for substrate conditions indicated above and for correct location and configuration.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Provide temporary ballast, until edges are permanently secured, that does not damage geomembrane liner or substrate, to prevent uplift of geomembrane liner in areas with prevailing winds.

C. Prepare surfaces of construction penetrating through geomembrane liner according to geomembrane liner manufacturer's written instructions.

D. General: Place geomembrane liner over prepared surfaces to ensure minimum handling. Install according to Shop Drawings and in compliance with geomembrane liner manufacturer's written instructions. Begin placing geomembrane liner at Project's upwind direction and proceed downwind. Install geomembrane liner in a relaxed condition, free from stress and with minimum wrinkles, and in full contact with subgrade. Do not bridge over voids or low areas in the subgrade. Fit closely and seal around inlets, outlets, and other projections through geomembrane liner. Permanently secure edges.

E. Field Seams: Comply with geomembrane liner and floating cover manufacturer's written instructions. Form seams by lapping edges of panels 2 to 4 inches unless instructions require a larger overlap. Wipe contact surfaces clean and free of dirt, dust, moisture, and other foreign materials. Use solvent-cleaning methods and grind geomembrane seam surfaces if recommended by geomembrane liner manufacturer. Proceed with seaming at required temperatures for materials and ambient conditions. Continuously bond sheet to sheet to construct single or double seams of width recommended for method of seaming used. Seal or fuse free seam edges. Inspect seams and reseal voids.

1. Adhesive Bonding: Apply bonding cement to both contact surfaces in seam area and press together immediately, or use other seaming methods as instructed by geomembrane liner manufacturer. Roll to press surfaces together, to distribute adhesive to leading edges of panels, and to remove wrinkles and fishmouths. Remove excess adhesive.
2. Thermal Bonding: Use thermal-welding technique recommended by geomembrane liner manufacturer. Apply pressure to smoothly bond surfaces together. Examine for and patch wrinkles and fishmouths.

F. Installation in Anchor Trench: Install geomembrane liner in trench according to manufacturer's written instructions. Backfill and compact to lock liner into trench.

G. Liner Repairs: Repair tears, punctures, and other imperfections in geomembrane liner field and seams using patches of geomembrane liner material, liner-to-liner bonding materials, and bonding methods according to geomembrane liner

manufacturer's written instructions. Apply bonding solvent or weld to contact surfaces of both patch and geomembrane liner, and press together immediately. Roll to remove wrinkles.

H. Field Quality Control:

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Nondestructive Testing: Visually inspect seams and patches. Comply with ASTM D 4437 for Air Lance Test, Vacuum Box Testing, or Ultrasonic (High Frequency) Pulse Echo Testing or with GRI Test Method GM6, as applicable to geomembrane liner and seam construction. Record locations of failed seams and patches. Individually number and date occurrences and details of leak and remedial action. Repair leaking seams and patches.
3. Prepare test and inspection reports.

I. Disinfection:

1. Disinfect the complete installation according to procedures in AWWA C652.

J. Protection:

1. Protect installed geomembrane liner according to manufacturer's written instructions. Repair or replace areas of geomembrane liner damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.
2. Before initial filling of pond or placement of earth cover, inspect seams and patched areas to ensure tight, continuously bonded installation. Repair damaged geomembrane and seams and reinspect repaired work.

End of Section

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APPENDIX A

KEYNOTE LIST

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DIVISION 00	**BIDDING AND CONTRACT REQUIREMENTS**	
00 01 01	**NOT USED**	**DIVISION 00**
00 01 01.01	NOT USED	00 01 01
DIVISION 01	**GENERAL REQUIREMENTS**	
01 00 01	**NOT USED**	**DIVISION 01**
01 00 01.01	NOT USED	01 00 01
DIVISION 02	**EXISTING CONDITIONS**	
02 00 01	**NOT USED**	**DIVISION 02**
02 00 01.01	NOT USED	02 00 01
DIVISION 03	**CONCRETE**	
03 05 13	**CONCRETE SEALERS**	**DIVISION 03**
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03 30 00.05	CONCRETE FOUNDATION - SEE STRUCTURAL	03 30 00
03 30 00.06	CONCRETE WALL - SEE STRUCTURAL	03 30 00
03 30 00.07	CONCRETE PIER - SEE STRUCTURAL	03 30 00
03 30 00.08	CONCRETE PAD - SEE STRUCTURAL	03 30 00
03 30 00.11	EXPANDABLE JOINT FILLER	03 30 00
03 30 00.12	NORMAL WEIGHT CONCRETE - SEE STRUCTURAL	03 30 00
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04 20 00.02	FACE BRICK - SOLID UNIT - REFERENCE ELEVATIONS FOR TYPE AND COURSING	04 20 00
04 20 00.10	CMU BASE - GROUND FACE CMU - REFERENCE DETAILS FOR TYPE AND DEPTH	04 20 00
04 20 00.11	CMU TYPE SF1 - GROUND FACE CMU - REFERENCE DRAWINGS FOR BLOCK DEPTH	04 20 00
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04 20 00.31	CMU - STANDARD - NORMAL WEIGHT - REFERENCE DRAWINGS FOR DEPTH SIZE AND FIRE RATING	04 20 00
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05 12 00.21	STEEL EDGE ANGLE - SEE STRUCTURAL	05 12 00
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05 40 00.06	STEEL STUDS - 6 INCH - 16 INCHES O.C. MAX	05 40 00
05 40 00.08	STEEL STUDS - 8 INCH - 16 INCHES O.C. MAX	05 40 00
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05 40 00.19	STEEL Z-CLIP - 16 GAGE MIN. - 1 INCH MIN. DEPTH - 16 INCHES O.C. MAX	05 40 00
05 40 00.20	STEEL STUD - REFER TO FLOOR PLANS FOR DEPTH	05 40 00
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05 50 00.43	STEEL PLATE - 3/8 INCH THICK - SIZE AS NOTED OR DRAWN	05 50 00
05 50 00.44	STEEL PLATE - 1/2 INCH THICK - SIZE AS NOTED OR DRAWN	05 50 00
05 50 00.45	STEEL PLATE - 5/8 INCH THICK - SIZE AS NOTED OR DRAWN	05 50 00
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05 50 00.54	STEEL WT4X5 - CEILING HANGER	05 50 00
05 50 00.56	THREADED ROD - 1/4 INCH DIAMETER WITH WASHERS AND BOLTS - CUT ROD FLUSH TO BOLTS AND GRIND SMOOTH	05 50 00
05 50 00.57	STEEL ROD - 5/8 INCH DIAMETER - SHOP APPLIED FINISH	05 50 00
05 50 00.60	SHOP APPLIED COLOR COATING	05 50 00
05 50 00.61	STEEL CLEVIS - NUMBER 2 - SHOP APPLIED FINISH	05 50 00
05 50 00.62	SCIENCE CLASSROOM MISC. METALS HANGER - SIZED AS NOTED	05 50 00
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05 50 00.83	SENSORY SWING HEAVY DUTY STEEL HANGER	05 50 00
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05 51 00.04	STEEL CHANNEL HEADER	05 51 00
05 51 00.05	STEEL CLOSURE PLATE - WELDED AND GROUND SMOOTH	05 51 00
05 51 00.06	STEEL TUBE LANDING BEAM	05 51 00
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05 51 00.10	STEEL ANGLE CONTINUOUS	05 51 00
05 51 00.11	STEEL ANGLE CLIP	05 51 00
05 51 00.12	STEEL ANGLE CARRIER	05 51 00
05 51 00.13	STEEL ANGLE - SIZE AS NOTED OR DRAWN	05 51 00
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05 51 00.17	STEEL PLATE - 1/4 INCH	05 51 00
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05 51 00.21	STEEL PIPE GUARDRAIL POST - 1-1/2 INCH O.D.	05 51 00
05 51 00.22	STEEL PIPE HANDRAIL - 1-1/2 INCH O.D.	05 51 00
05 51 00.24	STEEL HANDRAIL BRACKET	05 51 00
05 51 00.25	STEEL HANDRAIL POST BRACKET	05 51 00
05 51 00.26	STEEL POST CANOPY	05 51 00
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05 51 00.34	STAINLESS STEEL HANDRAIL BRACKET	05 51 00
05 51 00.35	STAINLESS STEEL HANDRAIL POST BRACKET	05 51 00
05 51 00.40	STEEL BAR - X INCH x X INCH	05 51 00
05 51 00.60	WELD TO STEEL FRAMING	05 51 00
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05 51 00.81	DECORATIVE METAL PANEL - TYPE 1 - STAINLESS STEEL	05 51 00
05 51 00.85	STEEL GUARDRAIL AT ROOF EDGE	05 51 00
05 51 00.93	STEEL PIPE RAIL POST - EXTERIOR	05 51 00
05 51 00.94	STEEL HANDRAIL BRACKET - EXTERIOR	05 51 00
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05 51 00.96	STEEL PIPE RAIL - 1-1/2 INCH O.D.- EXTERIOR	05 51 00
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06 10 00.51	WOOD STUD - 2X4 - 16 INCHES O.C.	06 10 00
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06 20 00.98	WOOD BLOCKING - FIRE RETARDANT TREATED - SIZE AS REQUIRED	06 20 00
06 20 00.99	WOOD BLOCKING - SIZE AS NOTED OR DRAWN	06 20 00
06 40 00	**ARCHITECTURAL WOODWORK**	**DIVISION 06**
06 40 00.01	ADMINISTRATION DESK	06 40 00
06 40 00.02	MAILBOX UNITS	06 40 00
06 40 00.03	LIBRARY CIRCULATION DESK	06 40 00
06 40 00.04	LIBRARY CUSTOM STACKS	06 40 00
06 40 00.05	DISPLAY CASE	06 40 00
06 40 00.06	STUDENT STORAGE UNIT	06 40 00
06 40 00.07	ROD DISPLAY SYSTEM	06 40 00
06 40 00.08	CORRIDOR BENCH - REFER TO DETAILS	06 40 00
06 40 00.11	ALUMINUM TRIM PROFILE - 1/4 INCH POST - BRUSHED FINISH	06 40 00
06 40 00.12	ALUMINUM TRIM PROFILE - 1 INCH REVEAL - BRUSHED FINISH	06 40 00
06 40 00.13	ALUMINUM TRIM PROFILE - 1/4 INCH POST CORNER - BRUSHED FINISH	06 40 00
06 40 00.16	STAINLESS STEEL SCREWS - FLATHEAD - COUNTERSUNK	06 40 00
06 40 00.17	STAINLESS STEEL SCREWS - WITH FINISH WASHERS	06 40 00
06 40 00.18	STAINLESS STEEL BOLTS - NUTS AND WASHERS - 1/2 INCH DIA	06 40 00
06 40 00.19	STAINLESS STEEL BOLTS - NUTS AND WASHERS - SIZE AS NOTED	06 40 00
06 40 00.20	HARDWOOD TRIM - TRANSPARENT FINISH	06 40 00
06 40 00.21	HARDWOOD TRIM - 1/2 INCH - TRANSPARENT FINISH	06 40 00
06 40 00.22	HARDWOOD TRIM - 5/8 INCH - TRANSPARENT FINISH	06 40 00

06 40 00.23	HARDWOOD TRIM - 3/4 INCH - TRANSPARENT FINISH	06 40 00
06 40 00.26	HARDWOOD TRIM - PENCILED EDGE 1/8 INCH RADIUS - TRANSPARENT FINISH	06 40 00
06 40 00.27	HARDWOOD TRIM - EASED EDGE 1/4 INCH RADIUS - TRANSPARENT FINISH	06 40 00
06 40 00.28	HARDWOOD TRIM - BULLNOSE - TRANSPARENT FINISH	06 40 00
06 40 00.29	HARDWOOD EDGING ON PLYWOOD - TRANSPARENT FINISH	06 40 00
06 40 00.31	HARDWOOD VENEER PLYWOOD - 1/2 INCH - TRANSPARENT FINISH	06 40 00
06 40 00.32	HARDWOOD VENEER PLYWOOD - 5/8 INCH - TRANSPARENT FINISH	06 40 00
06 40 00.33	HARDWOOD VENEER PLYWOOD - 3/4 INCH - TRANSPARENT FINISH	06 40 00
06 40 00.39	HARDWOOD VENEER PLYWOOD SHELF WITH HARDWOOD EDGING ON ALL SIDES - TRANSPARENT FINISH	06 40 00
06 40 00.41	PLYWOOD - 1/2 INCH	06 40 00
06 40 00.42	PLYWOOD - 5/8 INCH	06 40 00
06 40 00.43	PLYWOOD - 3/4 INCH	06 40 00
06 40 00.51	MDF PLYWOOD - 1/2 INCH	06 40 00
06 40 00.52	MDF PLYWOOD - 5/8 INCH	06 40 00
06 40 00.53	MDF PLYWOOD - 3/4 INCH	06 40 00
06 40 00.61	COAT HOOK - FLAT TOP BUTTON HOOK	06 40 00
06 40 00.62	ROD DISPLAY SYSTEM - 10MM ROD	06 40 00
06 40 00.63	ROD DISPLAY SYSTEM - FIXING	06 40 00
06 40 00.64	FABRIC WRAPPED TACKABLE SURFACE	06 40 00
06 40 00.65	ALUMINUM EXTRUSION TRIM - TACK WALL SURFACE	06 40 00
06 40 00.66	L-SHAPED SHELF BRACKET PEG	06 40 00
06 40 00.67	GLASS DOOR WITH CONCEALED HINGE HARDWARE	06 40 00
06 40 00.68	FABRIC WRAPPED SEAT CUSHION	06 40 00
06 40 00.69	FABRIC WRAPPED BACKREST CUSHION	06 40 00
06 40 00.71	GROMMET - 3 INCH - PLASTIC	06 40 00
06 40 00.72	WIRE MANAGEMENT HOOKS - 12 INCHES O.C. - UNDER COUNTER	06 40 00
06 40 00.73	STEEL UNDER COUNTER SUPPORT BRACKET - SIZE AS NOTED OR DRAWN	06 40 00
06 40 00.74	GLASS SHELVING STANDARDS AND SUPPORT BRACKETS	06 40 00
06 40 00.75	VERTICAL CONCEALED SHELVING STANDARD & BRACKET	06 40 00
06 40 00.76	GLASS SHELF	06 40 00
06 40 00.77	SLIDING GLASS DOOR SET - ALUMINUM TRACKS - PROVIDE LOCKS	06 40 00
06 40 00.78	LOCK	06 40 00
06 40 00.79	FLOATING SHELF BRACKET	06 40 00
06 40 00.81	PLASTIC LAMINATE - TYPE 1	06 40 00
06 40 00.88	PLASTIC LAMINATE COUNTER TOP	06 40 00
06 40 00.89	PLASTIC LAMINATE BACKSPLASH - HEIGHT AS NOTED	06 40 00
06 40 00.91	WOOD POST - SIZE AS NOTED OR DRAWN	06 40 00
06 40 00.92	WOOD TOP PLATE - CONTINUOUS - SIZE AS NOTED OR DRAWN	06 40 00
06 40 00.93	WOOD SOLE PLATE - CONTINUOUS - SIZE AS NOTED OR DRAWN	06 40 00
06 40 00.95	REMOVABLE ACCESS PANEL - MATCH ADJACENT FINISH	06 40 00
06 40 00.96	CONCEALED Z-CLIP MOUNTING SYSTEM	06 40 00
06 40 00.97	CLEAT HANGER	06 40 00
06 40 00.98	WOOD BLOCKING - FIRE RETARDANT TREATED - SIZE AS REQUIRED	06 40 00
06 40 00.99	WOOD BLOCKING - SIZE AS NOTED OR DRAWN	06 40 00
06 55 00	**SOLID SURFACING**	**DIVISION 06**
06 55 00.01	SOLID SURFACE MATERIAL	06 55 00
06 55 00.02	SEALANT	06 55 00
06 55 00.03	PLYWOOD BACKING	06 55 00
06 55 00.04	ADHESIVE	06 55 00
06 55 00.05	Z-CLIPS SECURED TO BLOCKING AND SOLID SURFACING	06 55 00
06 55 00.06	GROMMET - 3 INCH - PLASTIC	06 55 00
DIVISION 07	**THERMAL AND MOISTURE PROTECTION**	
07 13 24	**PRE-APPLIED SHEET MEMBRANE WATERPROOFING**	**DIVISION 07**
07 13 24.01	PRE-APPLIED SHEET MEMBRANE WATERPROOFING	07 13 24
07 16 13	**POLYMER MODIFIED CEMENT WATERPROOFING**	**DIVISION 07**
07 16 13.01	POLYMER MODIFIED CEMENT WATERPROOFING MATERIAL	07 16 13
07 21 00	**THERMAL INSULATION**	**DIVISION 07**
07 21 00.01	RIGID INSULATION - 2 INCH - FOUNDATION ONLY	07 21 00
07 21 00.02	RIGID INSULATION - 2 INCH - UNDER SLAB - HIGH COMPRESSIVE STRENGTH	07 21 00

07 21 00.11	INSULATING NAIL BASE - 2 5/8 INCH - EXTERIOR WALL	07 21 00
07 21 00.20	GLASS FIBER BLANKET INSULATION - MATCH DEPTH OF STUD - UNFACED	07 21 00
07 21 00.21	GLASS FIBER BLANKET INSULATION - MATCH DEPTH OF STUD - FACED	07 21 00
07 21 00.22	GLASS FIBER ACOUSTICAL BLANKET INSULATION - MATCH DEPTH OF STUD - UNFACED	07 21 00
07 21 00.30	MINERAL WOOL INSULATION	07 21 00
07 21 00.31	MINERAL WOOL ACOUSTICAL INSULATION - 6 INCH	07 21 00
07 21 00.32	MINERAL WOOL ACOUSTICAL INSULATION - 3 1/2 INCH	07 21 00
07 21 00.39	MINERAL WOOL ACOUSTICAL INSULATION - MATCH DEPTH OF STUD - UNFACED	07 21 00
07 21 00.40	FOAMED IN PLACE INSULATION / AIR BARRIER	07 21 00
07 21 00.50	MINERAL WOOL INSULATION - RIGID - EXTERIOR - 2 INCH	07 21 00
07 21 00.60	MINERAL WOOL INSULATION - FOIL-FACED	07 21 00
07 21 00.61	FOIL, SCRIM, AND KRAFT TAPE	07 21 00
07 21 29	**SPRAY-ON SOUND ABSORPTION**	**DIVISION 07**
07 21 29.01	SPRAY-ON SOUND ABSORPTION	07 21 29
07 21 31	**SPRAYED FOAM INSULATING**	**DIVISION 07**
07 21 31.01	FOAM INSULATION - SPRAYED-IN-PLACE - 1-1/2 INCH DEPTH BETWEEN STUDS	07 21 31
07 24 20	**EXTERIOR FINISH SYSTEM (EFS)**	**DIVISION 07**
07 24 20.01	EXTERIOR FINISH - TYPE AND COLOR SELECTED BY ARCHITECT	07 24 20
07 24 20.11	1/2 INCH EXTERIOR GRADE SHEATHING	07 24 20
07 24 20.12	CONTROL JOINT	07 24 20
07 24 20.13	BACKER ROD AND SEALANT - TYPE AS REQUIRED	07 24 20
07 24 20.14	ALUMINUM SOFFIT VENT	07 24 20
07 26 00	**VAPOR RETARDERS**	**DIVISION 07**
07 26 00.01	VAPOR RETARDER - UNDER SLAB	07 26 00
07 26 00.02	VAPOR RETARDER - EXTERIOR WALL	07 26 00
07 26 00.03	SCRIM - EXTERIOR WALL - BLACK	07 26 00
07 27 13	**MODIFIED BITUMINOUS SHEET AIR BARRIER**	**DIVISION 07**
07 27 13.01	AIR/VAPOR BARRIER MEMBRANE - SELF-ADHERING	07 27 13
07 27 13.02	AIR/VAPOR BARRIER MEMBRANE - SELF-ADHERING - 2 LAYERS	07 27 13
07 27 13.05	AIR/VAPOR BARRIER TRANSITION MEMBRANE - SELF-ADHERING	07 27 13
07 27 13.10	WATERPROOF MEMBRANE FLASHING	07 27 13
07 27 13.11	BACKER ROD - SIZE AND TYPE AS REQUIRED	07 27 13
07 27 13.20	FLASHING - STAINLESS STEEL	07 27 13
07 27 13.21	SADDLE FLASHING	07 27 13
07 42 13	**METAL WALL PANELS**	**DIVISION 07**
07 42 13.01	ALUMINUM PANEL - COLOR 1	07 42 13
07 42 13.02	ALUMINUM PANEL - COLOR 2	07 42 13
07 42 13.11	ALUMINUM PANEL ATTACHMENTS	07 42 13
07 42 13.12	ALUMINUM PANEL PREFINISHED FLASHING	07 42 13
07 42 13.13	ALUMINUM PANEL TRIM	07 42 13
07 46 46	**MINERAL FIBER CEMENT SIDING**	**DIVISION 07**
07 46 46.01	MINERAL FIBER CEMENT PANEL - REFERENCE ELEVATIONS FOR COLOR	07 46 46
07 46 46.02	MINERAL FIBER CEMENT SMOOTH PANEL - REFERENCE ELEVATIONS FOR COLOR	07 46 46
07 46 46.11	MINERAL FIBER CEMENT PANEL - COLOR 1	07 46 46
07 46 46.12	MINERAL FIBER CEMENT PANEL - COLOR 2	07 46 46
07 46 46.13	MINERAL FIBER CEMENT PANEL - COLOR 3	07 46 46
07 46 46.14	MINERAL FIBER CEMENT PANEL - COLOR 4	07 46 46
07 46 46.20	MINERAL FIBER CEMENT SOFFIT - COLOR 1	07 46 46
07 46 46.21	MINERAL FIBER CEMENT SOFFIT - COLOR 2	07 46 46
07 46 46.30	FASTENER	07 46 46
07 46 46.32	STARTER TRACK	07 46 46
07 46 46.35	INSECT SCREEN - CONTINUOUS	07 46 46
07 46 46.36	CORNER TAB - BLIND NAILER	07 46 46
07 46 46.37	15# BUILDING FELT	07 46 46
07 46 46.40	3 INCH WIDE PRESSURE TREATED PLYWOOD FURING STRIPS - 3/4 INCH THICK - COORDINATE LOCATION WITH FASTENING PATTERN	07 46 46
07 46 46.41	FLASHING	07 46 46
07 46 46.42	SEALANT - TYPE AS REQUIRED	07 46 46
07 46 46.51	LOW PROFILE OUTSIDE CORNER	07 46 46

07 46 46.52	REVEAL OPEN OUTSIDE CORNER	07 46 46
07 46 46.53	PANEL INSIDE CORNER	07 46 46
07 46 46.54	STANDARD HORIZONTAL Z	07 46 46
07 46 46.55	BEAD REVEAL TRIM	07 46 46
07 46 46.56	F REVEAL TRIM	07 46 46
07 46 46.57	J MOLD TRIM	07 46 46
07 46 46.58	SIDING H MOLD	07 46 46
07 46 46.59	VERTICAL REVEAL	07 46 46
07 46 46.60	MINERAL FIBER CEMENT TRIM BOARD - SIZE AS NOTED	07 46 46
07 46 46.61	MINERAL FIBER CEMENT TRIM BOARD - 4/4 THICK - SIZE AS NOTED	07 46 46
07 46 46.62	MINERAL FIBER CEMENT TRIM BOARD - 5/4 THICK - SIZE AS NOTED	07 46 46
07 46 46.69	MINERAL FIBER CEMENT TRIM BOARD - 4/4 THICK - TEXTURED WOOD GRAIN FINISH - SIZE AS NOTED	07 46 46
07 48 00	**RAINSCREEN ATTACHMENT SYSTEM**	**DIVISION 07**
07 48 00.11	HORIZONTAL GIRT - REFER TO SHOP DRAWINGS FOR SIZE	07 48 00
07 48 00.12	VERTICAL PANEL RAIL - REFER TO SHOP DRAWINGS FOR SIZE	07 48 00
07 48 00.13	HORIZONTAL TERMINATION GIRT - REFER TO SHOP DRAWINGS FOR SIZE	07 48 00
07 48 00.14	L GIRT - REFER TO SHOP DRAWINGS FOR SIZE	07 48 00
07 48 00.15	Z GIRT - REFER TO SHOP DRAWINGS FOR SIZE	07 48 00
07 48 00.16	VERTICAL TERMINATION GIRT - REFER TO SHOP DRAWINGS FOR SIZE	07 48 00
07 48 00.21	STAINLESS STEEL SELF-DRILLING SCREW	07 48 00
07 48 00.22	STAINLESS STEEL SELF-DRILLING SCREW WITH THERMAL ISOLATION	07 48 00
07 48 00.31	PREFINISHED ALUMINUM FLASHING	07 48 00
07 54 19	**POLYVINYL CHLORIDE (PVC) ROOFING**	**DIVISION 07**
07 54 19.01	PVC SINGLE PLY MEMBRANE ROOFING	07 54 19
07 54 19.02	HIGH DENSITY POLYISO RECOVERY BOARD	07 54 19
07 54 19.03	POLYISO RIGID INSULATION	07 54 19
07 54 19.04	POLYISO TAPERED INSULATION	07 54 19
07 54 19.05	FLASHING MEMBRANE	07 54 19
07 54 19.06	COATED METAL FLASHING	07 54 19
07 54 19.07	ROOFING BATTENS	07 54 19
07 54 19.08	CANT STRIPS	07 54 19
07 54 19.09	SHEET VAPOR RETARDER - TAPE SEAMS	07 54 19
07 54 19.10	FLAT SECUREMENT BARS	07 54 19
07 54 19.11	WIND UPLIFT SECUREMENT BARS	07 54 19
07 54 19.12	BLIND NAILER	07 54 19
07 54 19.13	MULTI-PURPOSE TAPE	07 54 19
07 54 19.14	STAINLESS STEEL HOSE CLAMP	07 54 19
07 54 19.15	3-SIDED METAL PAN	07 54 19
07 54 19.20	PVC EXPANSION JOINT	07 54 19
07 54 19.21	FOAM ROD TUBING - CONTINUOUS	07 54 19
07 54 19.30	GUTTER	07 54 19
07 54 19.31	DOWNSPOUT	07 54 19
07 54 19.32	SPLASHBLOCK	07 54 19
07 54 19.80	WALKWAY PADS	07 54 19
07 54 19.81	ROOF EDGE SCUPPER	07 54 19
07 54 19.90	ADHESIVE	07 54 19
07 54 19.91	SEALANT - CONTINUOUS	07 54 19
07 54 19.92	HOT-AIR WELD	07 54 19
07 61 00	**SHEET METAL ROOFING**	**DIVISION 07**
07 61 00.01	SHEET METAL - STANDING SEAM	07 61 00
07 61 00.02	CLIPS WITH FASTENERES	07 61 00
07 61 00.03	ALUMINUM FLASHING	07 61 00
07 61 00.04	30# ROOFING FELT	07 61 00
07 61 00.05	COUNTER FLASHING WITH REGLET & 'Z' CLOSURE	07 61 00
07 62 00	**SHEET METAL FLASHING AND TRIM**	**DIVISION 07**
07 62 00.01	SHEET METAL FLASHING	07 62 00
07 62 00.02	SHEET METAL COUNTER FLASHING	07 62 00
07 62 00.03	SPRING LOCK FLASHING	07 62 00
07 62 00.04	FLASHING REGLET	07 62 00

07 62 00.10	METAL COPING	07 62 00
07 62 00.11	PRE-FINISHED ALUMINUM FLASHING - CUSTOM COLOR	07 62 00
07 62 00.20	SEALANT - TYPE AS REQUIRED	07 62 00
07 62 00.30	SEAMLESS GUTTER	07 62 00
07 62 00.31	DOWNSPOUT	07 62 00
07 62 00.40	SHEET METAL COLLAR	07 62 00
07 62 00.41	SHEET METAL RAIN HOOD	07 62 00
07 71 00	**ROOF SPECIALTIES**	**DIVISION 07**
07 71 00.01	FACTORY FABRICATED FASCIA TRIM/ROOF EDGE - CUSTOM COLOR	07 71 00
07 71 00.02	EXPOSED ALUMINUM FINISH METAL - CUSTOM COLOR	07 71 00
07 71 00.03	PRE-FINISHED ALUMINUM DRIP EDGE - CUSTOM COLOR	07 71 00
07 71 00.04	FACTORY FABRICATED PARAPET WALL COPING - CUSTOM COLOR	07 71 00
07 71 00.05	FACTORY FABRICATED OVERFLOW ROOF SCUPPER - CUSTOM COLOR	07 71 00
07 71 00.10	SOFFIT STRIP VENT	07 71 00
07 71 00.20	CONTINUOUS SEALANT - TYPE AS REQUIRED	07 71 00
07 72 00	**ROOF ACCESSORIES**	**DIVISION 07**
07 72 00.01	ROOF SCUTTLE - TYPE 1 - 3'-0" x 3'-0"	07 72 00
07 72 00.02	ROOF SCUTTLE - TYPE 2 - X'-X" x X'-X"	07 72 00
07 72 00.10	NEOPRENE GASKET ENTIRE PERIMETER TYP.	07 72 00
07 72 00.11	RIGID INSULATION	07 72 00
07 72 00.12	SPRING LATCH W/ HANDLE AND PADLOCK HASP ON INSIDE	07 72 00
07 72 00.13	PADLOCK HASP	07 72 00
07 72 00.20	ELEVATOR ROOFTOP LOUVER	07 72 00
07 72 00.30	12 GA. ALUM. ROOF W/ INSULATION	07 72 00
07 72 00.31	STORM PROOF LOUVER BLADE (THREE SIDES)	07 72 00
07 72 00.32	INSECT SCREEN	07 72 00
07 72 00.34	RUBBER GASKET	07 72 00
07 72 00.40	WELDED ALUMINUM CURB	07 72 00
07 72 00.60	HEAT AND SMOKE VENT - 5'-0" x 10'-0"	07 72 00
07 72 00.70	SAFETY RAILING SYSTEM	07 72 00
07 72 00.80	ROOF PAVER SYSTEM	07 72 00
07 72 00.81	ROOF PAVER - CONCRETE	07 72 00
07 72 00.82	ROOF PAVER - ADJUSTABLE PEDESTAL	07 72 00
07 72 00.83	ROOF PAVER - DRAINAGE PAVER	07 72 00
07 81 00	**APPLIED FIREPROOFING**	**DIVISION 07**
07 81 00.01	CEMENTITIOUS FIREPROOFING	07 81 00
07 84 00	**FIRE STOPPING**	**DIVISION 07**
07 84 00.01	FIRE SAFING MINERAL WOOL	07 84 00
07 84 00.02	CAULK - CAULK AND PUTTY	07 84 00
07 84 00.03	FIRE STOP MORTAR	07 84 00
07 84 00.04	FIRE STOP PILLOWS	07 84 00
07 84 00.05	INTUMESCENT CAULK WITH URETHANE BACKING ROD	07 84 00
07 84 00.10	INSULATION HANGER SYSTEM	07 84 00
07 84 00.11	CURTAIN WALL INSULATION	07 84 00
07 84 00.12	VERTICAL MULLION COVER	07 84 00
07 84 00.13	SAFING INSULATION	07 84 00
07 84 00.14	SMOKE SEALANT	07 84 00
07 84 00.15	ELASTOMETRIC FIRE STOPPING	07 84 00
07 92 00	**JOINT SEALERS**	**DIVISION 07**
07 92 00.01	JOINT SEALANT - TYPE AS REQUIRED	07 92 00
07 92 00.02	BACKER ROD AND SEALANT - TYPE AS REQUIRED	07 92 00
07 92 00.03	BACKER ROD - TYPE AS REQUIRED	07 92 00
07 92 00.04	JOINT SEALANT - ACOUSTICAL SEALANT	07 92 00
07 92 00.11	EXTERIOR EXPANSION JOINT - 5 INCH	07 92 00
07 92 00.12	EXTERIOR EXPANSION JOINT - 3 INCH	07 92 00
07 95 13	**CONSTRUCTION AND EXPANSION JOINTS**	**DIVISION 07**
07 95 13.01	EXPANSION JOINT COVER - 4 INCH - INTERIOR - FLOOR / FLOOR	07 95 13
07 95 13.02	EXPANSION JOINT COVER - 4 INCH - INTERIOR - WALL / WALL OR CEILING / CEILING - GYPSUM BASE	07 95 13
07 95 13.03	EXPANSION JOINT COVER - 4 INCH - INTERIOR - WALL / WALL CORNER - GYPSUM BASE	07 95 13

07 95 13.04	EXPANSION JOINT COVER - 4 INCH - INTERIOR - FLOOR / WALL	07 95 13
07 95 13.05	EXPANSION JOINT COVER - 2 INCH - INTERIOR - FLOOR / FLOOR	07 95 13
07 95 13.06	EXPANSION JOINT COVER - 2 INCH - INTERIOR - WALL / WALL OR CEILING / CEILING - GYPSUM BASE	07 95 13
07 95 13.07	EXPANSION JOINT COVER - 3 INCH - INTERIOR - FLOOR / FLOOR	07 95 13
07 95 13.08	EXPANSION JOINT COVER - 3 INCH - INTERIOR - WALL / WALL OR CEILING / CEILING - GYPSUM BASE	07 95 13
DIVISION 08	**DOORS AND HARDWARE**	
08 11 13	**HOLLOW METAL DOORS AND FRAMES**	**DIVISION 08**
08 11 13.01	DOOR AND FRAME- SEE DOOR SCHEDULE	08 11 13
08 11 13.10	STEEL DOOR - SEE SCHEDULE FOR TYPES	08 11 13
08 11 13.11	STEEL FRAME - SEE SCHEDULE FOR TYPES	08 11 13
08 11 13.20	STEEL FRAME CLIP BY FRAME INSTALLER	08 11 13
08 11 13.21	STEEL FRAME ANCHOR	08 11 13
08 11 13.30	3/4" x 3/4" GLAZING STOP	08 11 13
08 14 16	**FLUSH WOOD DOORS**	**DIVISION 08**
08 14 16.01	SOLID CORE FLUSH WOOD DOOR- SEE DOOR SCHEDULE	08 14 16
08 31 00	**ACCESS DOORS AND PANELS**	**DIVISION 08**
08 31 00.01	FIRE RATED ACCESS DOOR	08 31 00
08 31 00.11	ACCESS PANEL	08 31 00
08 31 00.12	ACCESS PANEL - FIRE RATED	08 31 00
08 31 00.13	ACCESS PANEL - ACOUSTIC	08 31 00
08 32 33	**SLIDING DOOR SYSTEMS**	**DIVISION 08**
08 32 33.01	SLIDING DOOR TRACK	08 32 33
08 33 13	**COILING COUNTER DOORS**	**DIVISION 08**
08 33 13.01	TYPE OHCC1 - EXTERIOR - 12'-0"W x 4'-4"H - MANUALLY OPERATED	08 33 13
08 33 13.11	VERTICAL GUIDES	08 33 13
08 33 13.12	COILING DOOR HOUSING	08 33 13
08 33 23	**OVERHEAD COILING DOORS**	**DIVISION 08**
08 33 23.01	TYPE OHC1 - EXTERIOR - POWER OPERATED	08 33 23
08 33 23.21	ELECTRIC MOTOR	08 33 23
08 33 23.22	GUIDE	08 33 23
08 33 26	**OVERHEAD COILING GRILLES**	**DIVISION 08**
08 33 26.01	OVERHEAD COILING GRILLE - KITCHEN	08 33 26
08 33 26.21	ELECTRIC MOTOR	08 33 26
08 33 26.22	GUIDE	08 33 26
08 34 73	**SOUND CONTROL DOORS**	**DIVISION 08**
08 34 73.01	ACOUSTIC FLUSH WOOD DOOR - SEE DOOR SCHEDULE	08 34 73
08 35 13	**ACCORDION FOLDING DOORS**	**DIVISION 08**
08 35 13.01	ACCORDION FOLDING DOOR - SECURITY	08 35 13
08 35 13.02	ACCORDION FOLDING DOOR - FIRE	08 35 13
08 35 13.11	ACCORDION FOLDING DOOR - STRIKER JAMB	08 35 13
08 35 15	**SLIDING GLASS PANEL**	**DIVISION 08**
08 35 15.01	SLIDING GLASS PANEL SYSTEM	08 35 15
08 35 15.11	GLASS PANEL - 3/8 INCH - LAMINATED GLASS WITH POLISHED EDGES	08 35 15
08 35 15.21	SINGLE POINT FIXING	08 35 15
08 35 15.22	SINGLE POINT FIXING WITH BOTTOM STRAP	08 35 15
08 35 15.23	SOCKET BOLT LOCK	08 35 15
08 35 15.24	SOCKET - PLUMB SET	08 35 15
08 35 15.31	TRACK RAIL	08 35 15
08 35 15.32	TRACK ROLLER	08 35 15
08 35 15.33	TRACK SUBSTRUCTURE	08 35 15
08 35 15.34	THREADED ROD	08 35 15
08 43 13	**ALUMINUM FRAMED STOREFRONTS**	**DIVISION 08**
08 43 13.01	ALUMINUM STOREFRONT FRAME	08 43 13
08 43 13.02	ALUMINUM ENTRANCE DOOR	08 43 13
08 43 13.03	PREFINISHED ALUMINUM FLASHING	08 43 13
08 43 13.05	PERIMETER SEALANT	08 43 13

08 43 13.20	SEALANT & BACKER ROD	08 43 13
08 43 13.21	CLEAR SILICONE BUTT JOINT - 3/8 INCH	08 43 13
08 43 13.30	SPANDREL GLASS	08 43 13
08 43 13.31	SUB-FRAME / RECEPTOR	08 43 13
08 43 13.40	METAL SILL FLASHING	08 43 13
08 43 13.50	ALUMINUM BREAK METAL - 0.090 THICK MIN - CUSTOM COLOR TO MATCH STOREFRONT FRAMING	08 43 13
08 43 13.60	STEEL BACK PAN	08 43 13
08 43 15	**BULLET RESISTANT ALUMINUM STOREFRONT FRAMING SYSTEM**	**DIVISION 08**
08 43 15.01	BULLET-RESISTANT ALUMINUM FRAMED STOREFRONT	08 43 15
08 43 15.11	BULLET-RESISTANT ALUMINUM STOREFRONT FRAME	08 43 15
08 43 15.12	BULLET-RESISTANT ALUMIMUM ENTRANCE DOOR	08 43 15
08 43 15.51	BULLET-RESISTANT GLASS - LEVEL 5	08 43 15
08 43 15.61	BULLET-RESISTANT TWO-WAY COMMUNICATOR	08 43 15
08 43 15.71	BACKER ROD & SEALANT	08 43 15
08 44 13	**GLAZED ALUMINUM CURTAIN WALL**	**DIVISION 08**
08 44 13.01	ALUMINUM CURTAIN WALL FRAME	08 44 13
08 44 13.02	ALUMINUM ENTRANCE DOOR	08 44 13
08 44 13.03	PREFINISHED ALUMINUM FLASHING	08 44 13
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09 29 00.43	CORNER BEAD	09 29 00
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11 31 00.23	WASHER - STACKABLE	11 31 00
11 31 00.24	DRYER - STACKABLE	11 31 00
11 31 00.31	ICE MACHINE	11 31 00
11 31 00.41	WALL OVEN - BUILT-IN - ELECTRIC	11 31 00
11 31 00.42	IN COUNTER COOKTOP - ELECTRIC	11 31 00
11 31 00.44	UNDER CABINET RANGE HOOD	11 31 00
11 40 00	**FOODSERVICE EQUIPMENT**	**DIVISION 11**
11 40 00.01	FOODSERVICE EQUIPMENT - SEE FOODSERVICE SPECIFICATION AND DRAWINGS	11 40 00
11 40 00.11	EXHAUST VENTILATOR - REFER TO FOODSERVICE EQUIPMENT DRAWINGS AND SPECIFICATIONS	11 40 00
11 40 00.12	CLOSURE PANEL BY KITCHEN EQUIPMENT CONTRACTOR	11 40 00
11 40 00.21	STAINLESS STEEL MOBILE PREP TABLE	11 40 00
11 52 13	**PROJECTION SCREENS**	**DIVISION 11**
11 52 13.01	PROJECTION SCREEN - TYPE 1	11 52 13
11 52 13.02	PROJECTION SCREEN - TYPE 2	11 52 13
11 52 13.03	PROJECTION SCREEN - TYPE 3	11 52 13
11 53 00	**LABORATORY EQUIPMENT**	**DIVISION 11**
11 53 00.01	ACID STORAGE CABINET - BENCH TOP	11 53 00
11 53 00.02	FLAMMABLE STORAGE CABINET - BENCH TOP	11 53 00
11 53 00.11	GLASSWARE PEGBOARD	11 53 00
11 53 00.21	SAFETY GOGGLE CABINET	11 53 00
11 53 00.31	COUNTERTOP WATER DISTILLER	11 53 00
11 53 13	**LABORATORY FUME HOODS**	**DIVISION 11**
11 53 13.01	LABORATORY FUME HOOD	11 53 13
11 61 00	**THEATER AND STAGE EQUIPMENT**	**DIVISION 11**
11 61 00.01	DIMMING RACK	11 61 00
11 61 00.02	DIMMING CONSOLE	11 61 00
11 61 00.03	LIGHTING CONSOLE	11 61 00
11 61 00.04	STAGE MANAGER PANEL	11 61 00
11 61 00.05	TORM LADDER	11 61 00
11 61 00.06	STAGE RIGGING	11 61 00
11 61 00.07	CURTAIN - MAIN VALANCE	11 61 00
11 61 00.08	CURTAIN - MAIN TRAVELER	11 61 00
11 61 00.09	CURTAIN - BORDER	11 61 00
11 61 00.10	CURTAIN - LEG	11 61 00
11 61 00.11	CURTAIN - TRAVELER	11 61 00
11 61 00.12	CURTAIN - CYCLORAMA	11 61 00
11 61 00.13	CURTAIN - SIDE TABS	11 61 00
11 61 00.22	STEEL ANGLES WITH PRE-PUNCHED HOLES - SIZE AND GAGE AS REQUIRED	11 61 00
11 61 00.23	STAINLESS STEEL ROD - 3/16 INCH DIAMETER	11 61 00
11 61 00.24	STAINLESS STEEL BOLT AND WASHERS	11 61 00
11 61 00.31	CURTAIN TRACK ASSEMBLY	11 61 00
11 61 00.32	STAGE CURTAIN	11 61 00
11 61 00.33	CURTAIN TRACK ASSEMBLY - GREEN SCREEN	11 61 00
11 61 00.41	PIPE GRID - TV STUDIO	11 61 00
11 61 00.42	PIPE GRID - PERFORMANCE TECHNOLOGY STUDIO	11 61 00
11 66 23	**GYMNASIUM EQUIPMENT**	**DIVISION 11**
11 66 23.01	WALL PADDING - TYPE 1	11 66 23
11 66 23.02	WALL PADDING - TYPE 2	11 66 23
11 66 23.03	WALL PADDING - TYPE 3	11 66 23
11 66 23.11	VOLLEYBALL STANDARD FLOOR INSERT	11 66 23
11 66 23.31	BATTING CAGE	11 66 23
11 66 24	**BASKETBALL GYM EQUIPMENT**	**DIVISION 11**
11 66 24.01	BACKSTOP - FORWARD FOLDING - ADJUSTABLE CEILING MOUNTED - MANUALLY OPERATED	11 66 24
11 66 24.02	BACKSTOP - SIDE FOLDING - ADJUSTABLE CEILING MOUNTED - MANUALLY OPERATED	11 66 24
11 66 24.03	BACKSTOP - WALL MOUNTED - ADJUSTABLE HIEGHT - MANUALLY OPERATED	11 66 24

11 66 24.21	BACKBOARD - GLASS - OFFICIAL 72 x 48 - SAFETY PADDING	11 66 24
11 66 53	**GYMNASIUM DIVIDERS**	**DIVISION 11**
11 66 53.01	ROLL-FOLD DIVIDER CURTAIN - OVERHEAD SUPPORTED	11 66 53
11 66 53.11	DIVIDER CURTAIN MOTOR	11 66 53
11 95 13	**KILNS**	**DIVISION 11**
11 95 13.01	ART KILN	11 95 13
DIVISION 12	**FURNISHINGS**	
12 24 00	**WINDOW SHADES**	**DIVISION 12**
12 24 00.01	ROLLER SHADE	12 24 00
12 24 00.02	ROLLER SHADE - ELECTRICALLY OPERATED	12 24 00
12 24 00.11	BLACKOUT SHADE	12 24 00
12 24 00.12	BLACKOUT SHADE - ELECTRICALLY OPERATED	12 24 00
12 24 00.21	DUAL ROLLER SHADES	12 24 00
12 40 00.99	WINDOW SHADE - REFER TO FRAME SCHEDULE FOR TYPE	12 24 00
12 30 00	**CASEWORK**	**DIVISION 12**
12 30 00.01	BASE CABINET	12 30 00
12 30 00.02	WALL CABINET	12 30 00
12 30 00.03	TALL CABINET	12 30 00
12 30 00.04	LOCKING NARCOTICS CABINET	12 30 00
12 30 00.11	PVC EDGE BANDING	12 30 00
12 30 00.20	PLASTIC LAMINATE COUNTERTOP	12 30 00
12 30 00.21	PLASTIC LAMINATE BACKSPLASH - 4 INCH	12 30 00
12 30 00.22	PLASTIC LAMINATE BACKSPLASH - 6 INCH	12 30 00
12 30 00.31	STAINLESS STEEL COUNTERTOP	12 30 00
12 30 00.32	STAINLESS STEEL COUNTERTOP AND BACKSPLASH - SIZE AS NOTED	12 30 00
12 30 00.40	EPOXY RESIN LABORATORY COUNTERTOP	12 30 00
12 30 00.41	EPOXY RESIN LABORATORY BACKSPLASH - 4 INCH	12 30 00
12 30 00.42	EPOXY RESIN LABORATORY BACKSPLASH - 6 INCH	12 30 00
12 30 00.43	EPOXY RESIN INTEGRAL SINK	12 30 00
12 30 00.50	FILLER PIECE SCRIBED TO ADJACENT SURFACE - FINISH TO MATCH CASEWORK	12 30 00
12 30 00.60	CONTINUOUS WOOD VALANCE - FINISH TO MATCH CASEWORK - SIZE AS NOTED	12 30 00
12 30 00.61	FINISHED WOOD END PANEL - FINISH TO MATCH CASEWORK	12 30 00
12 30 00.65	CABINET UNIT SHALL BE INSTALLED 6 INCHES FROM WALL FOR PLUMBING CLEARANCE - COUNTERTOPS & FINISHED END PANELS ON UNITS WITH EXPOSED SIDES TO EXTEND TO WALL	12 30 00
12 30 00.71	GROMMET - 3 INCH - PLASTIC	12 30 00
12 30 00.73	STEEL UNDER COUNTER SUPPORT BRACKET - SIZE AS NOTED OR DRAWN	12 30 00
12 30 00.78	LOCK	12 30 00
12 30 00.80	SEALANT	12 30 00
12 30 00.90	FASTENER	12 30 00
12 35 51	**MUSICAL INSTRUMENT STORAGE CASEWORK**	**DIVISION 12**
12 35 51.10	MUSIC LIBRARY STORAGE SYSTEM	12 35 51
12 35 51.11	MUSIC INSTRUMENT STORAGE UNIT - ADJUSTABLE SHELF CABINET UNIT	12 35 51
12 48 13	**ENTRANCE FLOOR MATS AND FRAMES**	**DIVISION 12**
12 48 13.01	RECESSED ENTRANCE MAT - REFERENCE DRAWINGS FOR SIZE	12 48 13
12 48 13.02	RECESSED ENTRANCE GRATING - REFERENCE DRAWINGS FOR SIZE	12 48 13
12 48 13.03	ENTRANCE MAT - REFERENCE DRAWINGS FOR SIZE	12 48 13
12 48 13.05	EXTRUDED ALUMINUM RECESSED FRAMING - Z SHAPE	12 48 13
12 48 13.10	EXTRUDED ALUMINUM RECESSED FRAMING - L SHAPE	12 48 13
12 61 00	**FIXED AUDIENCE SEATING**	**DIVISION 12**
12 61 00.01	FIXED AUDIENCE SEAT	12 61 00
12 61 00.02	FIXED AUDIENCE SEAT WITH LIGHT UNDER ARMREST	12 61 00
12 61 00.03	FIXED AUDIENCE SEAT - ADA ACCESSIBLE ARMLESS SEAT	12 61 00
12 66 13	**TELESCOPING BLEACHERS**	**DIVISION 12**
12 66 13.01	TELESCOPING POWER ASSISTED BLEACHERS	12 66 13
12 66 13.02	TELESCOPING POWER ASSISTED AUDIENCE SEATING	12 66 13
12 66 13.11	END-CLOSURE CURTAINS	12 66 13
DIVISION 13	**SPECIAL CONSTRUCTION**	
13 00 00	**NOT USED**	**DIVISION 13**

13 00 00.01	NOT USED	13 00 00
13 34 23	**PRE-ENGINEERED RESTROOM BUILDING**	**DIVISION 13**
13 34 23.01	8" X 16" GROUND FACE CMU WALL WITH MORTAR JOINTS, GROUTED SOLID ALL CELLS	13 00 00
13 34 23.11	STANDING-SEAM METAL ROOF	13 00 00
13 34 23.12	ROOF UNDERLAYMENT - ICE & WATER SHEILD AT PERIMETER/RIDGE FOR 24" MIN.	13 00 00
13 34 23.13	#30 ROOFING FELT IN FIELD	13 00 00
13 34 23.14	FASCIA	13 00 00
13 34 23.21	WIRE MESH GABLE VENT	13 00 00
13 34 23.22	GLULAM BEAMS	13 00 00
13 34 23.31	WALL MOUNT LIGHT, TYP.	13 00 00
13 34 23.41	3" VTR WITH VENT BOOT, TYP.	13 00 00
13 34 23.51	ISA WITH BRAILLE SIGN PER ADA & LOCAL CODES	13 00 00
DIVISION 14	**CONVEYING SYSTEM**	
14 21 23	**COMPACT TRACTION ELEVATORS**	**DIVISION 14**
14 21 23.01	ELEVATOR - TYPE 1 - SEE SPECIFICATION	14 21 23
14 21 23.05	ELEVATOR CONTROLLER	14 21 23
14 21 23.11	ELEVATOR CAB	14 21 23
14 21 23.12	ELEVATOR PLATFORM	14 21 23
14 21 23.13	ELEVATOR SILL	14 21 23
14 21 23.14	ELEVATOR DOOR FRAME	14 21 23
14 21 23.15	ELEVATOR DOORS	14 21 23
14 21 23.16	ELEVATOR DOOR GUIDE	14 21 23
14 21 23.17	ELEVATOR GUIDE RAILS AND BRACKETS	14 21 23
14 21 23.18	ELEVATOR PIT LADDER	14 21 23
14 21 23.21	STEEL SILL GUARDS	14 21 23
14 21 23.22	SHIM	14 21 23
DIVISION 15	**RESERVED**	
15 00 00	**NOT USED**	**DIVISION 15**
15 00 00.01	NOT USED	15 00 00
DIVISION 16	**RESERVED**	
16 00 00	**NOT USED**	**DIVISION 16**
16 00 00.01	NOT USED	16 00 00
DIVISION 17	**RESERVED**	
17 00 00	**NOT USED**	**DIVISION 17**
17 00 00.01	NOT USED	17 00 00
DIVISION 18	**RESERVED**	
18 00 00	**NOT USED**	**DIVISION 18**
18 00 00.01	NOT USED	18 00 00
DIVISION 19	**RESERVED**	
19 00 00	**NOT USED**	**DIVISION 19**
19 00 00.01	NOT USED	19 00 00
DIVISION 20	**RESERVED**	
20 00 00	**NOT USED**	**DIVISION 20**
20 00 00.01	NOT USED	20 00 00
DIVISION 21	**FIRE SUPPRESSION**	
21 00 00	**FIRE SUPPRESSION**	**DIVISION 21**
21 00 00.01	SPRINKLER HEAD - PENDANT	21 00 00
21 00 00.02	SPRINKLER HEAD - UPRIGHT	21 00 00
21 00 00.03	SPRINKLER HEAD - RECESSED	21 00 00
21 00 00.04	SPRINKLER HEAD - SIDEWALL	21 00 00
21 00 00.05	FIRE STANDPIPE	21 00 00
21 00 00.06	SPRINKLER PIPE	21 00 00
21 00 00.07	FIRE DEPARTMENT VALVE / CABINET	21 00 00
21 00 00.08	FIRE DEPARTMENT VALVE	21 00 00
21 00 00.09	FIRE DEPARTMENT CONNECTION	21 00 00
21 00 00.10	VALVE AND EXTINGUISHER CABINET	21 00 00
DIVISION 22	**PLUMBING**	
22 00 00	**PLUMBING**	**DIVISION 22**
22 00 00.01	SINK - SEE PLUMBING	22 00 00
22 00 00.02	LAVATORY - SEE PLUMBING	22 00 00

22 00 00.03	WATER FOUNTAIN - SEE PLUMBING	22 00 00
22 00 00.04	ELECTRIC WATER COOLER - SEE PLUMBING	22 00 00
22 00 00.05	WATER CLOSET - SEE PLUMBING	22 00 00
22 00 00.06	URINAL - SEE PLUMBING	22 00 00
22 00 00.07	SHOWER - SEE PLUMBING	22 00 00
22 00 00.08	MOP RECEPTOR - SEE PLUMBING	22 00 00
22 00 00.09	HOSE REEL ASSEMBLY - SEE PLUMBING	22 00 00
22 00 00.10	HOSE BIB - SEE PLUMBING	22 00 00
22 00 00.11	MOP SINK - SEE PLUMBING	22 00 00
22 00 00.12	HYDRATION STATION - SEE PLUMBING	22 00 00
22 00 00.13	DECK MOUNTED DRINKING FOUNTAIN	22 00 00
22 00 00.14	DECK MOUNTED EYE WASH	22 00 00
22 00 00.15	COMPRESSED AIR SUPPLY VALVE - SEE PLUMBING	22 00 00
22 00 00.16	ESCUTCHEON COVER - SEE PLUMBING	22 00 00
22 00 00.20	ROOF DRAIN ASSEMBLY - SEE PLUMBING	22 00 00
22 00 00.21	FLOOR DRAIN - SEE PLUMBING	22 00 00
22 00 00.22	DRAIN PIPE - SEE PLUMBING	22 00 00
22 00 00.23	AREA DRAIN - SEE PLUMBING	22 00 00
22 00 00.24	TRENCH DRAIN - SEE PLUMBING	22 00 00
22 00 00.25	PIPE CLEANOUT FLOOR COVER - SEE PLUMBING	22 00 00
22 00 00.30	PIPE INSULATION - SEE PLUMBING	22 00 00
22 00 00.35	RAIN WATER LEADER - SEE PLUMBING	22 00 00
22 00 00.40	FREEZE PROOF WALL HYDRANT - SEE PLUMBING	22 00 00
22 00 00.50	PIPE PENETRATION - SEE PLUMBING	22 00 00
22 00 00.60	PIPE - SEE PLUMBING	22 00 00
22 00 00.70	EMERGENCY EYEWASH/SHOWER STATION	22 00 00
22 00 00.71	EMERGENCY UTILITY CONTROLLER	22 00 00
22 00 00.80	GAS METER - SEE PLUMBING	22 00 00
22 00 00.98	SHOWER HEAD & FAUCET - SEE PLUMBING	22 00 00
DIVISION 23	**HEATING, VENTILATING AND AIR CONDITIONING**	
23 00 00	**HEATING, VENTILATING, AND AIR CONDITIONING**	**DIVISION 23**
23 00 00.01	CONVECTOR - SEE HVAC	23 00 00
23 00 00.02	DIFFUSER - SEE HVAC	23 00 00
23 00 00.03	CABINET UNIT HEATER - SEE HVAC	23 00 00
23 00 00.04	PTAC UNIT - SEE HVAC	23 00 00
23 00 00.06	ROOF TOP UNIT - SEE HVAC	23 00 00
23 00 00.08	BOILER STACK - SEE HVAC	23 00 00
23 00 00.10	FAN - SEE HVAC	23 00 00
23 00 00.12	EXHAUST FAN UNIT - SEE HVAC	23 00 00
23 00 00.14	VENT - SEE HVAC	23 00 00
23 00 00.20	SUPPLY AIR REGISTER - SEE HVAC	23 00 00
23 00 00.21	RETURN AIR REGISTER - SEE HVAC	23 00 00
23 00 00.22	AIR PLENUM - SEE HVAC	23 00 00
23 00 00.23	DUCT - SEE HVAC	23 00 00
23 00 00.24	FLEXIBLE AIR DUCT - SEE HVAC	23 00 00
23 00 00.25	RADIANT PANEL - SEE HVAC	23 00 00
23 00 00.30	STAINLESS STEEL EXHAUST HOOD -SEE HVAC	23 00 00
23 00 00.40	PIPE - SEE HVAC	23 00 00
DIVISION 24	**RESERVED**	
24 00 00	**NOT USED**	**DIVISION 24**
24 00 00.01	NOT USED	24 00 00
DIVISION 25	**INTEGRATED AUTOMATION**	
25 00 00	**NOT USED**	**DIVISION 25**
25 00 00.01	NOT USED	25 00 00
DIVISION 26	**ELECTRICAL**	
26 00 00	**ELECTRICAL**	**DIVISION 26**
26 00 00.01	LIGHT FIXTURE - SEE ELECTRICAL	26 00 00
26 00 00.02	PENDENT LIGHT FIXTURE - SEE ELECTRICAL	26 00 00
26 00 00.03	RECESSED LIGHT FIXTURE- SEE ELECTRICAL	26 00 00
26 00 00.04	WALL MOUNTED LIGHT FIXTURE- SEE ELECTRICAL	26 00 00

26 00 00.05	INDUSTRIAL LIGHT FIXTURE - SEE ELECTRICAL	26 00 00
26 00 00.06	COVE LIGHT FIXTURE - SEE ELECTRICAL	26 00 00
26 00 00.07	UNDER-COUNTER LIGHT - SEE ELECTRICAL	26 00 00
26 00 00.08	EXTERIOR LIGHT FIXTURE - SEE ELECTRICAL	26 00 00
26 00 00.15	UNDER SLAB CONDUIT - SEE ELECTRICAL	26 00 00
26 00 00.16	ELECTRICAL CONDUIT - SEE ELECTRICAL	26 00 00
26 00 00.17	NO TECHNOLOGY CONDUIT - REMOVE BASE TUBE FROM TECHNOLOGY SIDE OF PEDESTAL	26 00 00
26 00 00.21	CEILING MOUNTED SPEAKER BAFFLE - SEE ELECTRICAL	26 00 00
26 00 00.22	FIRE ALARM ANNUNCIATOR PANEL - SEE ELECTRICAL	26 00 00
26 00 00.23	FIRE ALARM AUDIO/VISUAL UNIT - SEE ELECTRICAL	26 00 00
26 00 00.24	FIRE ALARM PULL - SEE ELECTRICAL	26 00 00
26 00 00.25	EXIT SIGN - SEE ELECTRICAL	26 00 00
26 00 00.26	FIRE ALARM CONTROL PANEL - SEE ELECTRICAL	26 00 00
26 00 00.27	FIRE BEACON - SEE ELECTRICAL	26 00 00
26 00 00.28	FIRE BELL - SEE ELECTRICAL	26 00 00
26 00 00.30	SCOREBOARD - SEE ELECTRICAL	26 00 00
26 00 00.31	SHOT CLOCK - SEE ELECTRICAL	26 00 00
26 00 00.35	DESTRATIFICATION FAN - SEE ELECTRICAL	26 00 00
26 00 00.41	LAB BENCH PEDESTAL - SEE ELECTRICAL	26 00 00
26 00 00.45	SURFACE MTD JUNCTION BOX AND CONDUIT FOR SOUND SYSTEM - SEE ELECTRICAL	26 00 00
26 00 00.50	ELECTRICAL OUTLET - SEE ELECTRICAL	26 00 00
26 00 00.51	ELECTRICAL FLOOR OUTLET - SEE ELECTRICAL	26 00 00
26 00 00.52	LIGHT SWITCH - SEE ELECTRICAL	26 00 00
26 00 00.53	ELECTRICAL RETRACTABLE OVERHEAD OUTLET - SEE ELECTRICAL	26 00 00
26 00 00.54	ELECTRICAL OUTLET WITH DIRECT CURRENT - SEE ELECTRICAL	26 00 00
26 00 00.60	LCD ANNUNCIATOR - SEE ELECTRICAL	26 00 00
26 00 00.72	ELECTRICAL POWER PANELS - SEE ELECTRICAL	26 00 00
26 00 00.75	EMERGENCY LIGHTING	26 00 00
26 00 00.76	SECURITY STROBE	26 00 00
26 00 00.81	KNOX BOX - FIRE	26 00 00
26 00 00.82	KNOX BOX - POLICE	26 00 00
26 00 00.98	EMERGENCY SHUT OFF - SEE ELECTRICAL	26 00 00
26 00 00.99	ELECTRICAL PANEL - SEE ELECTRICAL	26 00 00
26 60 00	**PHOTOVOLTAIC SYSTEM**	**DIVISION 26**
26 60 00.01	ROOF MOUNTED PHOVOLTAIC PANEL	26 60 00
DIVISION 27	**COMMUNICATIONS**	
27 10 00	**STRUCTURED CABLING**	**DIVISION 27**
27 10 00.01	CPU HOLDER - SEE TECHNOLOGY	27 10 00
27 10 00.10	DATA OUTLET - SEE TECHNOLOGY	27 10 00
27 10 00.11	TELEPHONE JACK - SEE TECHNOLOGY - TELEPHONE DEVICE TO BE OWNER FURNISHED AND INSTALLED	27 10 00
27 10 00.21	EQUIPMENT RACK - SEE TECHNOLOGY	27 10 00
27 10 00.22	CABLE TRAY - SEE TECHNOLOGY	27 10 00
27 21 33	**DATA COMMUNICATIONS WIRELESS ACCESS POINTS**	**DIVISION 27**
27 21 33.01	WIRELESS ACCESS POINT - SEE TECHNOLOGY	27 21 33
27 40 00	**AUDIO-VIDEO COMMUNICATIONS**	**DIVISION 27**
27 40 00.02	CAMERA - SEE TECHNOLOGY	27 40 00
27 40 00.03	VIDEO DISPLAY MONITOR	27 40 00
27 40 00.04	VIDEO DISPLAY WALL BRACKET	27 40 00
27 40 00.06	SPEAKER - SEE TECHNOLOGY	27 40 00
27 40 00.07	EQUIPMENT RACK	27 40 00
27 40 00.08	PROJECTOR - SEE TECHNOLOGY	27 40 00
27 40 00.10	FACE PLATE - SEE TECHNOLOGY	27 40 00
27 40 00.20	DISPLAY - INTERACTIVE - SEE TECHNOLOGY	27 40 00
27 40 00.21	DISPLAY - FLAT PANEL - SEE TECHNOLOGY	27 40 00
27 40 00.30	VOICE LIFT ACOUSTIC ENHANCEMENT SYSTEM	27 40 00
27 40 00.40	LED VIDEO WALL	27 40 00
27 40 00.99	BACKBOX - SEE TECHNOLOGY	27 40 00
27 50 00	**DISTRIBUTED COMMUNICATIONS AND MONITORING**	**DIVISION 27**

27 50 00.01	PA SPEAKER - SEE TECHOLOGY	27 50 00
27 50 00.11	CLOCK - SEE TECHNOLOGY	27 50 00
27 50 00.21	PA EMERGENCY CALL BUTTON - SEE TECHNOLOGY	27 50 00
27 70 00	**VIDEO DISTRIBUTION SYSTEM**	**DIVISION 27**
27 70 00.01	TV - FLAT SCREEN - SEE TECHNOLOGY	27 70 00
DIVISION 28	**ELECTRONIC SAFETY AND SECURITY**	
28 00 00	**ELECTRONIC SAFETY AND SECURITY**	**DIVISION 28**
28 00 00.01	CAMERA - SEE TECHNOLOGY	28 00 00
28 00 00.02	CARD READER - SEE TECHNOLOGY	28 00 00
28 00 00.03	PANIC BUTTON	28 00 00
28 00 00.11	SECURITY KEYPAD - SEE TECHNOLOGY	28 00 00
28 00 00.12	MOTION SENSOR - SEE TECHNOLOGY	28 00 00
DIVISION 29	**RESERVED**	
29 00 00	**NOT USED**	**DIVISION 29**
29 00 00.01	NOT USED	29 00 00
DIVISION 30	**RESERVED**	
30 00 00	**NOT USED**	**DIVISION 30**
30 00 00.01	NOT USED	30 00 00
DIVISION 31	**EARTHWORK**	
31 00 00	**NOT USED**	**DIVISION 31**
31 00 00.01	NOT USED	31 00 00
DIVISION 32	**EXTERIOR IMPROVEMENTS**	
32 13 13	**SITE CONCRETE**	**DIVISION 32**
32 13 13.01	SIDEWALK - SEE CIVIL/LANDSCAPE	32 13 13
32 13 13.02	BOND BREAKER	32 13 13
DIVISION 33	**UTILITIES**	
33 00 00	**NOT USED**	**DIVISION 33**
33 00 00.01	NOT USED	33 00 00
DIVISION 34	**TRANSPORTATION**	
34 00 00	**NOT USED**	**DIVISION 34**
34 00 00.01	NOT USED	34 00 00
DIVISION 35	**WATERWAY AND MARINE CONSTRUCTION**	
35 00 00	**NOT USED**	**DIVISION 35**
35 00 00.01	NOT USED	35 00 00

APPENDIX B

NE-CHPS PROJECT SCORECARD

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Collaborative for High Performance Schools (CHPS)

Project Scorecard: NE-CHPS Version 4.0

School Name: Central Falls High School

Use this scorecard to track expected scores. Note that prerequisites have points associated with them even though they are required. This enables project teams to talk more meaningfully

Key: RP - RHODE ISLAND Prerequisite **P -** Prerequisite; **PS -** CHPS Plan Sheet Required; **CD -** Construction Documents Required; **A -** Attachment Required

Criteria	Title	Prerequisite	Points Possible	Points Targeted	Points Claimed	Responsible Team Member	Design Review Requirements		Ready for Design Review	Construction Review Requirements		Ready for Construction Review	Performance Review Requirements	Ready for Performance Review	Documentation
	Total		**250**	176	0										
Integration and Innovation															
II 1.0	Integrated Design	P	4	4		Allyson Iwanicki/ ALE		CD			A				
II 1.1	Enhanced Integrated Design		2	2		Kris Kendall/Ai3			A						
II 2.1	District Level Commitment	RP	1	1		Rory Marty/CFSD			A						
II 3.1	School Master Plan	RP	1	1		CF / Community / SBC			A						
II 4.1	High Performance Transition Plan	RP	1	0		N/A RENOVATION ONLY			A		A				
II 5.0	Educational Display	P	1	1		Ai3 / CFSD / Signage		CD			A				
II 5.1	Demonstration Area		1	1		Ai3 / Signage consultant		CD			A				
II 6.1	Educational Integration	RP	2	2		CFSD / Ai3			A		A				
II 7.1	Design for Adaptation		3	0		n/a			A		A				
II 8.0	Safer Schools By Design	P	3	3		Ai3 / CFSD			A		A				
II 9.1	Innovation		4	4		Ai3									
II 10.1	Biophilic & Responsive Design		3	3		Ai3	VARIES			VARIES			VARIES		
	Subtotal		26	22	0										
Operations & Metrics															
OM 1.0	Facility Staff and Occupant Training	P	4	4		Rory Marty/ CFSD + CxA		CD			A				
OM 2.1	Post Occupancy Transition		2	2		Rory Marty/ CFSD			A		A				
OM 3.0	Performance Benchmarking	P	3	3		Rory Marty/ CFSD			A		A		A		
OM 4.0	Systems Maintenance Plan	P	1	1		Rory Marty/ CFSD			A		A		A		
OM 4.1	High Performance Operations		3	2		Rory Marty/ CFSD					A				
OM 5.0	Indoor Environmental Management Plan	P	2	2		Rory Marty/ CFSD					A				
OM 6.1	Green Cleaning		2	2		Rory Marty/ CFSD					A		A		
OM 7.0	Integrated Pest Management	P	1	1		Rory Marty/ CFSD	PS				A				
OM 8.0	Anti-Idling Measures	P	1	1		Rory Marty/ CFSD		CD			A				
OM 9.1	Green Power		2	2		Rory Marty/ CFSD			A						
OM 10.0	ENERGY STAR Equipment and Appliances	P	2	2		Rory Marty/ CFSD			A						
OM 11.1	Computerized Maintenance Management System	RP	1	1		Rory Marty/ CFSD	PS				A				
	Subtotal		24	23	0										
Indoor Environmental Quality															
EQ 1.0	HVAC Design - ASHRAE 62.1	P	8	8		Dave Hipolito/G&V	PS								
EQ 1.1	Enhanced Filtration		2	2		Dave Hipolito/G&V		CD			A				
EQ 1.2	Dedicated Outdoor Air System		3	3		Dave Hipolito/G&V		CD			A				
EQ 2.1	Pollutant and Chemical Source Control	P	2	2		CFSD + Ai3 + G&V + Traverse		CD	A		A				
EQ 3.0	Outdoor Moisture Management	P	1	1		CxA + Dave Hipolito/G&V		CD			A				
EQ 4.1	Ducted Returns		2	2		Dave Hipolito/G&V		CD							
EQ 5.1	Construction Indoor Air Quality Management		5	5		Contractor (specs)		CD			A				
EQ 5.2	Construction Moisture Management		1	1		Contractor (specs)		CD			A				
EQ 6.1	Post Construction Indoor Air Quality		1	1		Rory Marty/ CFSD		CD			A				
EQ 7.0	Low Emitting Materials	P	2	2		Kris Kendall/ Ai3	PS	CD		PS	A				
EQ 7.1	Additional Low Emitting Materials		5	5		Kris Kendall/ Ai3	PS	CD		PS	A				
EQ 8.1	Low Radon	RP	1	1		Rory Marty/ CFSD		CD			A				
EQ 9.1	Thermal Comfort - ASHRAE 55		4	0		n/a	PS	CD							
EQ 10.1	Individual Controllability		1	1		Dave Hipolito/G&V		CD			A				
EQ 10.2	Controllability of Systems		1	0		n/a		CD			A				
EQ 11.0	Daylighting: Glare Protection	P	4	4		AI/ALE/G&V		CD	A		A				
EQ 11.1	Daylight Availability		5	0*		AI/ALE + Bob Bravo/G&V	PS	CD	A		A				
EQ 12.0	Views	P	1	1		Kris Kendall/ Ai3	PS	CD							
EQ 12.1	Additional Views		2	1		Kris Kendall/ Ai3									
EQ 13.1	Electric Lighting Performance		3	3		Bob Bravo/G&V		CD	A						
EQ 13.2	Superior Electric Lighting Performance		5	0		Bob Bravo/G&V		CD			A				
EQ 14.0	Acoustical Performance	P	7	7		Ai3 + Acoustic	PS	CD	A		A		A		
EQ 15.1	Low-EMF Wiring		1	0**		n/a		CD			A				
EQ 15.2	Low-EMF Best Practices		2	0**		n/a		CD	A		A				
EQ 16.1	High Intensity Fluorescent Fixtures		1	1		Bob Bravo/G&V		CD			A				
	Subtotal		70	51	0										

Energy																
EE 1.0	Energy Performance	P	6	6		Allyson Iwanicki/ ALE		CD	A							
EE 1.1	Superior Energy Performance		40	18		Allyson Iwanicki/ ALE		CD	A							
EE 2.1	Zero Energy Capable		3	0		n/a		CD								
EE 3.0	Commissioning	P	4	4		Stephen Turner/CxA		CD	A			A				
EE 3.1	Additional Commissioning Qualifications		1	1		Stephen Turner/CxA		CD	A			A				
EE 3.2	Building Envelope Commissioning		1	1		Stephen Turner/CxA		CD	A			A				
EE 3.3	Enhanced Commissioning		1	1		Stephen Turner/CxA		CD	A			A		A		
EE 4.0	Environmentally Preferable Refrigerants	P	1	1		Dave Hipolito/G&V		CD								
EE 5.1	Energy Management System		2	2		Dave Hipolito/G&V		CD								
EE 5.2	Advanced Energy Management System and Submetering		2	2		Bob Bravo/G&V		CD								
EE 6.1	Natural Ventilation and Energy Conservation Interlocks		2	0		n/a	PS	CD				A				
EE 7.0	Local Energy Efficiency Incentive and Assistance	RP	2	2		Peregrine / Ai3 / ALE			A			A				
EE 8.1	Variable Air Volume Systems		1	1		Dave Hipolito/G&V		CD								
EE 9.1	Renewable Energy Performance Monitoring		1	1		Bob Bravo/G&V		CD				A				
EE 10.1	Electric Vehicle Charging		1	0		n/a		CD				A				
	Subtotal		68	40												
Water																
WE 1.0	Minimum Reduction in Indoor Potable Water Use	P	5	5		Adrian Delima/G&V	PS	CD				A				
WE 2.1	Reduce Potable Water Use for Sewage Conveyance		4	2		Adrian Delima/G&V	PS	CD				A				
WE 3.0	Irrigation and Exterior Water Budget - Use Reduction	P	4	4		Steven D'Ambrosia/Traverse		CD				A				
WE 4.1	Reduce Potable Water Use for Non-Recreational Landscaping		2	2		Steven D'Ambrosia/Traverse		CD	A			A				
WE 5.1	Reduce Potable Water Use for Recreational Landscaping		1	1		Steven D'Ambrosia/Traverse		CD				A				
WE 6.0	Irrigation Systems Commissioning	P	1	n/a		n/a			A			A				
WE 7.1	Rainwater Collection and Storage		2	0		n/a	PS	CD								
WE 8.1	Water Management System		2	2		Adrian Delima/G&V		CD				A				
	Subtotal		21	16	0											
Sites																
SS 1.0	Site Selection	P	2	2		CFSD			A							
SS 2.1	Environmentally Sensitive Land		3	0		CFSD / RM	PS	CD	A							
SS 3.1	Minimize Site Disturbance		1	0		CFSD + Ai3 + Traverse	PS	CD								
SS 4.1	Construction Site Runoff Control and Sedimentation		1	1		Vertex / Contractor (specs)		CD				A				
SS 5.1	Post Construction Stormwater Management		1	0		Contractor/CFSD	PS	CD				A				
SS 6.1	Central location		2	2		CFSD / RM	PS		A							
SS 7.1	Located Near Public Transportation		1	1		Ai3 / ALE			A							
SS 8.1	Joint-Use of Facilities		1	1		CFSD / RM		CD	A							
SS 9.1	Human-Powered Transportation		2	0		n/a	PS	CD				A				
SS 10.1	Reduce Heat Islands - Landscaping and Sites		1	1		Steven D'Ambrosia/Traverse		CD								
SS 11.1	Reduce Heat Islands - Cool Roofs and Green Walls		1	1		Kris Kendall/ Ai3		CD				A				
SS 12.1	Avoid Light Pollution and Unnecessary Lighting		2	0		CFSD / G&V		CD				A				
SS 13.1	School Gardens		1	0		n/a		CD	A			A				
SS 14.1	Use Locally Native Plants for Landscape		1	1		Steven D'Ambrosia/Traverse	PS	CD								
SS 15.0	Site and Building Best Practices	P	2	2		A/E / site	PS	CD	A							
	Subtotal		22	12	0											
Materials and Waste Management																
MW 1.0	Storage and Collection of Recyclables	P	2	2		CFSD + GC		CD				A				
MW 2.0	Minimum Construction Site Waste Management	P	2	2		GC (specs)		CD				A				
MW 2.1	Construction Site Waste Management		2	1		GC (specs)		CD				A				
MW 3.1	Single Attribute - Recycled Content		2	2		GC (specs)***		CD			PS	A				
MW 4.1	Single Attribute - Rapidly Renewable Materials		1	0				CD			PS	A				
MW 5.1	Single Attribute - Certified Wood		1	1		GC (specs)***		CD			PS	A				
MW 6.1	Single Attribute - Materials Reuse		1	0				CD			PS	A				
MW 7.1	Multi-Attribute Materials Selection		2	2		GC (specs)***	PS	CD			PS	A				
MW 8.1	Building Reuse - Exterior		2	0		n/a		CD			PS	A				
MW 9.1	Building Reuse - Interior		1	0		n/a		CD			PS	A				
MW 10.1	Health Product Related Information Reporting		1	1		GC (specs)***		CD			PS	A				
MW 11.1	Locally Produced Materials		2	2		GC (specs)***		CD			PS	A				
	Subtotal		19	13	0											
	Total		**250**	177	0											

* The project design includes daylight responsive controls in all classrooms and most perimeter spaces. The project team is evaluating the cost-benefit of conducting the additional analyses required for these credits and is not carrying points in the 60% CD submission NE-CHPS v4.0 scorecard to ensure that there are enough points in other categories/credits to meet the project's CHPS goals.

** The NE-CHPS v4.0 requirements for the Low-EMF Best Practices credit prohibits the use of Wi-Fi/ Wi-Fi enabled devices in the building. The project design includes Wi-Fi technology for the building.

*** These credits are targeted by the team and will be re-evaluated further once a General Contractor is awarded the contract.

APPENDIX C

BUILDING ENCLOSURE COMMISSIONING PLAN

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BUILDING ENCLOSURE COMMISSIONING PLAN

CENTRAL FALLS SCHOOL DISTRICT, NEW HIGH SCHOOL

10 HIGGINSON AVE, CENTRAL FALLS, RI

STEPHEN TURNER, INC.

317 HOPE STREET

PROVIDENCE, RI 02906

Date: October 10, 2023

A/E Project Number: 2202.00

BECx Project Number: P1497

859 North Main Street » Providence, RI 02904 USA » 401 239 1600 » info@BuildingES.com

1. OVERVIEW

A. The purpose of the Building Enclosure Commissioning Plan is to provide a clear and concise roadmap for the implementation of the building enclosure commissioning process and to provide a record of the results of the building enclosure commissioning process. Since the Building Enclosure Commissioning Plan contains the results of the process, it can be considered a living document where the results are added throughout the process.

B. To simplify the upkeep of the document, the basic process, and procedures to be followed throughout the project are detailed in the main body of the Building Enclosure Commissioning Plan. The materials and information that are developed during the building enclosure commissioning process are included in the Appendices.

2. REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. All Specification Sections pertaining to systems or components comprising the building enclosure are included in this Section by reference (Divisions 3 through 9).

C. Owner's Project Requirements (OPR) and Basis of Design (BOD) documentation are included for information only.

D. Refer to Specification Section 019119 Building Enclosure Commissioning Requirements for additional information.

3. SYSTEMS TO BE COMMISSIONED

A. The systems and materials to be commissioned are outlined in the table below. Systems and materials apply only as appropriate to the materials, components, and systems specified in each Building Enclosure Technical Section (Divisions 03-09). Enclosure systems listed do not include structural evaluations as is required for Special Inspections.

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TABLE 1 - SYSTEMS TO BE COMMISSIONED

System	BECx Field Observations	Remarks
Division 3 – Cast–In–Place – Concrete		
03 30 00 Cast in Place Concrete	Yes	Product Review: Inspect waterproofing and tie into air weather barrier.
Division 4 - Masonry		
04 20 00 - Unit Masonry	Yes	Product Review: General, Flashings, and Drainage
Division 6 – Wood, Plastics, and Composites		
06 16 00 - Sheathing	Yes	Product Review: General
Division 7 – Thermal and Moisture Protection		
07 16 13 – Polymer Modified Cement Waterproofing	Yes	Product Review: General. Field Review: General, Weather, Substrate
07 21 00 - Thermal Insulation	Yes	Product Review: General. Field Review: General
1- XPS (Rigid Extruded polystyrene board) at concrete slab	Yes	Product Review: General. Field Review: General
2- XPS (Rigid Extruded polystyrene board) at foundation wall	Yes	Product Review: General. Field Review: General
3- Rigid insulation at exterior masonry walls	Yes	Product Review: General. Field Review: General
4- Fiber-Glass blanket insulation	Yes	Product Review: General. Field Review: General
5- Foamed In-Place insulation	Yes	Product Review: General. Field Review: General
07 27 13 - Self-Adhering Sheet Air barriers (walls & openings)	Yes	Product Review: General. Field Review: General, Weather, Substrate, Interface. Field Testing: See Field Testing Table
07 42 13 - Metal Wall Panels	Yes	Product Review: General. Field Review: General
07 46 46 – Fiber Cement Siding	Yes	Product Review: General. Field Review: General
07 4800 – Cladding Support Systems	Yes	Product Review: General. Field Review: General
07 54 19 – Polyvinyl Chloride (PVC) Roofing	Yes	Product Review: General. Field Review: General, Substrate. Field Testing: See Field Testing Table. Final Roof Inspection (at completion) Specified in Part 3.6.A
07 62 00 - Sheet Metal Flashing and Trim	Yes	Product Review: General. Field Review: General, Continuity, End dams, AVB lapping.
077273 – Vegetated Roof Systems	Yes	Product Review: General. Field Review: General
07 92 00 - Joint Sealants	Yes	Product Review: General. Field Review: General, Substrate, Thickness, Weather, Continuity. Field Testing: See Field Testing Table.
07 95 13 Expansion Joint Cover Assemblies	Yes	Product Review: General.
Division 8 - Openings		
08 11 13 – Hollow Metal Doors & Frames	Yes	Product Review: General. Field Review: General.

08 43 13 - Aluminum-Framed Storefronts	Yes	Product Review: General. Field Review: General. Field Testing: See Field Testing Table
08 43 15 – Bullet Resistant Aluminum-Framed Storefronts	Yes	Product Review: General. Field Review: General. Field Testing: See Field Testing Table specified in Part 3.2
08 44 13 – Glazed Aluminum Curtain walls	Yes	Product Review: General. Field Review: General, AVB tie-in, Flashings. Field Testing: See Field Testing Table.
08 80 00 – Glazing	Yes	Product Review: General.
08 90 00 – Louvers & Vents	Yes	Product Review: General. Field Review: General, AVB tie-in, Flashings. Field Testing: See Field Testing Table.

4. COMMUNICATION AND DOCUMENT DISTRIBUTION

A. The following table outlines the submittal and distribution requirements for various documents used in the building enclosure commissioning process.

TABLE 2 - COMMUNICATIONS AND DOCUMENT DISTRIBUTION

Document	Prepared by	Submitted to	Copies to	Comments
Owner's Project Requirements	Owner	A/E, CA BECxP	Owner, GC, CxA	
Building Enclosure Commissioning Specification Section	BECxP	A/E, CA	Owner, GC, CxA	
Building Enclosure Commissioning Plan	BECxP	A/E, CA	Owner, CM/GC, CxA	
Schematic Design (SD) Document Review	BECxP	CA	A/E, Owner	Provide review comments on the SD documents related to the building enclosure for compliance with the Owner's Project Requirements for consideration by the Owner and A/E.
Design Development (DD) Document Review	BECxP	CA	A/E, Owner	Provide review comments on the DD documents related to the building enclosure for compliance with the Owner's Project Requirements for consideration by the Owner and A/E.
Construction Documents (CD) Review	BECxP	CA	A/E, Owner	Provide review comments on the constructiondocuments related to the building enclosure for compliance with the Owner's Project Requirements for consideration bythe Owner and A/E.
Enclosure Submittals and Shop Drawings	CM/GC	A/E, BECxP	CA, Owner	
Factory/Laboratory, Test Agency, and Inspection Reports	CM/GC	A/E, BECxP	CA, Owner	Periodic updates to the construction schedule to notify BECx team of scheduled tests, meetings, and milestone installation events.
Submittal and Shop Drawing Review Comments	BECxP	A/E	CM/GC, CxA	Provide review comments on submittals and shop drawings related to the building enclosure for consideration by the A/E.
Mock-Up Summary Report	BECxP	A/E, CM/GC	Owner, CxA	Attend the construction and testing of project-specific mock-ups and provide written summary reports.
Field Observation Reports	BECxP	A/E, CM/GC	Owner, CxA	Conduct periodic site visits to check the conformity of work with the OPR.
Daily Field Logs	CM/GC	A/E, BECxP		May be submitted to other parties if desired.
Construction Checklists	CM/GC	CM/GC, A/E		Construction checklists for building enclosure assemblies. These shall also be part of the CM/GC Daily Field Logs.

5. ROLES AND RESPONSIBILITIES

A. The following is a summary of the tasks assigned to each member of the Commissioning Team during the various project phases.

TABLE 3 - ROLES AND RESPONSIBILITIES

Project Phase	BECx Task	Description	Team Member	Responsibility
Design	Assist in the development or review of the Owner's Project Requirements (OPR)	Develop through Workshops and/or Review Owner's Project Requirement document relating to the building enclosure.	CxA	- Prepare and issue the Owner's Project Requirements based on the Owner/CA's input.
			BECxP	- Assist in the development and/or review and comment on the Owner's Project Requirements. Submit comments to the Owner and CxA.
			Owner/CA	- Review and comment on the Owner's Project Requirements. Submit comments to CxA.
			A/E	- Review for understanding project requirements. Prepare Design Narrative to describe design approach.
Design	Building Enclosure Commissioning Specification	Prepare Building Enclosure Commissioning Specification	CA/Owner CM/GC CxA	- Review, comment, and approve BECx specifications as part of project manual review.
			BECxP	- Prepare BECx Specifications Section.
			A/E	- Incorporate building enclosure commissioning specification into Project Manual.
Design	SD, DD, and Construction Documents Review	Peer review of SD, DD, and Construction Documents for compliance with the design intent and Owner's Project Requirements.	BECxP	- Review and provide comment on SD, DD, and CD's related to the building enclosure for compliance with the design intent and Owner's Project Requirements.
			CxA	- Review the design and identify design issues and/or conflicts that would present a problem for the total system commissioning.
			Owner, A/E, CM/GC	- Review, comment, and approve/disapprove BECxA review comments
Design	Building Enclosure Commissioning Plan	Develop a construction phase Building Enclosure Commissioning Plan to identify specific systems to be commissioned. The Building Enclosure Commissioning Plan will also include specific individual roles and responsibilities.	CA/Owner	- Review and approve Building Enclosure Commissioning Plan. - Provide comments to BECxP
			BECxP	- Prepare Building EnclosureCommissioning Plan. - Issue to Owner/CA and A/E. - Incorporate comments into BECx Plan revisions as necessary.

Preconstruction	Building Enclosure Commissioning Plan Review	Review the BECx Plan relative to CM/GC installing sub the contractor's roles and responsibilities	CM/GC	- Review building enclosure technical specifications, identify required BECx items and provide a schedule to the BECxP with anticipated dates foreach item. - Provide comments to BECxP.
Preconstruction	Submittal and Shop Drawing Review	Review product submittals and shop drawings for compliance with the design intent and Owner's Project Requirements.	CM/GC	- Provide submittals related to the building enclosure to the BECxP for their review, including shop drawings, product data, and factory/laboratory test reports.
			BECxP	- Review and provide comments on product submittals and shop drawings related to the building enclosure, for compliance with the design intent and Owner's Project Requirements. Provide comments to A/E for consideration in their review of the submittals.
			A/E	- Review, comment, and approve/disapprove BECxP review comments.
Preconstruction	Preconstruction Commissioning Conference Meeting	Conduct an initial commissioning meeting with the Owner, A/E, and Contractors. The purpose of the meeting will be to establish the purpose and proposed process for commissioning this facility in the construction, acceptance, and warranties phases of the project. Review the individual roles and responsibilities of each participating commissioning team member as specified in the construction documents.	CA/Owner	- Review building enclosure commissioning schedule data. - Coordinate with Contractors to incorporate building enclosure commissioning activities into the project schedule. - Attend pre-construction commissioning conference.
			BECxP	- Coordinate and Chair pre-construction commissioning conference. Review commissioning responsibilities and personnel assignments and discuss items of significance that could affect progress as required by the specifications. - Record and distribute meeting minutes.
			A/E	- Attend pre-construction commissioning conference.
			CM/GC	- Provide summary and schedule of laboratory and field quality control tests and inspections required by the Contract Documents to BECxP. - Incorporate building enclosure commissioning activities into Master Construction Schedule. - Attend pre-construction commissioning conference.

Preconstruction/ Construction	Mock-up Construction and Testing	Project-specific mock-up construction and testing.	CM/GC	- Participate in pre-construction mock-up coordination meetings. - Coordinate with BECxP pre-construction testing and submit laboratory quality control and inspection reports on building enclosure construction to the BECxP.
			BECxP	- Participate in project-specific mock-ups and outline the commissioning process and performance test procedures. - Attend the construction and testing of the mock-up to observe progress. - Provide written summary report.
			CA/Owner and A/E	- Participate in pre-construction mock-up coordination meetings. - Attend the construction and testing of the mock-up to observe progress at their discretion.
Preconstruction/ Construction	Construction Checklists	Review checklists for systems, components, and/or building enclosure materials to be commissioned. These checklists will be used for quality control and to document the completion of the system, component, and material installation. Completed checklists are to be submitted to the building enclosure commissioning agent and A/E.	BECxP	- Review checklists.
			CM/GC	- Prepare checklists. - Maintain checklists for building enclosure activities. - Issue to BECxP and A/E for review. - Incorporate changes into final checklists as necessary.
			A/E	- Review checklists. - Provide comments to CM/GC.
Construction	Building Enclosure System and Component Testing	Performance testing of installed building enclosure systems, components, and materials will be completed as specified in the building enclosure commissioning specifications and project technical specification sections (Divisions 04 through 08). The objective of performance testing is to demonstrate that each building enclosure system, and system-to-system interfaces meet or exceed the performance requirements of the contract documents and the building enclosure design intent.	CA/Owner A/E	- Participate in field testing coordination meetings. - Attend field testing to observe progress at their discretion.
			BECxP	- Participate in field testing coordination meetings. - Perform periodic site visits to document that work is being performed in compliance with the project specifications. - Outline the commissioning process and performance test procedures. - Witness and document building enclosure field testing.

			CM/GC	- Participate in field testing coordination meetings. - Coordinate with the BECxP construction testing and submit field quality control testing, field checklists, and inspection reports on building enclosure construction to BECxP. - Perform out-of-sequence work as required to facilitate field tests.
			BECxT	- Perform BECx testing. - Cooperate with the BECxP. - Submit reports to CM/GC.
Construction	Field Observations (Construction Checklists, Issues and Resolutions Log)	Conduct periodic visits to the construction site to observe construction activities related to building enclosure components and systems general conformance with the contract documents, building enclosure design intent, and the manufacturer's installation requirements.	CA/Owner	- Review field reports and provide responses as needed.
			BECxP	- Conduct periodic Field Observation visits to observe construction progress, system/component installation, and general quality of construction. - Identify Action Items that require a response, completion, corrective action, or additional work related to the building enclosure construction. - Assign Action Items to the proper party for remedial action. - Maintain and update the Action List log that includes all action items related to BECx activities, including a summary of the description of each action item, date, responsible party, date, and summary of corrective action. - Monitor and verify corrective actions.
			A/E	- Review the actions list and respond to items as needed.
Construction	Building Enclosure Commissioning Meetings	Routine meetings to review progress, status, and resolve items on the Issues and Resolutions Log. Meetings should be conducted no less than every two weeks during the construction of the building enclosure.	CM/GC	- Coordinate and Chair construction-phase coordination meetings. - Issue periodic updates to the construction schedule. The schedule shall be used to notify the BECx team of scheduled tests and milestone installation events. - Maintain at the site an updated set of records or “As-Built” documents reflecting actual installed conditions and all approved changes and modifications to the contract documents.
			CA/Owner	- Attend Building Enclosure Commissioning Meetings. - Provide final interpretive authority on disputed deficiencies.
			BECxP	- Attend building enclosure commissioning meetings. - Review Issues and Resolutions Log and resolve issues affecting the building enclosure. - Maintain and update the Issues and Resolutions Log.

			A/E	- Attend building enclosure commissioning meetings. - Provide resolution to items for which the BECxP and Contractor may be in disagreement.
			CM/GC	- Conduct routine meetings to include building enclosure commissioning.
Construction	Building Enclosure Commissioning Report	Compile a comprehensive commissioning report documenting all building enclosure commissioning activities	BECxP	- Provide all data outlined in the Specification Section 019119, 1.4.J, and 2.4.
			CxA	- Incorporate items provided by the BECxP into the Commissioning Report.
			CM/GC	- Provide to the BECxP all documents described under Section 019119, 1.4.J, and 2.4. Ensure that the latest, approved versions and all prior versions of all required documents, if not submitted prior, are submitted to the BECxP for inclusion in the BECx Report.

SEE NEXT PAGE

6. COMMISSIONING SCHEDULE

A. The following is a general outline of the Building Enclosure Commissioning Schedule for the commissioning tasks that will be performed on the project site or at the BECx Agent's offices.

TABLE 4 - COMMISSIONING SCHEDULE

Project Phase	Task	Duration	Schedule	Precursory
Design	Review OPR	Project Initiation	Developed by the CxA with input from the CA/Owner.	
Design	Building Enclosure Commissioning Specifications	2 Weeks	Building Enclosure Commissioning Specifications are to be issued concurrently with Commissioning Specifications and CD Specifications.	Receive drawings and specifications.
Design	BECx Plan	1 Week	Building Enclosure Commissioning Plan issued concurrently with BECx Plan and CD documents.	Receive drawings and specifications.
Design	DD Document Review	2 Week	Concurrent with DD Design review	Receive DD drawings and specifications.
Design	CD Document Review	2 Week	Concurrent with CD Design review	Receive CD drawings and specifications.
Construction	Submittals and Shop Drawing Review	2 Week	Concurrent with BECxP and A/E review	Receive submittals and shop drawings.
Construction	Review of Construction Checklists	TBD	Scheduled by BECxP	Approval of product submittals and shop drawings.
Construction	Building Enclosure Pre- Construction Commissioning Conference	1 day	Scheduled by CA/Owner and BECxP	None
Construction	Mock-up Construction and Testing	TBD	Scheduled by CA/Owner, BECxP, and CM/GC	Approval of product submittals and shop drawings.
Construction	Field Observation	TBD	Construction observations are scheduled concurrently with the installation of the building enclosure with more frequent visits being scheduled during milestone installations.	None
Construction	Building Enclosure System and Component Field Testing	TBD	Scheduled by Owner, CM, and BECxP	Building enclosure system and component installation commencement.
Construction	Building Enclosure Commissioning Meetings	TBD	Concurrent with buildings enclosure construction - meetings to be held no less than every two weeks.	Building Enclosure system and component installation commencement.
Post- Construction	Building Enclosure Commissioning Report	TBD	Issued after completion of field testing and construction of the building enclosure.	Building Enclosure system and component construction and field testing.
Post-Construction	Post Occupancy Site Visit	1 Day	Prior to the completion of the contractor's warranty period	Project Completion

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7. TESTING MATRIX

A. Testing Matrix below is maintained as its own document for ease of access during the construction process. The Testing Matrix will be added as Table 5 in the final submission of the Commissioning Plan in the BECx Final Report Package.

Table 5 – Field Testing Matrix

Specification Section	Field Verification Testing				
	Field Verification Testing Method	**Intervals**	**Notes**	**Responsible party** C = Contractor O=Owner	**Status**
07 21 00 – Thermal Insulation	N/A	N/A	None Specified or Recommended	N/A	
07 27 13 – Self-Adhering Sheet Air Barriers	ASTM D6862 Modified per BOD manufacturer (Carlisle Waterproofing)	One test per 600 SQFT – ABAA QAP	Specified in Section 014529, Part 1.10.B.5.b	C	
	ASTM E 1186 (Bubble Gun)	At mock up – Specific to anchors/girts	Specified in Section 014529, Part 1.10.B.5.a	O	
07 42 13 – Metal Wall Panels	N/A	N/A	None Specified or Recommended	N/A	
07 46 46 – Mineral Fiber Cement Siding	N/A	N/A	None Specified or Recommended	N/A	
07 54 19 – Polyvinyl Chloride (PVC) Roofing	Infrared Thermal Scan	At project completion	Specified in Part 3.14.B.3	O - CXA	
	Heat Welded Seam Testing	Each machine used, 3 test cuts per day	Specified in Part 3.14 D.1	C	
	Roof Drain Testing	3 randomly selected drains	Specified in Part 3.14 .E	C	
07 62 00 – Sheet Metal Flashing and Trim	N/A	N/A	None Specified or Recommended	N/A	
07 92 00 – Joint Sealants	ASTM C1193 (Adhesion Test)	Per ASTM C1521		C	

Specification Section	Field Verification Testing				
	Field Verification Testing Method	Intervals	Notes	Responsible party C = Contractor O=Owner	Status
07 95 13 – Expansion Joint Cover Assemblies	N/A	N/A	None Specified or Recommended	N/A	
08 11 13 – Hollow Metal Doors & Frames	N/A	N/A	None Specified or Recommended	N/A	
08 43 13 – Aluminum-framed storefronts	AAMA 501.2	3 mobilizations – 10%, 50%, and 90% completion		C	
	ASTM E783 (Air Leakage Quantification)	3 mobilizations – 10%, 50%, and 90% completion	Specified in Section 014529, Part 1.10.B.10	O	
	ASTM E1105	3 mobilizations – 10%, 50%, and 90% completion	Specified in Section 014529, Part 1.10.B.10	O	
08 44 13 – Glazed Aluminum Curtain Walls	AAMA 501.2	3 mobilizations – 10%, 50%, and 90% completion		O	
	ASTM E783 (Air Leakage Quantification)	3 mobilizations – 10%, 50%, and 90% completion	Specified in Section 014529, Part 1.10.B.13	O	
	ASTM E1105	3 mobilizations – 10%, 50%, and 90% completion	Specified in Section 014529, Part 1.10.B.13	O	
08 90 00 – Louvers & Vents	N/A	N/A	None Specified or Recommended	N/A	

SEE NEXT PAGE

8. COMMISSIONG TEAM

A. The following table includes the contact information for the Commissioning Team members at the time of drafting the Commissioning Plan. Advise the BECxP of any necessary changes.

TABLE 6 - COMMISSIONING TEAM

Team Member	Person	Company	E-mail
Owner	City Clerk Jahaira Rodriguez	City of Central Falls / Central Falls School District	
General Contractor	TBD	TBD	TBD
Commissioning Authority (CxA)	TBD	TBD	TBD
Mechanical Commissioning Agent	Jhony Burton-Williams	Stephen Turner, Inc.	jonny@sturnerinc.com
Building Enclosure Commissioning Provider (BECxp)	Craig Andrade	Building Enclosure Science (BES)	candrade@BuildingES.com
Architectural Firm		Ai3 Architects, LLC	
MEP Engineer		Griffith & Vary, Inc.	

APPENDIX D

HAZARDOUS MATERIALS VISUAL INSPECTION AND SAMPLING

DO NOT REMOVE
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UEC universal environmental consultants

April 20, 2023

Ms. Kristen Kendall
Associate
Ai3 Architects LLC
526 Boston Post Road
Wayland, MA 01778

Reference: **Hazardous Materials Visual Inspection and Sampling**
Central Falls High School (International Meat Market and High School Concession Stand)

Dear Ms. Kendall:

Thank you for the opportunity for Universal Environmental Consultants (UEC) to provide professional services.

UEC Rhode Island licensed asbestos inspector performed a visual inspection of the International Meet Market (IMM) and inspection, and sampling of the High School Concession Stand), Central Falls, RI.

Visual inspection of the IMM was performed and various types of materials suspected to contain asbestos was found. The estimated cost to remove the suspect material would be $65,000.00.

Inspection and bulk samples were performed of the High School Concession Stand. All sampled materials were found not to contain asbestos.

Attached are the bulk samples collected for reference.

Please do not hesitate to call me at (508) 628-5486 if you have questions.

Very truly yours,

Universal Environmental Consultants

Ammar M. Dieb
President

UEC:\223 221.00\Summary Letter.DOC

Enclosure

Asbestos Identification Laboratory.

165 New Boston St., Ste 227
Woburn, MA 01801
781-932-9600

Web: www.asbestosidentificationlab.com Email: mikemanning@asbestosidentificationlab.com

NVLAP® Testing Lab Code: 200919-0

Batch: 95588

Ammar Dieb
Universal Environmental Consultants
12 Brewster Road
Framingham, MA 01702

Project Information
Field House
Corrigan Sports Complex

Method: BULK PLM ANALYSIS, EPA/600/R-93/116

Dear Ammar Dieb,

Asbestos Identification Laboratory has completed the analysis of the samples from your office for the above referenced project. The Analysis Method is BULK PLM ANALYSIS, EPA/600/R-93/116The information and analysis contained in this report have been generated using the EPA /600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials. Materials or products that contain more than 1% of any kind or combination of asbestos are considered an asbestos containing building material as determined by the EPA. This Polarized Light Microscope (PLM) technique may be performed either by visual estimation or point counting. Point counting provides a determination of the area percentage of asbestos in a sample. If the asbestos is estimated to be less than 10% by visual estimation of friable material, the determination may be repeated using the point counting technique. The results of the point counting supersede visual PLM results. Results in this report only relate to the items tested. This report may not be used by the customer to claim product endorsement by NVLAP or any other U.S. Government Agency.
Laboratory results represent the analysis of samples as submitted by the customer. Information regarding sample location, description, area, volume, etc., was provided by the customer. Asbestos Identification Laboratory is not responsible for sample collection activities or analytical method limitations. Unless notified in writing to return samples, Asbestos Identification Laboratory discards customer samples after 30 days. Samples containing subsamples or layers will be analyzed separately when applicable. Reports are kept at Asbestos Identification Laboratory for three years. This report shall not be reproduced, except in full, without the written consent of Asbestos Identification Laboratory.

- NVLAP Lab Code: 200919-0
- Massachusetts Certification License: AA000208
- State of Connecticut, Department of Public Health Approved Environmental Laboratory Registration Number: PH-0142
- State of Maine, Department of Environmental Protection Asbestos Analytical Laboratory License Number: LB-0078(Bulk) LA-0087(Air)
- State of Rhode Island and Providence Plantations. Department of Health Certification: AAL-121
- State of Vermont, Department of Health Environmental Health License AL934461

Thank you Ammar Dieb for your business.

Michael Manning
Owner/Director

Ammar Dieb
Universal Environmental Consultants
12 Brewster Road
Framingham, MA 01702

Project Information
Field House
Corrigan Sports Complex

Method: BULK PLM ANALYSIS, EPA/600/R-93/116

FieldID / LabID	Material	Location	Color	Non-Asbestos %	Asbestos %
1 / 1048830	Fiber Board	Between Cement Floor & CMU Wall - Storage Room	brown	Cellulose 95 Non-Fibrous 5	None Detected
2 / 1048831	Fiber Board	Between Cement Floor & CMU Wall, Storage Room	brown	Cellulose 95 Non-Fibrous 5	None Detected
3 / 1048832	Insulation	In Metal Door, Exterior Bathroom - 1	brown	Cellulose 95 Non-Fibrous 5	None Detected
4 / 1048833	Insulationi	In Metal Door, Exterior Bathroom - 2	brown	Cellulose 95 Non-Fibrous 5	None Detected
5 / 1048834	Finish on CMU	Exterior Random	multi	Non-Fibrous 100	None Detected
6 / 1048835	Finish on CMU	Exterior Random	multi	Non-Fibrous 100	None Detected
7 / 1048836	Finish on CMU	Exterior Random	multi	Non-Fibrous 100	None Detected
8 / 1048837	Adhesive @ Roof Shingle	Exterior	black	Non-Fibrous 100	None Detected
9 / 1048838	Underlayment #8	Exterior	black	Cellulose 70 Non-Fibrous 30	None Detected
10 / 1048839	Adhesive @ Roof Shingle	Exterior	black	Non-Fibrous 100	None Detected
11 / 1048840	Underlayment #10	Exterior	black	Cellulose 70 Non-Fibrous 30	None Detected

Sampled: April 03, 2023 **Received:** April 03, 2023 **Analyzed:** April 03, 2023

Tuesday 04 April 2023

Analyzed by: **Batch:** 95588

CHAIN OF CUSTODY

Universal Environmental Consultants
12 Brewster Road
Framingham, MA 01702
Tel: (508) 628-5486 - Fax: (508) 628-5488
adieb@uec-env.com

Corrigan Sports Complex

Town/City: Central Falls, RI Building Name Field House

Sample	Description of Material	Sample Location	
1	fiberboard betwix cem flr	conc wall	storage rm
2	FB bd betwix cem flr	conc wall	storage rm
3	insulation in metal door	Exterior	bathrm-1
4	insul. in metal door		bathrm-2
5	Finish on conc		random
6	Finish on conc		random
7	Finish on conc		random
8	adhesive & roof shingle		
9	underlayment #8		
10	adh & roof shingle		
11	underlayment #10		

Reported By: [signature] Date: 4-3-23 Due Date: **24-Hours**

Received By: [signature] Date: 4/3/23

EMSL Analytical, Inc.

5 Constitution Way, Unit A Woburn, MA 01801

Tel/Fax: (781) 933-8411 / (781) 933-8412

http://www.EMSL.com / bostonlab@emsl.com

EMSL Order:	132306117
Customer ID:	UEC63
Customer PO:	
Project ID:	

Attention:	Ammar Dieb	**Phone:**	(617) 984-9772
	Universal Environmental Consultants	**Fax:**	(508) 628-5488
	12 Brewster Road	**Received Date:**	09/21/2023 2:00 PM
	Framingham, MA 01702	**Analysis Date:**	09/22/2023
		Collected Date:	
Project:	Carnicaria International Meat Market		

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
01 *132306117-0001*	Gypsum Ceiling Tile	Tan/White Fibrous Homogeneous	13% Cellulose <1% Glass	87% Non-fibrous (Other)	None Detected
02 *132306117-0002*	Gypsum Ceiling Tile	Tan/White Fibrous Homogeneous	13% Cellulose <1% Glass	87% Non-fibrous (Other)	None Detected
03 *132306117-0003*	Gypsum Ceiling Tile	Tan/White Fibrous Homogeneous	5% Cellulose <1% Glass	95% Non-fibrous (Other)	None Detected
04 *132306117-0004*	Gypsum Ceiling Tile	Tan/White Fibrous Homogeneous	10% Cellulose <1% Glass	90% Non-fibrous (Other)	None Detected
05 *132306117-0005*	Cove Base (Black)	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
06 *132306117-0006*	Cove Base (Black)	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
07 *132306117-0007*	Joint Compound	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
08 *132306117-0008*	Joint Compound	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
09 *132306117-0009*	Joint Compound	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
10 *132306117-0010*	Gypsum Walls	Tan/White Fibrous Homogeneous	13% Cellulose <1% Glass	87% Non-fibrous (Other)	None Detected
11 *132306117-0011*	Gypsum Walls	Tan/White Fibrous Homogeneous	12% Cellulose <1% Glass	88% Non-fibrous (Other)	None Detected
12 *132306117-0012*	Gypsum Walls	Tan/White Fibrous Homogeneous	12% Cellulose <1% Glass	88% Non-fibrous (Other)	None Detected
13 *132306117-0013*	2x2 Ceiling Tile	Gray/White Fibrous Homogeneous	65% Cellulose 10% Min. Wool	25% Non-fibrous (Other)	None Detected
14 *132306117-0014*	2x2 Ceiling Tile	Gray/White Fibrous Homogeneous	65% Cellulose 10% Min. Wool	25% Non-fibrous (Other)	None Detected
15 *132306117-0015*	Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
16 *132306117-0016*	Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 09/22/2023 07:00:58

EMSL Analytical, Inc.
5 Constitution Way, Unit A Woburn, MA 01801
Tel/Fax: (781) 933-8411 / (781) 933-8412
http://www.EMSL.com / bostonlab@emsl.com

EMSL Order:	132306117
Customer ID:	UEC63
Customer PO:	
Project ID:	

Analyst(s)
Ramon Buenaventura (16)

Steve Grise, Laboratory Manager
or Other Approved Signatory

Initial report from: 09/22/2023 07:00:58

OrderID: 132306117

Asbestos Chain of Custody (Air, Bulk, Soil)

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

EMSL Order Number / Lab Use Only

132306117

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information		Billing Information	
Customer ID:		Billing ID:	
Company Name:	Universal Environmental Consultants	Company Name:	
Contact Name:	Ammar Dieb	Billing Contact:	
Street Address:		Street Address:	
City, State, Zip:	12 Brewster Rd	City, State, Zip:	
Country:		Country:	
Phone:		Phone:	
Email(s) for Report:		Email(s) for Invoice:	

Project Information

Project Name/No: Carnicaria International Meat Market

Purchase Order:

EMSL LIMS Project ID: (If applicable, EMSL will provide)

US State where samples collected: RI

State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)

Sampled By Name: GB

Sampled By Signature:

No. of Samples in Shipment

Turn-Around-Time (TAT)

☐ 3 Hour ☐ 4-4.5 Hour AHERA ONLY ☒ 6 Hour ☐ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week

TEM Air 3-6 Hour, please call ahead to schedule. 32 Hour TAT available for select tests only; samples must be submitted by 11:30 am.

Test Selection

PCM Air
- ☐ NIOSH 7400
- ☐ NIOSH 7400 w/ 8hr. TWA

PLM - Bulk (reporting limit)
- ☐ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)
- ☐ POINT COUNT
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- POINT COUNT w/ GRAVIMETRIC
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- ☐ NIOSH 9002 (<1%)
- ☐ NYS 198.1 (Friable - NY)
- ☐ NYS 198.6 NOB (Non-Friable - NY)
- ☐ NYS 198.8 (Vermiculite SM-V)

TEM - Air
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312*

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (Non-Friable-NY)
- ☐ TEM EPA 600/R-93/116 w Milling Prep (0.1%)

Other Test (please specify)

TEM - Settled Dust
- ☐ Microvac - ASTM D5755
- ☐ Wipe - ASTM D6480
- ☐ Qualitative via Filtration Prep
- ☐ Qualitative via Drop Mount Prep

Soil - Rock - Vermiculite (reporting limit)*
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.25%)
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM Qualitative via Filtration Prep
- ☐ TEM Qualitative via Drop Mount Prep

*Please call with your project-specific requirements.

☐ Positive Stop - Clearly Identified Homogeneous Areas (HA) | Filter Pore Size (Air Samples) ☐ 0.8um ☐ 0.45um

Sample Number	Sample Location / Description	Volume, Area or Homogeneous Area	Date / Time Sampled (Air Monitoring Only)
01	Gypsum ceiling tile	2,900 FT²	
02	"	Throughout	
03	"		
04	"		
05	~~Blank compound~~ Cove base (black)	~150 L.F.	
06	Cove base (black)	back rm and hallway	
07	Joint compound	Undetermined	
08-09	"		

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

SM 1400

REC'D EMSL-BOSTON SEP 21 2023

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:

Controlled Document - COC-05 Asbestos R16 10/26/2021

☐ **AGREE TO ELECTRONIC SIGNATURE** (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

OrderID: 132306117

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

Asbestos Chain of Custody (Air, Bulk, Soil)

EMSL Order Number / Lab Use Only

132306117

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Sample Number	Sample Location / Description	Volume, Area or Homogeneous Area	Date / Time Sampled (Air Monitoring Only)
10	Gypsum walls	Undetermined	
11	"	"	
12	"	"	
13	2×2 Ceiling tile	~120 FT²	
14	"	bathroom hallway	
15	Caulking	~26 l.F.	
16	"	Front door	

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by:	Date/Time:	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

RECD EMSL-BOSTON SEP 21 2023

Controlled Document - COC-05 Asbestos R16 10/26/2021

☐ AGREE TO ELECTRONIC SIGNATURE (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

APPENDIX E

GEOTECHNICAL REPORT

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LGCI
Lahlaf Geotechnical Consulting, Inc.

August 4, 2023

James S. Jordan AIA, LEED AP BD+C
Ai3 Architects LLC
526 Boston Post Road
Wayland, MA 01778
Phone: (508) 358-0790
Fax: (508) 358-0791
E-mail: jordan@ai3architects.com

Re: **Geotechnical Report**
Proposed Central Falls High School
Central Falls, Rhode Island
LGCI Project No. 2232-Rev. 1

Dear Mr. Jordan:

Lahlaf Geotechnical Consulting, Inc. (LGCI) has completed additional subsurface explorations for the proposed Central Falls High School in Central Falls, Rhode Island. The attached geotechnical report contains the results of our subsurface explorations, including a summary of the subsurface conditions encountered in the preliminary borings, and our foundation design and construction recommendations.

The soil samples from our explorations are currently stored at LGCI for further analysis, if requested. Unless notified otherwise, we will dispose of the soil samples after three (3) months.

Thank you for choosing LGCI as your geotechnical engineer.

Very truly yours,

Lahlaf Geotechnical Consulting, Inc.

Abdelmadjid M. Lahlaf, Ph.D., P.E.
Principal Engineer

LGCI
Lahlaf Geotechnical Consulting, Inc.

GEOTECHNICAL REPORT
PROPOSED CENTRAL FALLS HIGH SCHOOL
CENTRAL FALLS, RHODE ISLAND

LGCI Project No. 2232-Rev.1
August 4, 2023

Prepared for:

AI3 ARCHITECTS LLC
526 Boston Post Road
Wayland, MA 01778
Phone: (508) 358-0790
Fax: (508) 358-0791

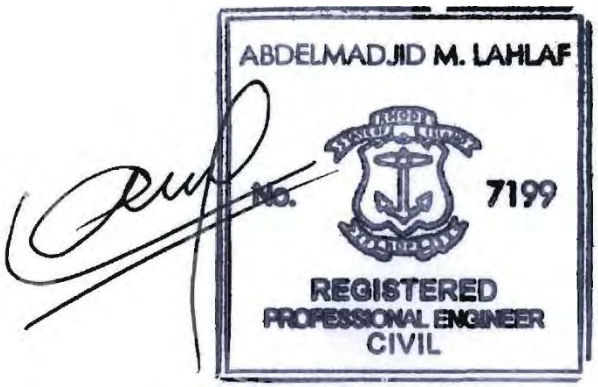
GEOTECHNICAL REPORT
PROPOSED CENTRAL FALLS HIGH SCHOOL
CENTRAL FALLS, RHODE ISLAND
LGCI Project No. 2232-Rev. 1
August 4, 2023

Prepared for:

AI3 ARCHITECTS LLC
526 Boston Post Road
Wayland, MA 01778
Phone: (508) 358-0790
Fax: (508) 358-0791

Prepared by:

LAHLAF GEOTECHNICAL CONSULTING, INC.
100 Chelmsford Road, Suite 2
Billerica, Massachusetts 01862
Phone: (978) 330-5912
Fax: (978) 330-5056



Abdelmadjid M. Lahlaf, Ph.D., P.E.
Principal Engineer

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1. PROJECT INFORMATION

1.1 Project Authorization

This geotechnical report presents the results of our subsurface explorations and a geotechnical evaluation performed by Lahlaf Geotechnical Consulting, Inc. (LGCI) for the proposed Central Falls High School in Central Falls, Rhode Island. We performed our services in two (2) phases as follows.

We performed our preliminary services in general accordance with the scope described in our proposal No. 22068-Rev. 1 dated May 27, 2022, revised on June 20, 2022. Our preliminary services were authorized by Mr. James S. Jordan of Ai3 Architects LLC (Ai3) by signing our proposal on June 28, 2022.

We performed our Design Development (DD) phase services in general accordance with the scope described in our proposal No. 22110 dated September 13, 2022. Our DD phase services were authorized by Mr. James S. Jordan of Ai3 by signing our proposal on November 16, 2022.

1.2 Purpose and Scope of Services

The purpose of our geotechnical services was to perform additional subsurface explorations at the site of the proposed Central Falls High School and to provide foundation design and construction recommendations. LGCI performed the following services:

- Coordinated our exploration locations with Ai3, marked the exploration locations at the site, and contacted Dig Safe Systems, Inc. (Dig Safe) and the City of Central Falls to clear the exploration locations for utilities.

- Engaged a drilling subcontractor during the preliminary exploration phase to advance two (2) soil borings at the site. To help with the utility clearance, our drilling subcontractor used vacuum explorations with an air knife in the top four (4) to six (6) feet of soil prior to drilling. Our drilling subcontractor applied for and obtained a street opening permit from the City of Central Falls prior to the start of the borings. Our drilling subcontractor also installed a groundwater observation well in one (1) of the borings during the preliminary phase.

- Engaged a drilling subcontractor during the DD exploration phase to advance an additional seven (7) soil borings and four (4) soil probes at the site. Our drilling subcontractor obtained four (4) undisturbed tube samples in the borings during the DD phase. Our drilling subcontractor also installed a groundwater observation well in one (1) of the borings during the DD phase.

- Engaged a geophysical company to perform a geophysical survey including measuring the shear wave velocity of soils in the top 100 feet using a multi-channel analysis of surface waves (MASW), and estimation of depth to bedrock.

- Engaged a cone penetrometer subcontractor to perform seismic Cone Penetrometer Tests (CPTs) at the site.

- Provided an LGCI geotechnical field representative at the site to coordinate and observe the explorations, describe the soil samples, and prepare field logs.

- Submitted twenty-two (22) soil samples collected from the explorations to LGCI's laboratory for grain-size analyses, including ten (10) soil samples collected from the preliminary phase explorations and twelve (12) soil samples collected from the DD phase explorations.

- Submitted two (2) undisturbed tube samples to a laboratory for shear strength and consolidation tests.

- Prepared this geotechnical report containing the results of our subsurface explorations and our foundation recommendations.

LGCI's scope of services does not include an environmental assessment for the presence or absence of wetlands or analytical testing for hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site, or mold in the soil or in any structure at the site. Any statements regarding odors, colors, or unusual or suspicious items or conditions are strictly for the information of the client.

Following our preliminary phase explorations and our DD explorations, LGCI submitted a preliminary geotechnical data report dated August 22, 2022, and a preliminary geotechnical report dated February 7, 2023. This geotechnical report includes the results of our geotechnical data report and our preliminary geotechnical report, and supersedes them.

LGCI's scope of services also includes attending meetings, preparing specifications, reviewing drawings, and providing construction services. These services will be performed separately and are not included in this geotechnical report. Recommendations for stormwater management, erosion control, slope stability analyses, pavement design, and detailed cost or quantity estimates are not included in our scope of work.

1.3 Site Description

Our understanding of the site is based on our field observations, our discussions with Ai3, and on the following drawings:

- Drawing L1.1 titled: "Central Falls High School Basemap," (Basemap) prepared by Traverse Landscape Architects of Providence, Rhode Island, undated, and provided to LGCI by Ai3 via e-mail on July 6, 2022.

- Drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," (Existing Conditions Plan) prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 via e-mail on July 28, 2022.

- Drawing C1.0: "Existing Conditions and Demolition Plan, Central Fills High School," submitted as part of the 60 percent Construction Documents (Existing/Demo Plan), prepared by the Vertex Companies, LLC, dated June 28, 2023, and provided to LGCI by Ai3 via e-mail on July 28, 2023.

The site is the Francis L. Corrigan Sports Complex located at 12 Higginson Avenue in Central Falls, Rhode Island as well as the International Meat Market located at 756 Lonsdale Avenue as shown in Figure 1. Based on the Basemap, the site is bordered by Higginson Avenue on the northern side; by Crow Point Road and Moshassuck Highway on the western side; by Brook Street, Oakland Street, Bristol Street, and private properties on the eastern side; and by a pond on the southern side.

The site consists of a football/track field, a baseball field, a soccer field, basketball courts, and two (2) small, paved parking lots near Higginson Avenue and Moshassuck Highway (one each). The eastern portion of the site includes the existing International Meat Market building and its associated small parking lots to the north and south of the existing building.

Based on the Existing Conditions Plan, the existing grades range between about El. 51 feet and El. 55 feet in the existing parking lot on the Higginson Avenue side, between El. 55 feet and El. 58 feet in the basketball courts, and between El. 52 feet and El. 53 feet in the baseball field and the football/track field. The existing grades within the parking lot north of the existing International Meat Market building range between El. 58 feet and El. 62.5 feet. The Existing Conditions Plan does not include grading information for the soccer field, the existing parking lot on the Moshassuck Highway side, and the existing parking lot south of the International Meat Market building.

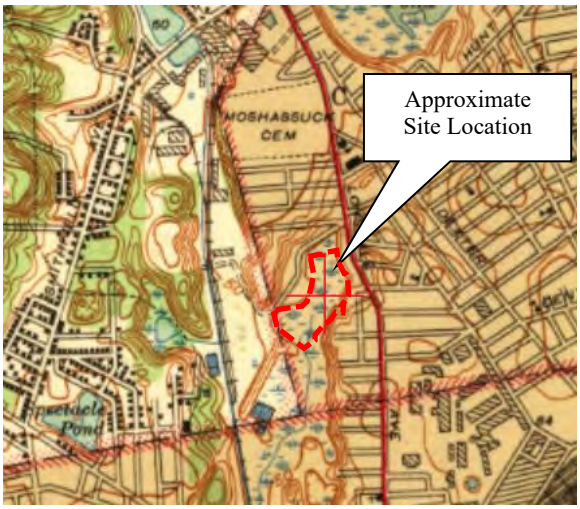
Moshassuck River extends in a north-south direction west of the site. Also, an unnamed pond is located to the south. Based on historic topographic maps (described in Section 1.4 below), the pond appears to be part of a former tributary of the Moshassuck River that was partially filled.

Based on the Existing Conditions Plan, a 20-foot sewer easement extends in the north south direction across the site and crosses the Higginson Avenue parking lot at an angle. The easement passes just west of the existing tennis courts. Based on the Exiting/Demo Plan, two twin-48-inch combined sewer pipes are located within the easement.

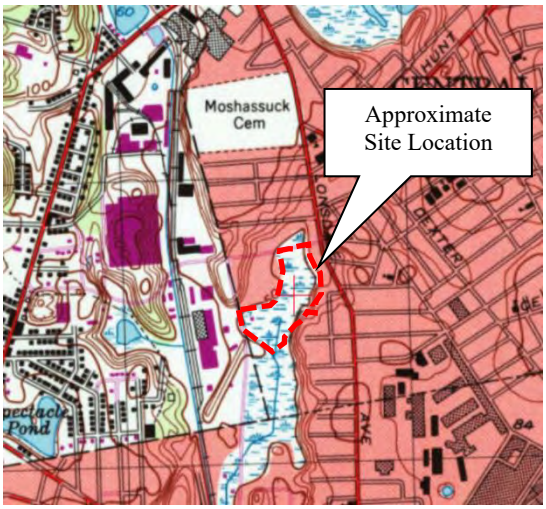
1.4 Historic Topographic Maps

Based on our review of historic topographic maps of the site from 1938 and 1998, shown below, and the current topographic map of the site shown in Figure 1, it appears that the site was connected to the unnamed pond located south of the existing fields at least until 1998. It appears that the site was subsequently filled to create the existing fields.

Based on the historic topographic maps, the top of the former pond was at El. 50 feet, i.e., close to the existing grades. The El. 50 feet contour line appears to extend along the limits of the existing sports complex, suggesting that the fill was the thickest near the center of the field.



1938 Topographic Map



1998 Topographic Map

1.5 Project Description and Background

Our understanding of the project is based on our discussions with you and on the following drawings:

- Drawing titled: "Proposed Sample Location Plan, 10 Higginson Avenue, Central Falls, Rhode Island," (Sample Location Plan) prepared JPL, dated October 30, 2021, and provided to LGCI by Ai3 via e-mail on May 17, 2022.

- Document titled: "Stage III Project Description & Boring Map LGCI," prepared by Ai3, undated, and provided to LGCI by Ai3 via e-mail on August 22, 2022.

- Drawings A1.10 to A1.50 titled: "Overall First Floor Plan to Overall Roof Plan, Schematic Design, Central Falls High School, 24 Summer St., Central Falls, RI," (Architectural Drawings) prepared by Ai3, dated February 3, 2023, and provided to LGCI by Ai3 via e-mail on January 16, 2023.

- Drawing C3.0 titles: "Grading Plan, Central Fills High School," submitted as part of the 60 percent Construction Documents (Grading Plan), prepared by the Vertex Companies, LLC, dated June 28, 2023, and provided to LGCI by Ai3 via e-mail on July 28, 2023.

We understand that Ai3 was engaged by the City of Central Falls to design a new high school at the site. Based on the Sample Location Plan, the initially proposed building was to have an inverted U-shape with a footprint of about 112,000 square feet (sq. ft.).

The Sample Location Plan shows the initially proposed building near the northern side of the site, i.e., overlapping with the existing parking lot on the Higginson Avenue side, the basketball courts, and the baseball field. Subsurface explorations previously performed by others and described in Section 2.2 below, indicated deep existing fill and organic soil within the proposed building

footprint; thus, requiring costly deep foundations. The previous explorations suggested that the existing fill and organic soil may be thinner near the eastern side of the site.

In an attempt to explore the subsurface conditions near the eastern side of the site in the hope of confirming that the deep existing fill and the organic soil are thinner there, the City of Central Falls authorized Ai3 to engage LGCI to explore the subsurface conditions on Lonsdale Avenue in July of 2022. Our explorations on Lonsdale Avenue indicated relatively shallow existing fill and no organic soil as described in Section 2.3 below.

We understand that since our July 2022 explorations, the City of Central Falls has acquired the properties on the eastern side of the site (along Lonsdale Avenue) and that the proposed high school building will now be located near the corner of Lonsdale Avenue and Higginson Avenue and will partially overlap with the private properties along Lonsdale Avenue.

Based on the Architectural Drawings, we understand that the proposed high school building will have an inverted L-shape and will have two wings: an eastern wing extending parallel to Lonsdale Avenue and a northern wing extending parallel to Higginson Avenue as shown below.

Sketch based on e-mail sent to LGCI by Ai3 on August 23, 2022

We understand that the proposed high school building will have a footprint of about 42,000 sq. ft. and will be four (4) stories high. We understand that the proposed high school building will not have a basement. We understand that the first finished floor elevation (FFE) of the proposed building will be at El. 64.25 feet; thus, requiring fills of up to 13 feet to achieve the proposed FFE.

Based on the Grading Plan, site retaining wall will be provided on the southern and western sides of the proposed building. Based on the Grading Plan, the proposed site retaining walls will be located about 10 feet from the proposed building and will have exposed heights that will range up to 6 feet. These walls will separate the proposed building from the driveway loop located at a slightly lower elevation on the southwestern side of the proposed building. The driveway loop

will have finished grades ranging between El. 55 feet and El. 59 feet. The driveway loop connects to a proposed southern parking lot that has a finished elevation of about El. 54.5 feet and a proposed northern parking lot that has a finished grade ranging between about El. 53 feet and El. 56 feet.

We understand that the northern perimeter wall will be designed as a retaining wall.

The proposed construction will also include relocating the existing twin-48-inch combined sewer pipes to the west so as not to overlap with the proposed building. The proposed pies will be reinforced concrete pipes (RCP). We understand that the relocations will include extending the pipes along Higginson Avenue.

1.6 Elevation Datum

The plans referenced in Sections 1.3 and 1.5 do not include a reference to an elevation datum. We have assumed that the elevations shown in these plans are referenced to the National American Vertical Datum of 1988 (NAVD 88).

2. SITE AND SUBSURFACE CONDITIONS

2.1 Surficial Geology

LGCI reviewed the following Surficial Geologic Map: "Geologic Map of the Pawtucket Quadrangle, Rhode Island-Massachusetts, Surficial Geology" prepared by Newton E. Chute, Pawtucket, Rhode Island-Massachusetts.

The Surficial Geologic Map indicates that the natural soils in the general area of the site consist of swamp deposits. The swamp deposits are defined as containing post-glacial deposits of silt, sand, gravel, and peat. The Surficial Geologic Map also shows artificial fill at the site. This information is consistent with the history of filling described in Section 1.4.

The Surficial Geologic Map is shown in Figure 2.

2.2 Previous Explorations

As part of the initial explorations at the site, Paul B. Aldinger & Associates, Inc. (PBA) was engaged to perform an exploration program at the site within the initially proposed building footprint on the northern side of the site near Higginson Avenue. PBA performed explorations at the site consisting of twelve (12) borings and submitted a geotechnical report titled: "Preliminary Geotechnical Engineering Report for the Proposed Central Falls High School, Central Falls, Rhode Island," dated March 2022.

A plan showing the locations of the previous borings and the previous boring logs are included in Appendix A.

The previous borings extended to depths ranging between 60 and 148.5 feet beneath the ground surface. The previous borings indicated between 8 and 17 feet of fill, overlying organic soil extending to depths ranging between 17 and 59 feet beneath the ground surface, overlying glacial outwash deposits that extended to the termination depths of the borings. The outwash deposits were mostly loose to medium dense. The previous borings indicated that the thickness of the fill and organic soil somewhat decreased in an easterly direction but was still thick enough to cause the site to be classified as a Site Class F, which requires a site-specific seismic analysis.

PBA indicated in its report that based on the groundwater map of Pawtucket compiled by William B. Allen for the US Geological Survey in 1946, that the top of bedrock in the vicinity of the site could range between 150 and 200 feet beneath the ground surface. PBA referenced a report by Sage Environmental, Inc. (Sage) in which Sage indicated that the site is in three (3) separate flood zones and that the annual risk of flooding of the site ranges between minimal and high risk.

In its preliminary report, PBA indicated that based on its borings, the site is susceptible to liquefaction during a seismic event and that it is a Site Class F. PBA recommended that fill placed to raise the grades above the flood elevation should consist of lightweight fill to reduce the potential for and magnitude of settlement of the soft compressible materials at the site. PBA

preliminarily recommended supporting the proposed building on deep ground improvement consisting of aggregate piers and/or concrete columns, or deep friction piles with a structural slab. PBA indicated that additional explorations were needed to confirm the feasibility of its recommended foundations.

2.3 LGCI's Explorations

2.3.1 General

LGCI coordinated our exploration locations with Ai3 and with the City of Central Falls and marked the exploration locations in the field by taping distances from the existing landmarks at the site. LGCI notified Dig Safe and the City of Central Falls for utility clearance prior to starting our explorations at the site.

Unless notified otherwise, we will dispose of the soil samples obtained during our explorations after three (3) months.

2.3.2 LGCI's Soil Borings

During the preliminary phase, LGCI engaged Northern Drill Service, Inc. (NDS) of Northborough, Massachusetts to advance two (2) borings (B-3 and B-4-OW) along Lonsdale Avenue between July 18 and July 25, 2022. The borings could not be advanced in the private properties east of the site where the City is considering constructing the proposed high school, as the properties were not owned by the City and at the time of our borings, a right of entry agreement had not been secured with the private property owners. The borings were advanced with a Mobile B-59 truck rig. Before the start of drilling, NDS performed vacuum explorations at the boring locations using an air knife in the top 4 to 6 feet to assist with utility clearance. The borings were advanced using drive and wash technique with a 4-inch casing. The borings extended to depths of 101 feet beneath the ground surface. Upon completion, boring B-3 was backfilled with grout and gravel, and the ground surface was restored with asphalt cold patch. Boring B-4-OW was backfilled to a depth of 20 feet beneath the ground surface with gravel and a groundwater observation well was installed.

During the DD phase, LGCI engaged NDS to advance an additional seven (7) borings (B-101 to B-107) and four (4) probes (P-1 to P-4) at the site between December 12 and 27, 2022. The probes were initially intended to be performed without sampling, but ended up being sampled similar to the borings and extended to depths shallower than 32 feet. The borings and probes were advanced with a Mobile B-48 ATV rig using drive and wash technique with a 4-inch casing. The borings and probes extended to depths ranging between 31 and 96 feet beneath the ground surface. Upon completion, the borings and probes were backfilled with grout and gravel. A groundwater observation well was installed in boring B-106-OW.

NDS performed Standard Penetration Tests (SPT) during drilling and obtained split spoon samples in the borings and probes with an automatic hammer at typical depth intervals of 2-

feet or 5-feet as noted on the boring and probe logs in general accordance with ASTM D-1586.

An LGCI field representative observed and logged the borings and probes in the field.

2.3.3 Exploration Logs and Locations

The exploration locations are shown in Figure 3. Appendix B contains LGCI's boring and probe logs. Table 1 includes a summary of LGCI's borings and probes.

2.4 Geophysical Survey

LGCI engaged Hager GeoScience, Inc. of Woburn, Massachusetts to perform a geophysical survey at the site between February 22 and 27, 2023. The survey included a Multichannel Analysis of Surface Waves (MASW) survey, a seismic refraction survey, and a Horizontal/Vertical Spectral Ratio (HVSR) survey.

The MASW geophysical survey consists of placing geophones connected to one another through a seismic cable along a line on the ground, recording surface waves induced by an active energy source, analyzing the propagation velocities of the recorded surface waves, and then calculating the shear wave velocities of the waves.

The purpose of the seismic refraction and the (HVSR) surveys was to obtain information about the top of rock and thickness of soil strata.

The results of the geophysical survey are included in Appendix D.

2.5 CPTs

LGCI engaged ConeTec Inc. (ConeTec) of West Berlin, New Jersey to perform seismic CPTs at the site on April 19, 2023. ConeTec performed four (4) seismic CPTs (SCPT23-01 to SCPT23-04). The seismic CPTs were advanced to depths of about 70.5, 7.4, 91.9, and 100.1 feet beneath the ground surface at SCPT23-01, SCPT23-02, SCPT23-03, and SCPT23-04, respectively. Test SCPT23-02 terminated at a shallow depth due to an obstruction on a possible utility and was abandoned. The seismic CPTs were performed in accordance with ASTM D5778 and ASTM D7400 standards.

The CPTs are conducted using an integrated electronic piezocone penetrometer and data acquisition system. The data collected includes depth, uncorrected tip resistance, sleeve friction, and dynamic pore pressure. The data is analyzed and correlated to the corrected SPT N-value, and the shear strength/friction angle of the soil. During seismic CPTs, the shear wave velocity is also measured.

The results of the seismic CPTs are in included in Appendix E.

2.6 Subsurface Conditions

The subsurface description in this report is based on a limited number of explorations and is intended to highlight the major soil strata encountered during our explorations. The subsurface conditions are known only at the actual exploration locations. Variations may occur and should be expected between exploration locations. The boring and probe logs represent conditions that we observed at the time of our explorations and were edited, as appropriate, based on the results of the laboratory test data and inspection of the soil samples in the laboratory. The strata boundaries shown in our boring and probe logs are based on our interpretations and the actual transitions may be gradual. Graphic soil symbols are for illustration only.

The soil strata encountered in LGCI's borings and probes were as follows, starting at the ground surface.

Asphalt – Asphalt was encountered at the ground surface in borings B-3, B-4-OW and B-101 to B-104, and in probes P-1 to P-4. The thickness of the asphalt ranged between 0.3 and 0.5 feet beneath the ground surface.

Topsoil – A layer of surficial organic topsoil was encountered at the ground surface in borings B-105, B-106-OW, and B-107. The thickness of the topsoil ranged between 0.3 and 0.5 feet beneath the ground surface.

Fill – A layer of fill was encountered beneath the asphalt or topsoil in all borings and probes. The fill extended to depths ranging between 6 and 26 feet beneath the ground surface. The depth to the bottom of the fill generally increased in a westerly direction with the shallowest fill on the side of the proposed building along Lonsdale Avenue and the thickest fill on the western side of the eastern wing and also near the center and the western side of the northern wing. The depths to the bottom of the fill encountered in our borings and probes are generally consistent with those encountered in the borings advanced by PBA near the western side of the northern wing.

The samples in the fill were mostly described as poorly graded sand and silty sand. Nine (9) samples were described as well graded sand and three (3) samples were described as well graded gravel. The fines content in the fill ranged between 0 and 25 percent and the gravel content ranged between 0 and 45 percent. When described as gravel, the sand content in the fill ranged between 15 and 30 percent. The fill contained traces of organic soil, asphalt, brick, roots, glass, trash, wood, and nails.

The standard penetration test (SPT) N-values in this layer ranged between 1 and 34 blows per foot (bpf), with most values less than 10 bpf, indicating mostly very loose to loose fill. The SPT N-values higher than 10 bpf, may have been caused by obstructions in the fill and may not represent the true density of the fill. The loose condition of the fill was also observed in the shear wave velocity profiles obtained from the MASW geophysical survey (Figures S-1 and S-2 of the geophysical survey report) shown in purple and dark blue in Figures S-1 and S-2. The results of the seismic CPTs also indicated very loose to loose material in the top 30 to 35 feet, which include the fill and the underlying peat and organic soil described below.

Peat – A layer of peat was encountered beneath the fill in borings B-101 to B-105, and B-107, and in probe P-3. The peat extended to depths ranging between 20 and 36 feet beneath the ground surface. One (1) sample within this layer was described as silty sand. The peat was described as non-fibrous to fibrous and non-plastic to slightly plastic. The sand content within the peat ranged between 0 and 5 percent. When described as sand, the fines content in the peat layer ranged between 25 and 30 percent. The peat contained traces of peat fibers, organic soil, and roots.

The SPT N-values in the peat ranged between 2 and 13 bpf, with most values less than 8 bpf, indicating very soft to medium stiff material consistent with the results of the geophysical survey and seismic CPTs as described above under Fill.

Based on the results of the laboratory consolidation and unconfined undrained shear strength tests on an undisturbed tube sample obtained in the peat, the peat appears to be normally consolidated and has a low undrained shear strength of about 120 psf.

Organic Soil – A layer of organic soil was encountered beneath the layer of fill or peat in borings B-106-OW and B-107. The organic soil extended to depths of 28 feet beneath the ground surface. The samples within this layer were described as poorly graded sand, silty sand, and silt. The fines content within this layer ranged between 10 and 30 percent. When described as silt, the sand content in this layer ranged between 15 and 35 percent and the silt was described as slightly to moderately plastic. The buried organic soil contained traces of organic soil.

The SPT N-values in the buried organic soil ranged between 2 and 5 bpf, indicating very loose to loose material consistent with the results of the geophysical survey and seismic CPTs as described above under Fill.

Silt – Layers of silt, interbedded with the sand, were encountered beneath the fill or peat starting at depths of 58, 49, 27.5, and 38 feet in borings B-3, B-4-OW, B-103, and B-105, respectively. The silt extended to depths of 84, 94, 32, and 49 feet beneath the ground surface in borings B-3, B-4-OW, B-103, and B-105, respectively. The samples in the silt were described as sandy silt, silt with sand, or silt. One (1) sample was described as poorly graded sand. The sand content in the silt layer ranged between 5 and 45 percent. When described as sand, the fines content in this layer ranged between 5 and 10 percent. The silt was described as slightly to moderately plastic. Two (2) samples contained traces of organic soil and roots. One (1) sample contained an organic odor.

The SPT N-values in the silt layers ranged between 2 and 44 bpf, with most values between 2 and 29 bpf, indicating very soft to medium stiff silt.

Based on the results of laboratory consolidation and unconfined undrained shear strength tests on an undisturbed tube sample obtained in the top of the silt, the silt appears to be normally consolidated and has a low undrained shear strength of about 190 psf.

Sand – A layer of sand was encountered beneath the fill, peat, or organic soil in all borings and probes and extended to the termination depths of the borings and probes. The samples in this layer were mostly described as poorly graded sand or well graded sand. Sixteen (16) samples were

described as silty sand, two (2) samples were described as well graded gravel, one (1) sample was described as poorly graded gravel, and one (1) sample was described as silt. The fines content in this layer ranged between 0 and 25 percent and the gravel content ranged between 0 and 30 percent. When described as gravel or silt, the sand content ranged between 10 and 25 percent. The silt was described as slightly plastic. Two (2) samples contained petroleum odors.

The SPT N-values in the sand ranged between 0 and 69 bpf, with most values between 10 and 30 bpf indicating mostly medium dense sand. The SPT N-values lower than 10 bpf generally occurred in the top few feet of the sand layer immediately beneath the fill, peat, or organic soil layer, with only a few isolated samples with less than 10 bpf at greater depths. Generally, the loose sand was encountered beneath the peat and organic soil up to depths of about 50 to 60 feet in the borings advanced on the western side of the eastern wing and the western side of the northern wing. The depth and thickness of the loose sand observed in the borings are consistent with those indicated by the medium blue color in Figures S-1 and S-2 of the geophysical survey report. The results of the seismic CPTs indicated that the very loose soils extend to depths of about 35 feet, i.e., shallower than indicated by SPT borings and the MASW geophysical survey. The discrepancy may be due to the fact that the seismic CPTs are conducted at discrete points, whereas the MASW geophysical survey provides a continuous profile of shear wave velocities.

Our explorations confirmed that although present in our borings advanced within the proposed building footprint, the fill, peat, and organic soil are not as deep as observed in the previous borings performed in the field.

2.7 Groundwater

Groundwater was encountered in all borings and probes at depths ranging between 4 and 15.5 feet beneath the ground surface as shown in Table 1 and in the boring and probe logs.

Groundwater observation wells were installed in borings B-4-OW and B-106-OW. The groundwater levels were monitored in B-4-OW on December 16 and December 27, 2022, and were 12 feet and 11.5 feet beneath the ground surface, respectively. The groundwater level in B-106-OW was 9.5 feet beneath the ground surface on December 27, 2022.

The groundwater information reported herein is based on observations made during or shortly after the completion of drilling. Furthermore, the drilling procedure introduced water into the boreholes. Therefore, the levels indicated in our boring and probe logs may not represent the actual groundwater conditions, as additional time may be required for the groundwater levels to stabilize. The groundwater information presented in this report only represents the conditions encountered at the time and location of the explorations. Seasonal fluctuation should be anticipated.

2.8 Laboratory Test Data

LGCI submitted twenty-two (22) soil samples collected from our explorations for grain-size analysis, including ten (10) soil samples collected from the preliminary explorations and twelve

(12) soil samples collected from the DD phase explorations. The results of the grain-size analyses are provided in the test data sheets included in Appendix C and are summarized in the table below.

Grain-Size Analysis Test Results

Boring No.	Sample No.	Stratum	Sample Depth (ft.)	Percent Gravel	Percent Sand	Percent Fines
B-3	G1	Fill	0.5 – 6.0	23.3	68.3	8.4
B-3	S2	Fill	8.0 – 10.0	12.2	80.8	7.0
B-3	S4	Sand	12.0 – 14.0	3.5	90.1	6.4
B-3	S5	Sand	14.0 – 16.0	0.2	97.6	2.2
B-3	S6	Sand	16.0 – 18.0	0.5	94.4	5.1
B-4-OW	G1	Fill	0.5 – 5.0	16.8	77.6	5.6
B-4-OW	S1	Fill	4.0 – 6.0	20.6	70.1	9.3
B-4-OW	S2	Fill	6.0 – 8.0	40.9	57.0	2.1
B-4-OW	S3	Sand	8.0 – 10.0	15.0	73.9	11.1
B-4-OW	S5	Sand	12.0 – 14.0	13.9	78.8	7.3
B-101	S16	Sand	39.0 – 41.0	0.5	94.7	4.8
B-103	S6	Fill	10.0 – 12.0	26.9	67.8	5.3
B-103	S9	Fill	16.0 – 18.0	19.5	74.5	6.0
B-103	S10	Fill	18.0 – 20.0	22.4	72.3	5.3
B-103	S17	Sand	32.0 – 34.0	3.4	74.9	21.7
B-104	S1	Fill	0.5 – 2.0	43.0	51.1	5.9
B-105	S9	Fill	24.0 – 26.0	10.6	67.1	22.3
B-107	S14	Sand	34.0 – 36.0	16.3	79.0	4.7
P-1	S2	Fill	2.0 – 4.0	33.8	43.8	22.4
P-3	S3	Sand	9.0 – 11.0	3.5	93.6	2.9
P-3	S4	Sand	14.0 – 16.0	11.5	72.4	16.1
P-4	S2	Fill	2.0 – 4.0	16.2	76.1	7.7

LGCI also submitted two (2) undisturbed tube samples obtained in the peat and the silt layers (one each) for consolidation and unconsolidated undrained (UU) shear strength testing. The results, included in Appendix C, indicate that the peat and the silt are normally consolidated and have compression ratio (CR) values of 0.38 and 0.3, respectively. The shear strength tests indicate that peat and the top of the silt layer have a low undrained shear strength of about 120 and 190 psf, respectively.

3. EVALUATION AND RECOMMENDAITONS

3.1 General

3.1.1 Variable Subsurface Conditions

Based on our understanding of the proposed Central Falls High School building, our observation of the explorations, and the results of our laboratory testing, there are a few issues that we would like to highlight for consideration and discussion.

- Our borings, advanced along Lonsdale Avenue, indicated subsurface conditions that are significantly different from those indicated by PBA's and LGCI's borings advanced at the site.

- The explorations performed to date within and near the proposed building footprint, including LGCI's borings and those previously performed by PBA, show subsurface conditions that vary drastically across the proposed building in an east-west direction.

- The subsurface conditions range from relatively shallow fill extending to a depth of about 8 feet overlying medium dense to dense sand on the eastern side near Lonsdale Avenue, to deep fill, overlying peat and organic soil extending to depth of about 36 feet on the western side of the northern wing of the proposed building.

- In addition to the deep peat and organic soil, the explorations performed to date, especially the previous borings performed by PBA, indicate loose soils beneath the peat and the organic soil.

Soil Boring/Probe*	Depth to Bottom of Fill, Peat, or Loose Soil whichever is deeper (ft.)
LGCI's Borings and Probes	
P-1	16
P-2	16
P-3	21
P-4	20
B-3	8
B-4	10
B-101	41
B-102	23.5
B-103	34
B-104	20 (1 loose sample: 29' to 31')
B-105	49
B-106	28 (2 loose samples: 39' to 46')
B-107	44

Soil Boring*	Depth to Bottom of Fill, Peat, or Soil, whichever is deeper (ft.)
PBA's Borings	
PBA-1	63
PBA-2	48
PBA-3	53
PBA-4	48 (1 loose sample: 63' to 65')
PBA-5	53 (2 loose samples: 78' to 85')
PBA-6	43
PBA-7	68
PBA-8	68
PBA-9	68
PBA-10	98
PBA-11	78
PBA-12	68

* Highlighted fields (in gray) indicate exploration location within or near proposed building footprint.

- The results of the borings summarized above and shown in Table 1 are supported by and are consistent with the results of the results of the MASW geophysical survey and the seismic CPTs. Based on the data from the borings and probes, the existing subsurface conditions at the site are not suitable to support shallow foundations.

- The subsurface conditions encountered on the eastern side of the proposed building footprint are favorable for ground improvements to allow supporting the proposed building and retaining walls on shallow spread and continuous footings and a slab-on-grade. Based on the borings and probes, we believe that the ground improvements will extend to depths of about 40 feet over an area of about one half (1/2) to two thirds (2/3) of the proposed building footprint. Over the remainder of the proposed building footprint, we believe that the ground improvements would extend to depths of up to 60 feet.

- Based on our discussions with specialty ground improvement contractors, we believe that ground improvements by means of aggregate piers (APs) are feasible at the site. Where a peat layer is present, the aggregate piers would need to be grouted to reduce the potential for bulging of the aggregate pier.

- We have contacted specialty contractors that install aggregate piers. We understand that aggregate piers are cost effective for depths up to 40 feet. At depths of 40 to 60 feet, the cost of aggregate piers almost doubles for every vertical foot of improvement beyond a depth of 40 feet.

- In consideration of the above, we have also considered ground improvement by means of rigid inclusions (RIs). Based on our discussions with the specialty ground improvement contractors, RIs are also feasible at the site. The cost of installing RIs is slightly higher than that of the APs. However, the advantage of RIs over aggregate piers is that they can be installed to much greater depths than aggregate piers at a relatively constant unit price per vertical foot of improvement. The limitation of RIs in loose sand susceptible to liquefaction, is that unlike aggregate piers, the RIs do not densify the soil around them and therefore are not locally considered a liquefaction mitigation solution. However, based on our review of available literature[1], we understand that high modulus grouted columns, similar to RIs, have been documented to have reduced the potential for liquefaction during an earthquake. Accordingly, the portion of the proposed building where ground improvement deeper than 40 feet is needed could be improved with a combination of RIs under the footings and APs in between RI clusters.

- The design of the ground improvements should consider the settlement threshold established by LGCI both for static and earthquake loads described in Sections 3.3.2 and 3.7.

[1] James R. Martin II, C. Guney Olgun, James K. Mitchell, and H. Tiran Durgunoglu, "High-Modulus Columns for Liquefaction Mitigation," *Journal of Geotechnical and Geoenvironmental Engineering*, June 2004, Vol. 130, No. 6.

3.1.2 Asphalt, Surficial Topsoil, and Existing Fill

The surficial topsoil and asphalt should be entirely removed from under the proposed building and proposed paved areas. The removal should extend beyond the building footprint a minimum distance of 5 feet.

In paved areas and under sidewalks, the existing fill should be improved in accordance with the recommendations in Section 4.1

3.1.3 Shallow Foundations and Slabs-on-Grade

After the surficial topsoil and asphalt are entirely removed from within the proposed building footprint, the proposed building may be supported on shallow footings bearing on ground improved with aggregate piers and/or RIs. The proposed slab may be designed as a slab-on-grade supported on Structural Fill placed directly on top of ground improved with APs and/or RIs.

Our recommendation for footing design and slabs-on-grade are presented in Sections 3.3.1 and 3.4, respectively. Our recommendations for subgrade preparation are presented in Section 4.1.

3.1.4 Retaining Walls

The proposed retaining walls may be supported on Structural Fill placed on ground improved using APs and/or RIs as described in Section 3.1.1.

3.1.5 Utilities

- We understand that the structures on either end of the proposed twin-48-inch combined sewer pipes are sensitive to settlement. Accordingly, we recommend supporting the proposed twin-48-inch combined sewer pipe and the structures on either ends on ground improved using APs and/or RIs.
- Ground improvements using APs and/or RIs may also be needed beneath other new utilities at the site. At a minimum, ground improvements should be installed under utility structures.
- The utility pipes should be outfitted with flexible connections to the utility structures to allow for some differential movement between the pipes and the utility structures.
- The ground improvements for the utilities structures may need to extend deeper than those for the proposed building as the new utilities are in general located on the western and southern sides of the site where the unsuitable soils are deeper.
- An allowance should be included in the cost estimate to perform the ground improvements for utilities.
- The contract documents should include a requirement for instrumentation monitoring of existing utilities to assess the effect the ground vibration induced by the ground improvements.

3.1.6 Reuse of Onsite Materials

Based on our grain-size analyses, the existing fill free of organic matter may be used as Ordinary Fill. Additional recommendations for fill materials and reuse of onsite materials are presented in Sections 4.6 and 4.7.

3.1.7 Additional Explorations

We recommend additional explorations on Higginson Avenue along the alignment of the proposed twin-48-inch combined sewer pipe extension. The borings should extend to depths of 50 feet.

3.2 Aggregate Pier Option/Rigid Inclusions Option

3.2.1 General

The types of ground improvement we have considered are APs and RIs.

The ground improvement technologies are patented, and the design is performed by the specialty contractors. We recommend that the project plans and specifications for ground improvement be performance-based, allowing a variety of ground improvement contractors the opportunity to bid the work. Specifications should indicate the required allowable bearing pressure for footings and slabs, and the allowable total and differential settlements for the structure, including static and earthquake induced settlement. In addition, we recommend that the specifications require that the supporting design calculations be available for review by the design team. Ground improvement contractors should also be provided with grading plans and subsurface information associated with the proposed structure for use in preparing their bids.

The layout and length of the proposed ground improvements will be designed by the ground improvement specialty contractor. We anticipate that the length of the ground improvements will increase across the length of the proposed building from east to west. For cost estimating purposes, we recommend assuming ground improvements extending to an average depth of 40 feet beneath the ground surface over two thirds (2/3) of the proposed building, and ground improvements extending to depths of 60 feet over the remainder of the proposed building.

We believe that ground improvements extending to depths of 15 to 20 feet beneath the proposed site retaining walls will be adequate to provide the required bearing capacity, to reduce the static settlement to within tolerable limits, and to improve the global stability of the proposed walls. If settlement of the proposed site retaining walls is not desired during a seismic event, the ground improvements should extend to greater depths.

The work of the specialty contractor installing the APs and/or the RIs should be coordinated with that of the site contractor who should perform pre-trenching for possible boulders, abandoned foundations, metal pipes, or other obstructions before the installation of the APs or RIs.

3.2.2 Aggregate Piers (APs)

APs are typically relatively short, stiff elements of compacted aggregate which improve the existing fill. These elements are typically installed by augering holes ranging from 20 inches to 36 inches in diameter. Aggregate (new crushed stone, recycled concrete, or other granular material) is then introduced into the hole and is generally compacted in one-foot lifts by repeated penetrations with the vibrator, which can be mounted to a crane or tracked carrier. The vibratory or ramming energy densifies the aggregate in the element; thus, producing high modulus APs. The installation of APs also densifies the surrounding soil depending on the type of soil. These high modulus elements reinforce the treatment zone and increase the composite friction angle and stiffness of the reinforced soil mass. The design of APs is typically verified with a modulus load test.

Where the subsurface conditions include a layer of organic soil and/or peat, the APs should be grouted in order to reduce the potential for bulging of the AP elements in the soft organic material or peat.

While the AP installation generates little spoils. Where it is not desired to generate spoils during the improvement process, vertical displacement APs could be used. These are installed by driving a mandrel and hammer to the design depth, feeding the backfill material through the hollow mandrel, and compacting the backfill in one-foot lifts using the hammer; thus, generating no spoils. Vertical displacement APs are typically installed with diameters ranging between 12 and 16 inches to typical depths ranging between 15 and 40 feet with conventional ground improvement rigs. At depths exceeding 40 feet, larger ground improvement rigs or a vibratory probe installed on a crane could be used to depths of up to 60 feet where needed.

The length of the APs should be based on improvements that reduce the total and differential settlement to within the thresholds established for the project for both static and earthquake loads.

To reduce the length of the APs, we believe that the APs should be installed from the current grade, before placing the Structural Fill required to raise the grades. This option will result in shorter APs under the proposed slab. However, based on our discussions with local installers, this option will likely require more AP elements under the proposed slab to support the weight of the additional fill.

3.2.3 Rigid Inclusions (RIs)

We have prepared this report assuming the ground improvements will consist of APs. However, and based on experience, the specialty ground improvement contractors may propose RIs in lieu of the APs or in addition to APs. LGCI does not object to such a change if proposed by the specialty contractor, provided that the RIs fulfill the design requirements of the project, including reducing settlement and mitigating liquefaction potential.

RIs are a ground improvement technique whereby rigid, cylindrical concrete elements are installed through a soil that is not suitable to support shallow foundations, such as the existing fill, peat, organic soil, and loose sand at the site. The concrete is installed using a bottom feed from a mandrel as the mandrel is extracted from the ground. After the ground is improved using RIs, the proposed building may be supported on shallow foundations. RIs generally generate little spoils.

3.3 Foundation Recommendations

3.3.1 Footing Design

- For footings supported on a minimum of 6 inches of Structural Fill placed directly over ground improved with APs or RIs, we recommend a net allowable bearing pressure of 3 kips per square foot (ksf).

- Footing subgrades should be prepared in accordance with the recommendations in Section 4.1.

- All foundations should be designed in accordance with *The Rhode Island State Building Code* (RISBC).

- Exterior footings and footings in unheated areas should be placed at a minimum depth of 4 feet below the final exterior grade to provide adequate frost protection. Interior footings in heated areas may be designed and constructed at a minimum depth of 2 feet below finished floor grades.

- Wall footings should be designed and constructed with continuous, longitudinal steel reinforcement for greater bending strength to span across small areas of loose or soft soils that may go undetected during construction.

- A representative of LGCI should be engaged to observe that the subgrade has been prepared in accordance with our recommendations.

3.3.2 Estimated Settlement Under and Seismic Static Loads

For footings designed using the net allowable bearing pressure recommended above, we anticipate that the settlement will be about 1 3/4 -inch and that the differential settlement of the footings will be 1 inch or less, over 25 feet or between footings. Total and differential settlements of these magnitudes are usually considered excessive for the anticipated construction.

For ground improvement design, the threshold for settlement under static loads should be a total settlement of about 1inch and a differential settlement of about 3/4-inch over a distance of 25 feet.

Our estimate for earthquake induced settlement is shown in Section 3.6.

3.4 Concrete Slab Considerations

- The proposed floor slabs can be constructed as a slabs-on-grade bearing on a minimum of 12 inches of Structural Fill placed on ground improved with APs and/or RIs. The subgrade of the proposed slabs should be prepared as described in Section 4.1.

- To reduce the potential for dampness in the proposed floor slabs, the project architect may consider placing a vapor barrier beneath the floor slabs. The vapor barrier should be protected from puncture during construction of the slabs.

- For the design of the proposed floor slabs bearing on the materials described above, we recommend using a modulus of subgrade reaction, k_{s1}, of 80 tons per cubic foot (tcf). Please note that the values of k_{s1} are for a 1 x 1 square foot area. These values should be adjusted for larger areas using the following expression:

$$Modulus\ of\ Subgrade\ \mathrm{Re}action\ (k_s) = k_{s1} * \left(\frac{B+1}{2B}\right)^2$$

where:

k_s = Coefficient of vertical subgrade reaction for loaded area,
k_{s1} = Coefficient of vertical subgrade reaction for 1 x 1 square foot area, and
B = Width of area loaded, in feet.

Please note that cracking of slabs-on-grade can occur as a result of heaving or compression of the underlying soil, but also as a result of concrete curing stresses. To reduce the potential for cracking, the precautions listed below should be closely followed for construction of all slabs-on-grade:

- Construction joints should be provided between the floor slab and the walls and columns in accordance with the American Concrete Institute (ACI) requirements, or other applicable code.

- Backfill in interior utility trenches should be properly compacted.

- For the movement of exterior slabs not to be transmitted to new foundations or superstructures, exterior slabs such as approach slabs and sidewalks, should be isolated from the superstructure.

3.5 Under-Slab Drains

Based on the current groundwater levels observed in the explorations, we anticipate that an under-slab drainage system will not be required under the proposed building.

3.6 Liquefaction Analyses

Liquefaction Analysis based on SPT Data – To assess the potential of the site soils for liquefaction, we performed liquefaction analyses using the Youd[2] et al. (2001) method. We used a peak ground acceleration of 0.12 g, where g is the acceleration of gravity, and a design earthquake with a magnitude of 6.5. The results indicate that 2 to 6-foot zones in sand and silt layers are susceptible to liquefaction. The liquefiable zones occur at variable depths ranging between 9 and 50 feet beneath the ground surface in most borings, but extend up to a depth of 80 feet in boring PA-9. While the Youd et al. (2001) method is widely used to assess the liquefaction potential, it applies to clean sands, i.e., sands with less than 5 percent fines and is conservative for silty sands and silts. Kayen[3] et al. (2013) indicates that the shear wave velocity is considerably less sensitive to problems of soil compression and reduced penetration resistance in silty soil than SPT data and is therefore more reliable for soils with high fines contents.

Liquefaction Analysis based Shear Wave Velocity Data –Using the shear wave velocities from the MASW geophysical survey and the procedure by Ronald D. Andrus and Kenneth K. Stokoe II[4], we evaluated the potential for liquefaction of the sand and silt layers at the site. The results indicate that fewer zones in the natural sand and silt layers are susceptible to liquefaction. Furthermore, the results indicate that the liquefiable zones are located at depths between 20 and 35 feet. Based on these results, the proposed school building will not experience total collapse during a seismic event. However, the proposed building will experience earthquake-induced settlement during a seismic event as described below.

3.7 Earthquake-Induced Settlement

We calculated the earthquake-induced settlement in the loose sand and silt layer using the Tokimatsu and Seed[5] method. We estimate that during an earthquake, the loose fill and sand would settle between 6 and 22 inches.

Lew and Tran[6] compared the estimated settlement in silt using the Tokimatsu and Seed method and the settlement measured during a seismic event, and found the Tokimatsu and Seed method to

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[2] T. L. Youd, I.M. Idriss, Ronald D. Andrus, Ignacio Arango, Gonzalo Castro, John T. Christian, Richardo Dobry, W. D. Liam Finn, Leslie F. Harder Jr., Mary Ellen Hynes, Kenji Ishihara, Joseph P. Koester, Sam S. C. Liao, William F. Marcuson III, Geoffrey R. Martin, James K. Mitchell, Yoshiharu Moriwaki, Maurice S. Power, Peter K. Robertson, Raymond B. Seed, and Kenneth H. Stokoe II, (2001), "Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 SCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils," *Journal of Geotechnical and Geoenvironmental Engineering*, October 2001, Vol. 127, No. 10

[3] R. Kayen, R. E. S. Moss, E. M. Thompson, R. B. Seed, K. O. Cetin, A. Der Kiureghian, Y. Tanaka, and K. Tokimatsu (2013), "Shear-Wave Velocity-Based Probabilistic and Deterministic Assessment of Seismic Soil Liquefaction Potential," *Journal of Geotechnical and Geoenvironmental Engineering*, March 2013, Vol. 139, No. 3.

[4] Ronald D. Andrus and Kenneth K. Stokoe II (2000), "Liquefaction Resistance of Soils From Shear-Wave Velocity," *Journal of Geotechnical and Geoenvironmental Engineering*, November 2000, Vol. 126, No. 11.

[5] Kohji Tokimatsu, H. Bolton Seed (1987), "Evaluation of Settlements in Sands Due to Earthquake Shaking," *Journal of Geotechnical Engineering*, August 1987, Vol. 113, No. 8.

[6] M. Lew and L. Tran (2012), "Case History of Observed Liquefaction-Induced Settlement Versus Predicted Settlement," 15th World Conference on Earthquake Engineering," Lisbon, Portugal.

overestimate the settlement. In consideration of the results of the latter comparison, we used the charts published by Soydemir[7] and estimated a total settlement of 3 to 13 inches, with less than 3 inch occurring below a depth of 60 feet beneath the ground surface. The deep earthquake-induced settlement is anticipated to occur more or less uniformly and should result in less than 3/4 inch additional differential settlement to that caused by the static loading, estimated in Section 3.3.2.

For ground improvement designed to limit the total earthquake-induced settlement to less than 3 inches and earthquake-induced differential settlement of less than 3/4-inch over a distance of 25 feet.

3.8 Seismic Design

In accordance with RISB and the International Building Code of 2018 (IBC 2018), and based on the available subsurface data, and the results of the liquefaction analyses, described above, the seismic criteria for the site are as follows:

- Site Class: E
- Spectral Response Acceleration at short period (Ss): 0.178g
- Spectral Response Acceleration at 1 sec. (S_1): 0.062g
- Site Coefficient Fa (Table 1613.5.3(1)): 2.5
- Site Coefficient Fv (Table 1613.5.3(2): 3.5
- Adjusted spectral response S_{MS}: 0.445 g
- Adjusted spectral responses S_{M1}: 0.217 g

3.9 Lateral Pressures for Wall Design

3.9.1 Lateral Earth Pressures

The lateral earth pressures shown below should be used to design any proposed retaining walls.

Coefficient of Active Earth Pressure, K_A:	0.33
Coefficient of At-Rest Earth Pressure, K_o:	0.5
Coefficient of Passive Earth Pressure, K_p:	3.0
Total Unit Weight γ:	125 pcf

Note: The values in the table are based on a friction angle for the backfill of 30 degrees and neglecting friction between the backfill and the wall. The design active and passive coefficients are based on horizontal surfaces (non-sloping backfill) on both the active and passive sides, and a vertical wall face.

- Exterior walls of below-ground spaces and retaining walls braced at the top to restrain movement/rotation, should be designed using the "at-rest" pressure coefficient.

[7] Cetin Soydemir (1994), "Earthquake Induced Settlement in Silty Sands for New England Seismicity," *ASCE National Convention, Ground Failures Under Seismic Conditions*, Atlanta, GA.

- We recommend placing free-draining material within the 3 feet immediately behind retaining walls. We recommend providing weep holes in site walls to promote drainage where possible; or a pipe should be placed at the base of the wall to collect the groundwater. Groundwater collected by the wall drains should be discharged in a lower area if gravity flow is possible.

- Passive earth pressures should only be used at the toe of the wall where special measures or provisions are taken to prevent disturbance or future removal of the soil on the passive side of the wall, or in areas where the wall design includes a key. In any case, the passive pressures should be neglected in the top 2 feet.

- Where a permanent vertical uniform load will be applied on the active side immediately adjacent to the wall, a horizontal surcharge load equal to half of the uniform vertical load should be applied over the height of the wall. At a minimum, a temporary construction surcharge of 100 psf should be applied uniformly over the height of the wall.

- We recommend using an ultimate friction factor of 0.45 between the natural sand and the bottom of the wall. Below-grade walls should be designed for minimum factors of safety of 1.5 for sliding and 2.0 for overturning.

3.9.2 Seismic Pressures

We recommend including the appropriate seismic increment of lateral pressure in the wall design.

3.9.3 Perimeter Drains

- Free-draining material should be placed within 3 feet of retaining walls and walls of below-grade spaces. To reduce the potential for dampness in below-ground spaces, if any, perimeter walls of the proposed below-ground spaces should be damp-proofed.

- We recommend that drains be provided behind the exterior of walls of below-ground spaces, if any, and behind site retaining walls, if any. The drains should consist of 6-inch perforated PVC pipes installed with the slots facing down. Perimeter drains should be installed at the bottom of the wall in 18 inches of crushed stone wrapped in a geotextile fabric for separation and filtration. Site retaining walls may be designed with weep holes discharging near the bottom of the face of the walls.

- Groundwater collected by the wall drains could be discharged in a lower area if gravity flow is possible. Alternatively, it should be discharged into the street drains. A permit would be required for discharge into street drains.

3.10 Pavement Considerations

3.10.1 General

The subsurface conditions encountered at the site are generally suitable to support the proposed driveways, parking lots, and sidewalks after preparation of the subgrade as described in Section 4.1.

- We recommend entirely removing the asphalt and the topsoil from within the footprint of the proposed driveways and parking lots.

- Cobbles and boulders should be removed to at least 18 inches below the bottom of the pavement.

- The existing fill should be improved in accordance with the recommendation in Section 4.1.

3.10.2 Sidewalks

Sidewalks should be placed on a minimum of 12 inches of Structural Fill with less than 5 percent fines. To reduce the potential for heave caused by surface water penetrating under the sidewalk, the joints between the sidewalk concrete sections should be sealed with a waterproof compound. The sidewalks should be sloped away from the building or other vertical surfaces to promote flow of water. To the extent possible, roof leaders should not discharge onto sidewalk surfaces.

3.10.3 Pavement Sections

A typical, minimum, standard-duty pavement section that could be used for parking areas is as follows:

1.5"	Asphalt "Top Course"
2.0"	Asphalt "Base Course"
8"	Aggregate Base (Gravel Borrow, RIDOT M.01.09; Table 1, Column 1)

A typical, minimum, heavy-duty pavement section that could be used in access roads and for areas of heavy traffic is as follows:

2.0"	Asphalt "Top Course"
2.5"	Asphalt "Base Course"
12"	Aggregate Base (Gravel Borrow, RIDOT M.01.09; Table 1, Column 1)

The pavement sections shown above represent minimum thicknesses representative of typical local construction practices for similar use. Periodic maintenance should be anticipated.

Pavement material types and construction procedures should conform to specifications of the Rhode Island Department of Transportation, Standard Specifications for Road and Bridge Construction, 2004 Edition.

Areas to receive relatively highly concentrated, sustained loads such as dumpsters, loading areas, and storage bins are typically installed over a rigid pavement section to distribute concentrated loads and reduce the possibility of high stress concentrations on the subgrade. Typical rigid pavement sections consist of 6 inches of concrete placed over a minimum of 12 inches of subbase material.

3.11 Underground Utilities

Boulders at the bottom of utility trenches should be removed to at least 12 inches below the pipe invert and the resulting excavation should be backfilled with suitable backfill. Utilities should be placed on suitable bedding material in accordance with the manufacturer's recommendations. "Cushion" material should be placed, by hand, above the utility pipe in maximum 6-inch lifts. The lift should be compacted by hand to avoid damage to the utility. Where the bedding/cushion material consists of crushed stone, it should be wrapped in a geotextile fabric.

Compaction of fill in utility trenches should be in accordance with our recommendations in Section 4.6. To reduce the potential for damage to utilities, placement and compaction of fill immediately above the utilities should be performed in accordance with the manufacturer's recommendations.

4. CONSTRUCTION CONSIDERATIONS

4.1 Subgrade Preparation

- The surficial topsoil, subsoil, if any, asphalt, and other deleterious matter should be entirely removed from within the proposed building footprint before the start of foundation work.

- Tree stumps, root balls, and roots larger than ½ inch in diameter should be removed and the cavities filled with suitable material and compacted per Section 4.6 of this report.

- Cobbles and boulders should be removed at least 6 inches from beneath footings, and 24 inches beneath the bottom of proposed slab and paved areas. The resulting excavations should be backfilled with compacted Structural Fill under the building and with Ordinary Fill under the subbase of paved areas.

- Due to the high susceptibility of the natural soil for disturbance under foot and vehicular traffic, we recommend placing a minimum of 6 inches of Structural Fill at the bottom of the excavation or 4 inches of lean concrete to serve as a working mat.

- The base of the footing excavations in granular soil should be compacted with a dynamic vibratory compactor weighing at least 200 pounds and imparting a minimum of 4 kips of force to the subgrade before placing the required 6 inches of Structural Fill.

- The subgrade of the slab should be compacted using a vibratory roller compactor imparting a minimum of 40 kips of force to the subgrade before placing Structural Fill.

- Where soft zones are revealed during the preparation of the subgrade, the soft materials or buried organic soil should be removed and replaced with Structural Fill within the building footprint and with Ordinary Fill beneath the subbase of paved areas.

- To reduce the potential of increasing lateral pressures on any retaining walls, fill placed within 3 feet of the walls, if any, should be compacted using a small plate compactor imparting a maximum dynamic effort of 4 kips. The fill within 3 feet of the walls should be placed in maximum 8-inch loose lifts.

- Fill placed within the footprint of the proposed building should meet the gradation and compaction requirements of Structural Fill shown in Section 4.6.1.

- Fill placed in the top 12 inches beneath sidewalks and exterior slabs should consist of Structural Fill with less than 5 percent fines.

- When crushed stone is required in the drawings or it is used for the convenience of the contractor, it should be wrapped in a geotextile fabric for separation. The geotextile fabric should not be used under retaining walls as it promotes a plane of sliding.

- APs or RIs that are damaged as a result of excavation for footings should be repaired in accordance with the requirements of the specialty contractor installing the APs or RIs.

- Before fill is placed under footings or to raise the grades, the APs should be exposed, and the subgrade should be compacted to a firm and unyielding conditions.

- If RIs are used, they should be cutoff at the minimum depth required to install the load transfer platform (LTP), before placing the proposed footings. The RIs could be installed a few feet higher than the proposed cutoff elevation and the excess concrete cutoff using an auger before the concrete sets.

- Care should be exercised not to mix soil with the concrete for the RIs during placement of the concrete or during augering to the proposed cutoff elevation.

- An LGCI geotechnical representative should observe the installation of the APs (or RIs) and the modulus test. An LGCI geotechnical representative should also observe the exposed subgrades prior to fill and concrete placement to verify that the exposed the APs (or RIs) are properly exposed.

4.2 Subgrade Preparation for Paved Areas, Sidewalks, and Exterior Pads

- Topsoil, root balls, and other deleterious material should be entirely removed from within the paved areas and under sidewalks.

- After the surficial topsoil is entirely removed from within the proposed paved areas and under sidewalks, the exposed existing fill should be improved by compacting the exposed surface with at least six (6) overlapping passes of a vibratory roller compactor imparting a dynamic effort of at least 40 kips. Where soft zones of soil are observed, the soft soil should be removed, and the grade should be restored using Ordinary Fill to the bottom of the proposed subbase layer.

- Fill placed under the subbase of paved areas and sidewalks should meet the gradation and compaction requirements of Ordinary Fill shown in Section 4.6.2.

- The subbase of paved areas should conform to the recommendations in Section 3.10.3 above.

- The subbase of sidewalks should consist of Structural Fill with less than 5 percent fines.

4.3 Subgrade Protection

The site soils are frost susceptible. If construction takes place during freezing weather, special measures should be taken to prevent the subgrade from freezing. Such measures should include the use of heat blankets or excavating the final 6 inches of soil just before pouring concrete. Footings should be backfilled as soon as possible after footing construction. Soil used as backfill

should be free of frozen material, as should the ground on which it is placed. Filling operations should be halted during freezing weather.

Materials with high fines contents are typically difficult to handle when wet as they are sensitive to moisture content variations. Subgrade support capacities may deteriorate when such soils become wet and/or disturbed. The contractor should keep exposed subgrades properly drained and free of ponded water. Subgrades should be protected from machine and foot traffic to reduce disturbance.

4.4 Fill Materials

Structural Fill and Ordinary Fill should consist of inert, hard, durable sand and gravel, free from organic matter, clay, surface coatings and deleterious materials, and should conform to the gradation requirements shown below.

4.4.1 Structural Fill

The Structural Fill should have a plasticity index of less than 6 and should meet the gradation requirements shown below. Structural Fill should be compacted in maximum 9- inch loose lifts to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557), with moisture contents within ±2 percentage points of optimum moisture content.

Sieve Size Percent	Passing by Weight
3 inches	100
1 ½ inch	80-100
½ inch	50-100
No. 4	30-85
No. 20	15-60
No. 60	5-35
No. 200*	0-10

* 0 – 5 Under sidewalks, unheated slabs, exterior stairs, ramps, and pads

4.4.2 Ordinary Fill

Ordinary Fill should have a plasticity index of less than 6 and should meet the gradation requirements shown below. Ordinary Fill should be compacted in maximum 9-inch loose lifts to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557), with moisture contents within ±2 percentage points of optimum moisture content.

Sieve Size Percent	Passing by Weight
6 inches	100
1 inch	50-100
No. 4	20-100
No. 20	10-70
No. 60	5-45
No. 200	0-20

4.5 Reuse of Onsite Materials

Based on our field observations and the results of the grain-size analyses, we anticipate some of the existing fill free of organic matter may be used as Ordinary Fill. The natural soil may be improved by blending with crushed stone to produce Structural Fill.

The contractor should avoid mixing the existing soils with suitable imported material. Should reusable materials be encountered during excavation, they should be excavated and stockpiled separately for compliance testing.

Soils with 20 percent or greater fines content are generally very sensitive to moisture content variations and are susceptible to frost. Such soils are very difficult to compact at moisture contents that are much higher or much lower than the optimum moisture content determined from the laboratory compaction test. Therefore, strict moisture control should be implemented during compaction of onsite soils with fines contents of 20 percent or greater. The contractor should be prepared to remove and replace such soils if pumping occurs.

All materials to be used as fill, including blended materials, should first be tested for compliance with the applicable gradation specifications.

4.6 Groundwater Control Procedures

Based on the groundwater levels encountered in our explorations, we do not anticipate that groundwater control procedures will be needed during the excavations to remove the existing fill and in utility trenches.

We anticipate that filtered sump pumps installed in a series of sump pump pits located at least 3 feet below the bottom of the proposed excavations may be sufficient to handle surface runoff that may enter the excavations during wet weather. Please note that the natural soil was fairly permeable. Accordingly, the site contractor should be prepared to use multiple sump pumps during wet weather.

The contractor should be permitted to employ whatever commonly accepted means and practices are necessary to maintain the groundwater level below the bottom of the excavations, and to maintain a dry excavation during wet weather. Groundwater levels should be maintained at a minimum of 1-foot below the bottom of excavations during construction. Placement of reinforcing steel or concrete in standing water should not be permitted.

To reduce the potential for sinkholes developing over sump pump pits after the sump pumps are removed, the crushed stone placed in the sump pump pits should be wrapped in a geotextile fabric. Alternatively, the crushed stone should be entirely removed after the sump pump is no longer in use and the sump pump pit should be restored with suitable backfill.

4.7 Temporary Excavations

All excavations to receive human traffic should be constructed in accordance with the OSHA guidelines.

The site soils should generally be considered Type "C" and should have a maximum allowable slope of 1.5 Horizontal to 1 Vertical (1.5H:1V) for excavations less than 20 feet deep. Deeper excavations, if needed, should have shoring designed by a professional engineer.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of the excavation sides and bottom and to protect existing structures.

4.8 Submittals

The site contractor should submit the following submittals:

- Groundwater control.
- AP and/or RI installation.
- Modulus test for APs or RIs.
- Vibration and instrumentation monitoring

5. REPORT LIMITATIONS

Our analyses and recommendations are based on project information provided to us at the time of this report. If changes to the type, size, and location of the proposed structures or to the site grading are made, the recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions and recommendations modified in writing by LGCI. LGCI cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations, and whether our recommendations have been properly implemented in the design.

It is not part of our scope to perform a more detailed site history; therefore, we have not explored for or researched the locations of buried utilities or other structures in the area of the proposed construction. Our scope did not include environmental services or services related to moisture, mold, or other biological contaminants in or around the site.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from anticipated conditions are encountered, it may be necessary to revise the recommendations in this report. We cannot accept responsibility for designs based on recommendations in this report unless we are engaged to 1) make site visits during construction to check that the subsurface conditions exposed during construction are in general conformance with our design assumptions and 2) ascertain that, in general, the work is being performed in compliance with the contract documents.

Our report has been prepared in accordance with generally accepted engineering practices and in accordance with the terms and conditions set forth in our agreement. No other warranty, expressed or implied, is made. This report has been prepared for the exclusive use of Ai3 Architects LLC for the specific application to the proposed Central Falls High School in Central Falls, Rhode Island as conceived at this time.

6. REFERENCES

In addition to the references included in the text of the report, we used the following references:

Rhode Island State Building Code (Feb. 2022), comprised of the International Building Code of 2018 (IBC-2018) and RI amendments.

The Department of Labor, Occupational Safety and Health Administration (1989), "Occupational Safety and Health Standards - Excavations; Final Rule," 20 CFR Part 1926, Subpart P.

USGS Central Falls, MA topographic map from http://mapserver.mytopo.com.

Table 1 - Summary of LGCI's Explorations
Proposed High School
Central Falls, RI
LGCI Project No. 2232

Exploration No.	Ground Surface Elevation (ft.)[1]	Groundwater[2] Depth / El. (ft.)	Bottom of Asphalt / **Topsoil** Depth / El. (ft.)	Bottom of Fill Depth / El. (ft.)	Bottom of Peat / **Organic Soil** Depth / El. (ft.)	Bottom of Silt Depth / El. (ft.)	Bottom of Sand Depth / El. (ft.)	Bottom of Exploration Depth / El. (ft.)
July 2022 Explorations								
B-3	-	8.0 / **-**	0.5 / **-**	8.0 / **-**	- / **-**	84.0 / **-**	101.0 [3]/ **-**	101.0 / **-**
B-4-OW	-	8.0 / **-**	0.5 / **-**	8.0 / **-**	- / **-**	**94.0** / **-**	101.0 [3]/ **-**	101.0 / **-**
December 2022 Explorations								
B-101	58.0	8.0 / **50.0**	0.3 / **57.7**	21.7 / **36.3**	29.0 / **29.0**	- / **-**	96.0 [3]/ **-38.0**	96.0 / **-38.0**
B-102	61.5	4.0 / **57.5**	0.3 / **61.2**	22.5 / **39.0**	23.5 / **38.0**	**-** / **-**	61.0 [3]/ **0.5**	61.0 / **0.5**
B-103	-	4.0 / **-**	0.3 / **-**	24.0 / **-**	27.5 / **-**	32.0 / **-**	61.0 [3]/ **-**	61.0 / **-**
B-104	59.5	6.0 / **53.5**	0.3 / **59.2**	18.0 / **41.5**	20.0 / **39.5**	- / **-**	61.0 [3]/ **-1.5**	61.0 / **-1.5**
B-105	57.5	4.0 / **53.5**	**0.3** / **57.2**	26.0 / **31.5**	36.0 / **21.5**	49.0 / **8.5**	61.0 [3]/ **-3.5**	61.0 / **-3.5**
B-106-OW	56.0	6.0 / **50.0**	**0.3** / **55.7**	18.0 / **38.0**	**28.0** / **28.0**	- / **-**	61.0 [3]/ **-5.0**	61.0 / **-5.0**
B-107	56.0	8.0 / **48.0**	**0.5** / **55.5**	18.0 / **38.0**	**28.0** [4]/ **28.0**	- / **-**	51.0 [3]/ **5.0**	51.0 / **5.0**
P-1	61.5	4.0 / **57.5**	0.3 / **61.2**	6.0 / **55.5**	- / **-**	- / **-**	32.0 [3]/ **29.5**	32.0 / **29.5**
P-2	62.0	11.0 / **51.0**	0.3 / **61.7**	8.0 / **54.0**	- / **-**	- / **-**	31.0 [3]/ **31.0**	31.0 / **31.0**
P-3	62.5	9.0 / **53.5**	0.3 / **62.2**	19.0 / **43.5**	21.0 / **41.5**	- / **-**	31.0 [3]/ **31.5**	31.0 / **31.5**
P-4	-	4.0 / **-**	0.3 / **-**	6.0 / **-**	- / **-**	- / **-**	32.0 [3]/ **-**	32.0 / **-**

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.
2. Groundwater was measured during drilling, at the end of drilling, after drilling, or based on sample moisture whichever is shallower.
3. Boring terminated in the sand layer.
4. A layer of peat was encountered above the buried organinc soil layer between the depths of 18 feet and 22 feet.
5. "-" means groundwater or layer was not encountered.

N

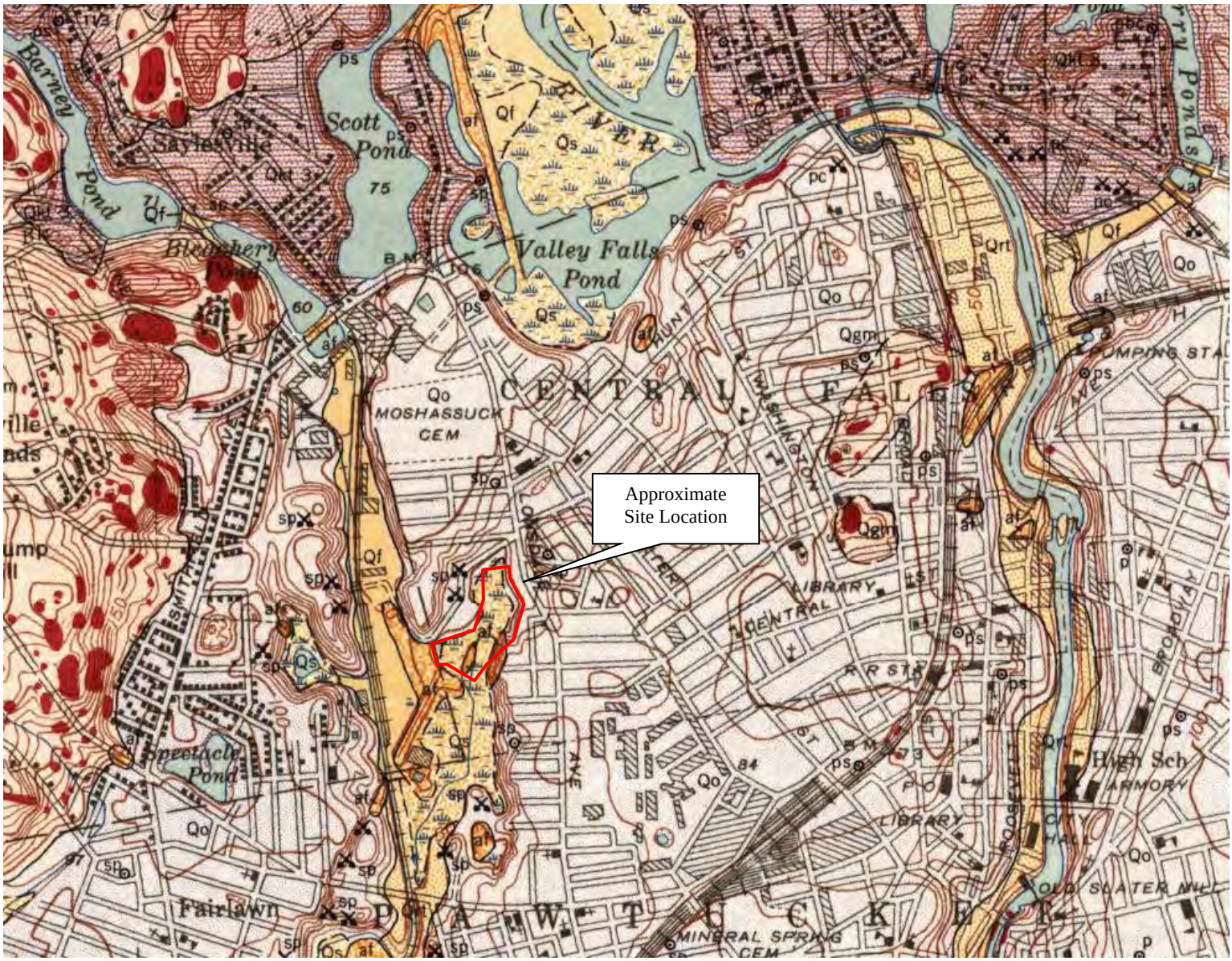
Contour Intervals: 3 meters

0.4 mi

Note: Figure based on USA Topo Maps of Central Falls, RI obtained from https://viewer.nationalmap.gov/

Client:	Project:	
Ai3 Architects, LLC	Proposed Central Falls High School	Figure 1 – Site Location Map

	Project Location:	LGCI Project No.:	Date:
LGCI Lahlaf Geotechnical Consulting, Inc.	Central Falls, RI	2232	Aug. 2023



Note: Figure based on map titled: "Geologic Map of the Pawtucket Quadrangle, Rhode Island-Massachusetts, Surficial Geology" prepared by Newton E. Chute, Pawtucket, Rhode Island-Massachusetts.

Client:	Project:	Figure 2 – Surficial Geologic Map	
Ai3 Architects, LLC	Proposed Central Falls High School		
LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Central Falls, RI	LGCI Project No.: 2232	Date: Aug. 2023

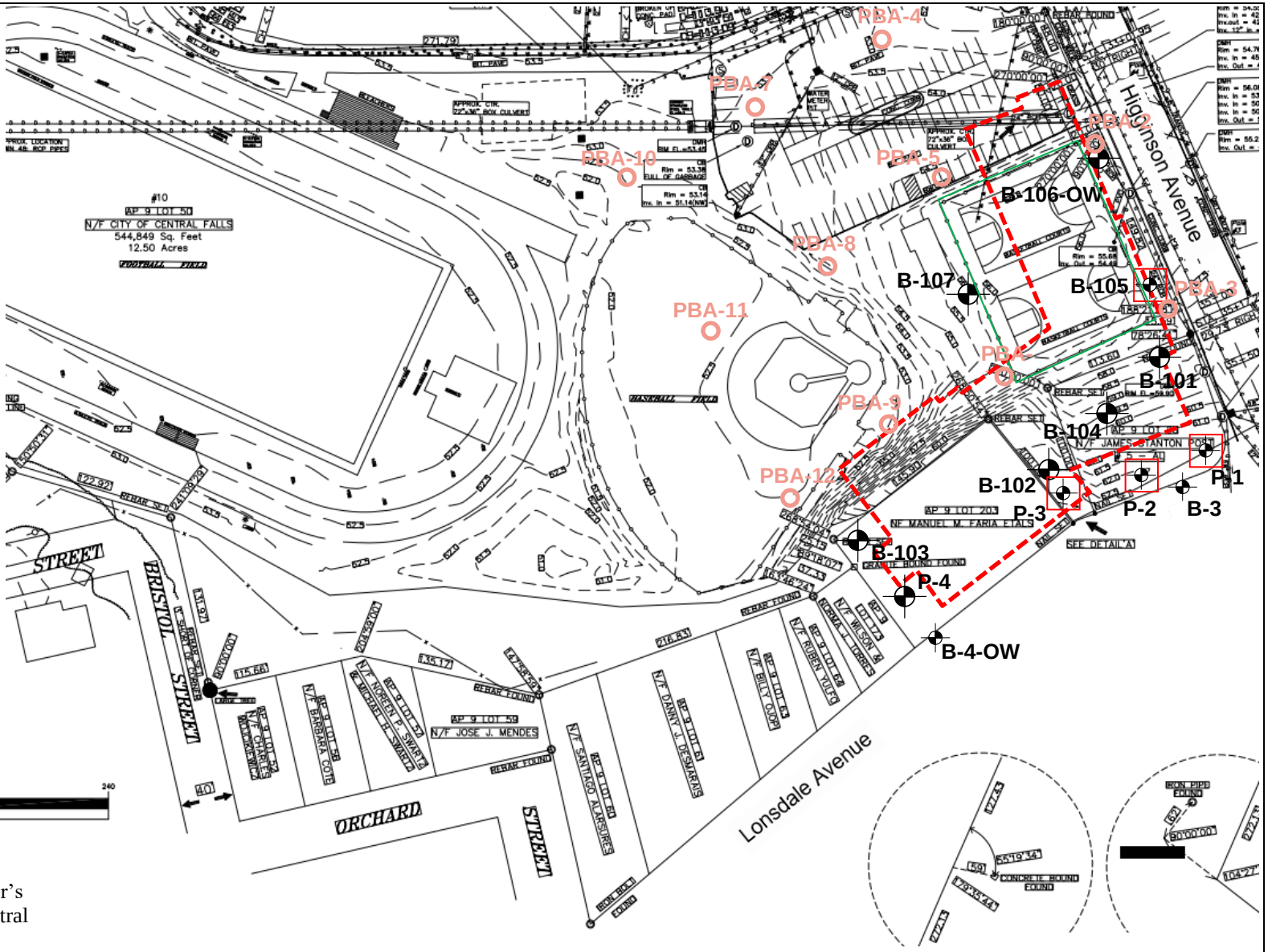
Legend

Approximate location of borings advanced by Northern Drill Services, Inc. (NDS) of Northborough, MA between July 18 and 25, 2022 and observed by Lahlaf Geotechnical Consulting, Inc. (LGCI).

Approximate location of borings advanced by NDS between December 12 and 27, 2022, and observed by LGCI.

Approximate location of probes advanced by NDS between December 14 and 21, 2022, and observed by LGCI.

Boring advanced by Paul B. Aldinger & Associates, Inc. at the site in 2021.



Note

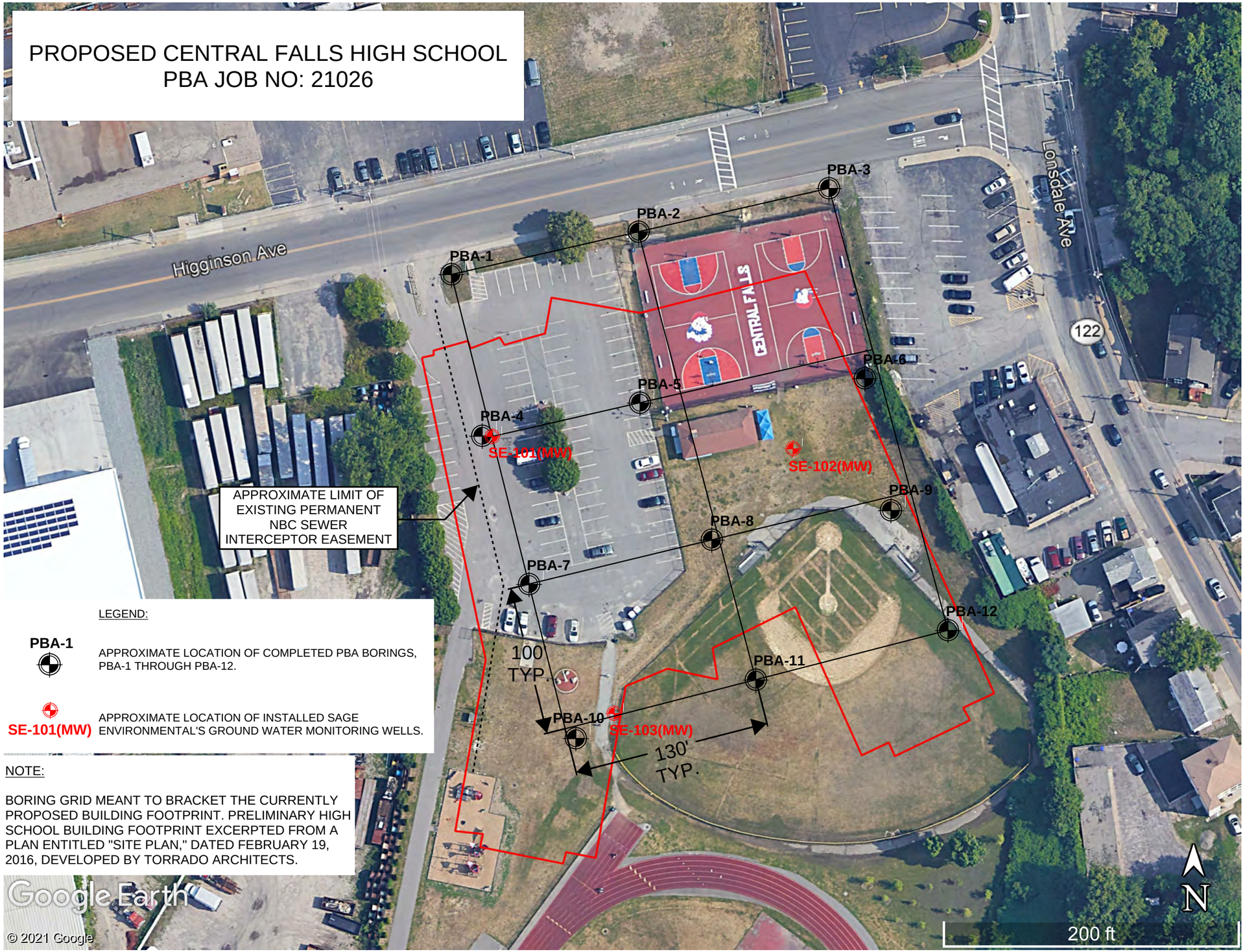
Figure based on drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

Proposed building limits based on a sketch provided to us by Ai3 Architects vis e-mail on 08/22/22.

Client: Ai3 Architects, LLC	Project: Proposed Central Falls High School	Figure 3 – Exploration Location Plan	
LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Central Falls, RI	LGCI Project No.: 2232	Date: Aug. 2023

Appendix A – Locations and Logs of Previous Borings by PBA

PROPOSED CENTRAL FALLS HIGH SCHOOL
PBA JOB NO: 21026



LEGEND:

PBA-1 — APPROXIMATE LOCATION OF COMPLETED PBA BORINGS, PBA-1 THROUGH PBA-12.

SE-101(MW) — APPROXIMATE LOCATION OF INSTALLED SAGE ENVIRONMENTAL'S GROUND WATER MONITORING WELLS.

NOTE:

BORING GRID MEANT TO BRACKET THE CURRENTLY PROPOSED BUILDING FOOTPRINT. PRELIMINARY HIGH SCHOOL BUILDING FOOTPRINT EXCERPTED FROM A PLAN ENTITLED "SITE PLAN," DATED FEBRUARY 19, 2016, DEVELOPED BY TORRADO ARCHITECTS.

Paul B. Aldinger & Associates, Inc.
Geotechnical Engineering and Hydrogeology
860A Waterman Avenue, Suite 9
East Providence, RI 02914
Phone: (401) 435-5570 Fax: (401) 435-5569

PROPOSED CENTRAL FALLS HIGH SCHOOL

Higginson Avenue
Central Falls, Rhode Island

BORING LOCATION PLAN

PBA JOB NO.: 21026
DATE: DECEMBER 2021
SCALE: 1" = 62.5'±
DRAWN BY: TGL
DESIGNED BY:
CHECKED BY: DN

Figure No: **3**

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-1

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 4.8 FT AFTER 0 HRS

AT ___ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/22/21

DATE FINISHED: 11/23/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Cathead utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	1	4	6	5	**6"**	Topsoil/Subsoil.	1	24	17
									Dry, medium dense, dark brown fine to coarse SAND, some Gravel, little Silt, trace Asphalt.			
		3'-5'	D	16	10	8	4		Wet, medium dense, brown fine to coarse SAND AND GRAVEL, trace Silt (3" spoon utilized for sample).	2	24	0
5												
								FILL				
									Casing dropped to 10 feet upon rollerbit advance.			
10												
		10'-12'	D	17	11	9	6		Wet, medium dense, brown fine to coarse GRAVEL, little fine to coarse Sand (3" spoon utilized for additional sample).	3	24	3
								13'				
		13'-15'	D	11	6	5	6		Wet, medium dense, brown fine to coarse SAND, little fine Gravel, little Silt, trace Organics.	4	24	14
15		(MOIST. CONTENT: 14% / FINES: 13%), N.P.										
		18'-20'	D	9	4	1	1		Wet, loose, gray fine to coarse SAND AND SILT, trace Organics (Organic Odor).	5	24	15
20		(MOIST. CONTENT: 23% / FINES: 41%), N.P.							Bottom 4" - Wet, gray fine to coarse SAND, little Gravel, trace Silt.			
		23'-25'	D	5	2	3	4			6	24	19
25		(MOIST. CONTENT: 449% / ORG. CONTENT: 90%)							Wet, dark brown PEAT with Roots and leaf matter.			
								ORGANICS				
		28'-30'	D	2	2	2	3		Wet, very loose, dark brown fibrous PEAT.	7	24	24
30		(MOIST. CONTENT: 417% / ORG. CONTENT: 31%)										
		33'-35'	D	1	2	3	4		Wet, loose, dark brown fibrous PEAT.	8	24	24
35		(MOIST. CONTENT: 418% / ORG. CONTENT: 50%)										
		38'-40'	D	1/12"		2	2		Wet, very loose, dark brown PEAT.	9	24	24
40		(MOIST. CONTENT: 184% / ORG. CONTENT: 56%)										

GROUND SURFACE TO 38 FT., USED 4 " CASING:

THEN 3" casing to 83 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 19

HOLE NO.: PBA-1

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-1

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 4.8 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/22/21

DATE FINISHED: 11/23/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Cathead utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		43'-45'	D	WOH/12"	2	3			Wet, very loose, dark brown ORGANIC fine Sand and	10	24	24
		(MOIST. CONTENT: 130% / ORG. CONTENT: 11%)							Silt.			
45												
		48'-50'	D	WOR/12"	3	3			Wet, very loose, brown SILT, some fine to coarse	11	24	15
		(MOIST. CONTENT: 35% / FINES: 75%), N.P.						ORGANICS	Sand, little fine to coarse Gravel, trace Organics.			
50												
		53'-55'	D	WOR/24"					Wet, very loose, light brown CLAYEY SILT, little fine	12	24	24
		(MOIST. CONTENT: 45% / FINES: 95%), P.I. Est. 1-5							to coarse Sand, trace fine Gravel, little Organics.			
55												
		58'-60'	D	5	4	5	6	59'	Wet, loose, gray/black, fine to medium SAND, trace coarse Sand, trace Roots.	13	24	21
60									Wet, brown fine SAND, trace medium Sand, trace Silt.			
		63'-65'	D	3	4	7	10		Wet, medium dense, brown fine to coarse SAND,	14	24	9
		(MOIST. CONTENT: 22% / FINES: 2%), N.P.							trace Silt.			
65												
		68'-70'	D	5	8	12	12		Wet, medium dense, brown fine SAND, trace Silt	15	24	1
70								GLACIAL OUTWASH	(limited recovery).			
		73'-75'	D	5	6	9	10		*No Recovery.	16	24	0
75												
		78'-80'	D	8	13	17	16		Wet, dense, brown fine SAND, trace Silt	17	24	3
80									(limited recovery).			

GROUND SURFACE TO 38 FT., USED 4 " CASING:

THEN 3" casing to 83 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 19

HOLE NO.: PBA-1

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-1

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 4.8 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/22/21

DATE FINISHED: 11/23/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Cathead utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	8	17	23	28		Wet, dense, brown fine to coarse SAND, trace Silt	18	24	4
90		(MOIST. CONTENT: 23% / FINES: 6%), N.P.						GLACIAL OUTWASH	(limited recovery).			
95												
		98'-100'	D	15	20	26	27		Wet, dense, dark brown fine to coarse SAND, trace	19	24	5
100		(MOIST. CONTENT: 17% / FINES: 10%), N.P.						100'	Silt (limited recovery).			
									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 38 FT., USED 4 " CASING:

THEN 3" casing to 83 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 19

HOLE NO.: PBA-1

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 2

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-2

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 6.5 FT AFTER 0 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/19/21

DATE FINISHED: 11/22/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	2	4	5	5	**3"**	Topsoil.	1	24	18
									Dry, loose, brown/red fine SAND, some Gravel, trace medium to coarse Sand, trace Silt, trace Brick.			
		3'-5'	D	5	7	8	7		Wet, medium dense, brown fine to medium SAND,	2	24	13
5									trace Gravel, trace coarse Sand, trace Silt, trace Brick.			
		8'-10'	D	1/24"				FILL	Wet, very loose, gray fine SAND, some	3	24	22
		(MOIST. CONTENT: 22% / FINES: 28%), N.P.							Silt, trace fine to coarse Gravel, trace Roots.			
10												
		13'-15'	D	WOH/24"					Wet, very loose, gray fine to coarse GRAVEL, some	4	24	20
		(MOIST. CONTENT: 17% / FINES: 29%), N.P.							Silt, some fine to coarse Sand, trace Roots.			
15												
								17'				
		18'-20'	D	WOH	1/18"				Wet, very loose, gray SILT, some fine Sand, little	5	24	22
		(MOIST. CONTENT: 91% / FINES: 86%), N.P.							Roots/Wood.			
20												
								ORGANICS	Dark brown wash water indicative of possible PEAT.			
		23'-25'	D	1	1	2	10		Wet, very loose, dark brown ORGANIC fine to	6	24	23
		(MOIST. CONTENT: 72% / ORG. CONTENT: 9%)							medium Sand.			
25												
								27'	Dark brown wash water indicative of possible PEAT.			
		28'-30'	D	5	8	6	6		Wet, medium dense, gray/brown/reddish SILT, little	7	24	13
30									fine to coarse Sand, trace Gravel (varved).			
								GLACIAL				
		33'-35'	D	4	3	3	5	OUTWASH	Wet, loose, brown fine to coarse GRAVEL, little fine	8	24	9
		(MOIST. CONTENT: 12% / FINES: 3%), N.P.							to coarse Sand, trace Silt.			
35												
									Cobble at 37 feet.			
		38'-40'	D	10	4	4	5		Wet, loose, brown fine to coarse SAND, some fine	9	24	7
		(MOIST. CONTENT: 17% / FINES: 3%), N.P.							to coarse Gravel, trace Silt.			
40												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN open hole to 60 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 60

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 13

HOLE NO.: PBA-2

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 2

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-2

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 6.5 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/19/21

DATE FINISHED: 11/22/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
45		43'-45'	D	2	2	2	3		Wet, very loose, brown fine to coarse GRAVEL, little fine to coarse Sand, trace Silt.	10	24	7
		(MOIST. CONTENT: 13% / FINES: 2%), N.P.										
		48'-50'	D	6	9	12	5		Wet, medium dense, gray fine to coarse GRAVEL,	11	24	3
50								GLACIAL OUTWASH	some fine to coarse Sand, trace Silt.			
		53'-55'	D	6	7	3	4		Wet, medium dense, gray/brown fine to coarse	12	24	2
55									GRAVEL, little fine to coarse Sand (3" spoon utilized for additional sample).			
		58'-60'	D	8	6	7	11		Wet, medium dense, gray/brown fine to coarse	13	24	7
60								60'	GRAVEL, little fine to coarse Sand.			
									Bottom of Boring at 60 feet.			
65												
70												
75												
80												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN open hole to 60 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 60

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 13

HOLE NO.: PBA-2

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 2

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-3

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 10 FT AFTER 0 HRS

AT ___ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/22/21

DATE FINISHED: 11/23/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	4	6	7	7	**3"**	Topsoil.	1	24	20
									Dry, medium dense, brown fine to coarse SAND, some Gravel, little Silt, trace Asphalt/Roots.			
		3'-5'	D	11	13	14	12		Dry, medium dense, dark brown/black GRAVEL AND fine to coarse SAND, trace Silt, trace Asphalt.	2	24	19
5												
								FILL				
		8'-10'	D	26	24	19	20		Wet, dense, dark brown fine to coarse GRAVEL, little fine to coarse Sand, trace Roots.	3	24	13
10												
		13'-15'	D	1/12"		1	2		Wet, very loose, brown fine to coarse SAND AND fine to coarse GRAVEL, trace Silt, trace Glass.	4	24	7
		(MOIST. CONTENT: 21% / FINES: 8%), N.P.										
15								**17'**				
		18'-20'	D	1	1	2	5		Wet, very loose, gray fine to coarse SAND, little fine Gravel, little Silt, trace Organics.	5	24	12
		(MOIST. CONTENT: 23% / FINES: 12%), N.P.										
20												
		23'-25'	D	2	3	3	4		Wet, loose, gray fine to coarse SAND, little fine to coarse Gravel, trace Silt, trace Roots.	6	24	11
		(MOIST. CONTENT: 18% / FINES: 4%), N.P.						**ORGANICS**				
25												
		28'-30'	D	1	2	2	5		Wet, very loose, dark brown PEAT.	7	24	24
		(MOIST. CONTENT: 427% / ORG. CONTENT: 89%)										
30								**33'**				
		34'-36'	D	2	3	4	4		Wet, loose, brown fine to coarse SAND, some fine to coarse Gravel, trace Silt.	8	24	9
35		(MOIST. CONTENT: 16% / FINES: 5%), N.P.						**GLACIAL OUTWASH**				
		40'-42'	D	1	3	2	4		Wet, loose, brown fine to coarse SAND, some fine to coarse Gravel, trace Silt.	9	24	10
40		(MOIST. CONTENT: 14% / FINES: 4%), N.P.										

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN open hole to 65 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 65

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 14

HOLE NO.: PBA-3

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 2

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-3

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 10 FT AFTER 0 HRS

AT ___ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/22/21

DATE FINISHED: 11/23/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
45		43'-45'	D	1	1	2	4		Wet, very loose, brown fine to medium SAND, some fine Gravel, trace Silt.	10	24	14
		(MOIST. CONTENT: 22% / FINES: 3%), N.P.										
50		48'-50'	D	2	3	3	5		Wet, loose, brown fine to medium SAND, trace fine Gravel, trace Silt.	11	24	14
		(MOIST. CONTENT: 24% / FINES: 5%), N.P.										
								GLACIAL OUTWASH				
55		53'-55'	D	5	7	6	7		Wet, medium dense, brown fine to medium SAND, trace coarse Sand, trace Silt.	12	24	24
60		58'-60'	D	5	8	9	12		Wet, medium dense, brown fine SAND, trace medium Sand, trace Silt.	13	24	12
65		63'-65'	D	5	13	17	15		Wet, dense, light gray fine SAND, little Silt. Bottom 6" - Wet, brown GRAVEL, some fine to coarse Sand, little Silt.	14	24	14
		(MOIST. CONTENT: 23% / FINES: 14%), N.P.						**65'**				
									Bottom of Boring at 65 feet.			
70												
75												
80												

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN open hole to 65 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 65

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 14

HOLE NO.: PBA-3

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-4

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 20.5 FT AFTER ___ HRS

AT ___ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW	S/S	---
SIZE, I.D.	---	4"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/05/21

DATE FINISHED: 11/09/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Cathead utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
								3"	Asphalt.			
		0.5'-2.5'	D	21	10	7	7		Moist, medium dense, dark brown fine to coarse Sand, some Gravel, some Silt.	1	24	16
		3'-5'	D	3	2	4	5		Moist, loose, brown/gray fine SAND, little Organics, trace Gravel.	2	24	14
5												
								8'				
		8'-10'	D	5	6	6	6		Wet, medium dense, gray/dark brown fine SAND, little Silt, trace Organics (Organic Odor).	3	24	16
10												
		13'-15'	D	3	2	2	4		Wet, very loose, dark brown ORGANIC SILT, trace Wood/Roots.	4	24	16
		(MOIST. CONTENT: 60% / ORG. CONTENT: 15%)										
15												
		18'-20'	D	2	1	2	2		Wet, very loose, gray fine to medium SAND, little fine to coarse Gravel, trace Silt (Organic Odor).	5	24	12
		(MOIST. CONTENT: 19% / FINES: 2%), N.P.										
20												
		23'-25'	D	6	4	6	9	ORGANICS	Wet, medium dense, gray fine to coarse SAND, trace fine Gravel, trace Silt (Organic Odor).	6	24	14
		(MOIST. CONTENT: 17% / FINES: 4%), N.P.										
25												
		28'-30'	D	3	5	7	9		Wet, medium dense, dark brown PEAT.	7	24	20
		(MOIST. CONTENT: 385% / ORG. CONTENT: 90%)										
30												
		33'-35'	D	2	3	6	9		Wet, loose, dark brown fibrous PEAT.	8	24	23
		(MOIST. CONTENT: 323% / ORG. CONTENT: 54%)										
35												
		38'-40'	D	3	4	5	8		Wet, loose, dark brown fibrous PEAT.	9	24	22
		(MOIST. CONTENT: 133% / ORG. CONTENT: 19%)										
40												

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 19

HOLE NO.: PBA-4

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-4

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 20.5 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW	S/S	---
SIZE, I.D.	---	4"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/05/21

DATE FINISHED: 11/09/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Cathead utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		43'-45'	D	4	3	2	2		Wet, loose, gray SILT, some fine Sand, trace Roots.	10	24	24
45		(MOIST. CONTENT: 34% / FINES: 72%), N.P.						ORGANICS				
		48'-50'	D	1	2	11	9	**49'**	Wet, gray SILT, trace fine Sand, trace Roots.	11	24	17
50									Bottom 5" - Wet, gray fine to medium SAND, trace Silt.			
		53'-55'	D	7	7	7	7		Wet, medium dense, brown/gray fine to coarse SAND, little Gravel, trace Silt.	12	24	10
55												
		58'-60'	D	5	5	6	14		Wet, medium dense, brown fine to coarse SAND, trace Silt.	13	24	6
60												
		63'-65'	D	3	4	5	7		Wet, loose, brown fine to coarse SAND, trace Silt.	14	24	10
65		(MOIST. CONTENT: 22% / FINES: 2%), N.P.						GLACIAL OUTWASH				
		68'-70'	D	3	6	8	10		Wet, medium dense, brown fine to medium SAND, trace coarse Sand, trace Silt.	15	24	14
70												
		73'-75'	D	8	8	14	21		Wet, medium dense, brown fine SAND, trace Silt.	16	24	16
75												
		78'-80'	D	10	11	14	15		Wet, medium dense, brown fine to coarse SAND, trace Silt.	17	24	10
80		(MOIST. CONTENT: 23% / FINES: 6%), N.P.										

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 19

HOLE NO.: PBA-4

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-4

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 20.5 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW	S/S	---
SIZE, I.D.	---	4"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/05/21

DATE FINISHED: 11/09/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Cathead utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	16	14	21	28		Wet, dense, brown fine SAND, trace medium to	18	24	14
90								GLACIAL OUTWASH	coarse Sand, trace Silt.			
95												
		98'-100'	D	9	10	13	16		Wet, medium dense, brown fine to coarse SAND,	19	24	12
		(MOIST. CONTENT: 23% / FINES: 7%), N.P.						100'	trace Silt.			
100									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 19

HOLE NO.: PBA-4

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 4

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-5

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 8.6 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW	S/S	---
SIZE, I.D.	---	4"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/04/21

DATE FINISHED: 11/09/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
								4"	Asphalt.			
		0.5'-2.5'	D	18	15	13	13		Moist, light/dark brown fine to coarse SAND, some Gravel, little Silt.	1	24	17
		3'-5'	D	4	8	5	5		Wet, medium dense, dark brown/gray fine to medium SAND, some Silt, trace Gravel.	2	24	15
5												
		8'-10'	D	7	8	5	4		Moist, medium dense gray fine SAND AND SILT	3	24	16
								FILL	Moist, gray/brown fine to medium SAND, trace Silt, trace Wood.			
10												
		13'-15'	D	4	3	3	2		Wet, loose, gray fine to medium SAND, trace Silt.	4	24	6
		(MOIST. CONTENT: 22% / FINES: 3%), N.P.										
15								**18'**				
		18'-20'	D	2	3	4	5		Wet, loose, dark brown sandy PEAT.	5	24	24
		(MOIST. CONTENT: 354% / ORG. CONTENT: 72%)										
20								**ORGANICS**				
		23'-25'	D	WOH/12"	1	3			Wet, very loose, very dark gray SILT, some fine to medium Sand, trace Roots.	6	24	20
		(MOIST. CONTENT: 41% / FINES: 71%), N.P.										
25								**27'**				
		28'-30'	D	2	3	4	4		No Recovery, Gravel Wash.	7	24	0
30												
								GLACIAL OUTWASH				
		33'-35'	D	1	3	4	4		Wet, loose, gray fine to coarse SAND, little fine Gravel, trace Silt.	8	24	11
		(MOIST. CONTENT: 18% / FINES: 3%), N.P.										
35												
		38'-40'	D	1	3	4	5		Wet, loose, gray fine to medium SAND, trace fine Gravel, trace Silt.	9	24	11
		(MOIST. CONTENT: 18% / FINES: 2%), N.P.										
40												

GROUND SURFACE TO 145 FT., USED 4 " CASING:

THEN open hole to 148.5 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 148.5

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 24

HOLE NO.: PBA-5

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY:

PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 4

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-5

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 8.6 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW	S/S	---
SIZE, I.D.	---	4"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/04/21

DATE FINISHED: 11/09/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		43'-45'	D	1	2	3	5		Wet, loose, gray fine SAND, trace Silt.	10	24	6
		(MOIST. CONTENT: 11% / FINES: 8%), N.P.										
45												
		48'-50'	D	1	2	4	6		Wet, loose, gray fine SAND, trace Silt.	11	24	10
		(MOIST. CONTENT: 22% / FINES: 4%), N.P.										
50												
		53'-55'	D	2	5	8	10		Wet, medium dense, brown fine SAND, trace Silt, trace Roots.	12	24	16
55									Bottom 3" - Wet, brown Silt, trace fine Sand.			
		58'-60'	D	2	6	7	8		Wet, medium dense, gray fine SAND, some Silt.	13	24	16
60								GLACIAL OUTWASH				
		63'-65'	D	12	16	16	16		Wet, dense, gray SILT, little fine Sand.	14	24	15
65												
		68'-70'	D	6	9	9	13		Wet, medium dense, gray SILT AND CLAY, trace fine Sand.	15	24	14
		(MOIST. CONTENT: 26% / FINES: 98%), P.I. Est. 5-10										
70									Bottom 2" - Wet, gray SAND AND GRAVEL, trace Silt.			
		73'-75'	D	12	15	9	6		Wet, medium dense, gray fine to coarse Gravel, some fine to coarse Sand.	16	24	10
75									Bottom 6" - Wet, gray SILT, little fine SAND.			
		78'-80'	D	6	5	4	6		Wet, loose, gray fine to medium SAND, some Gravel, trace Silt, coarse piece of gravel in spoon tip.	17	24	5
80												

GROUND SURFACE TO 145 FT., USED 4 " CASING:

THEN open hole to 148.5 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 148.5

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 24

HOLE NO.: PBA-5

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 4

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-5

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 8.6 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW	S/S	---
SIZE, I.D.	---	4"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/04/21

DATE FINISHED: 11/09/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		83'-85'	D	1	1	2	6		Wet, dark brown fine to coarse SAND, little fine to	18	24	14
		(MOIST. CONTENT: 16% / FINES: 8%), N.P.							coarse Gravel, trace Silt.			
85									Wet, gray SILT, trace fine SAND.			
90												
		93'-95'	D	5	18	14	14		Wet, dense, gray fine to medium SAND, some	19	24	13
95									Gravel, trace coarse Sand, trace Silt. Bottom 4" - Coarse Gravel present.			
100								GLACIAL OUTWASH				
		103'-105'	D	25	37	41	100		Wet, very dense, gray GRAVEL, little fine to coarse	20	24	9
105									Sand, trace Silt.			
110												
		113'-115'	D	4	2	6	6		Wet, loose, brown fine to coarse SAND, little fine to	21	24	11
		(MOIST. CONTENT: 22% / FINES: 6%), N.P.							coarse Gravel, trace Silt.			
115												
120												

GROUND SURFACE TO 145 FT., USED 4 " CASING:

THEN open hole to 148.5 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 148.5

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 24

HOLE NO.: PBA-5

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 4 OF 4

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-5

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 8.6 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW	S/S	---
SIZE, I.D.	---	4"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/04/21

DATE FINISHED: 11/09/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		123'-125'	D	21	10	8	16		Wet, medium dense, gray fine to coarse SAND AND GRAVEL, trace Silt (3" spoon utilized for additional sample).	22	24	4
125												
130								GLACIAL OUTWASH				
		133'-135'	D	2	6	9	15		Wet, medium dense, brown fine to medium SAND, trace Gravel, trace coarse Sand, trace Silt.	23	24	13
135												
140												
		143'-145'	D	2	8	18	21		Wet, medium dense, brown fine to medium SAND, trace Silt.	24	24	18
145									Bottom 6" - Wet, brown GRAVEL, some fine to coarse Sand, fractured piece of rock in spoon tip. Boulder 147'-148'.			
								148.5'				
150									Bottom of Boring at 148.5 feet.			
155												
160												

GROUND SURFACE TO 145 FT., USED 4 " CASING:

THEN open hole to 148.5 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 148.5

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 24

HOLE NO.: PBA-5

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-6

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 19.4 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/09/21

DATE FINISHED: 11/11/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	2	4	3	3	4"	Topsoil.	1	24	21
									Dry, loose, brown fine to coarse SAND, little Gravel, little Silt, trace Roots/Glass.			
		3'-5'	D	5	2	2	2			2	24	9
5									Moist, brown/gray fine SAND, trace Silt, trace Roots.			
		8'-10'	D	14	19	10	6		Top 6" - Wood.	3	24	13
10								FILL	Bottom 7" - Gray/Red GRAVEL AND fine to coarse SAND, trace Brick/Roots.			
		13'-15'	D	2	2	1	2		Wet, very loose, very dark brown fine to coarse SAND,	4	24	8
15		(MOIST. CONTENT: 16% / FINES: 3%), N.P.							some fine to coarse Gravel, trace Silt, trace Glass (slight Organic Odor).			
								17'				
		18'-20'	D	1	3	5	3		Wet, loose, very dark brown SILT AND CLAY, some	5	24	4
20		(MOIST. CONTENT: 56% / FINES: 73%), P.I. Est. 5-10							fine to medium Sand.			
		(MOIST. CONTENT: 117% / ORG. CONTENT: 30%)							Wet, dark brown fibrous PEAT.			
		23'-25'	D	3	4	1	7	ORGANICS	Wet, gray CLAYEY SILT, trace fine Sand, trace Roots.	6	24	19
25		(MOIST. CONTENT: 36% / FINES: 96%), P.I. Est. 1-5										
								28'				
		28'-30'	D	5	5	5	5		Wet, medium dense, brown fine to coarse SAND,	7	24	9
30		(MOIST. CONTENT: 18% / FINES: 4%), N.P.							little fine to coarse Gravel, trace Silt.			
		33'-35'	D	3	3	2	4	GLACIAL	Wet, loose, gray fine to coarse SAND, little fine Gravel,	8	24	6
35		(MOIST. CONTENT: 19% / FINES: 2%), N.P.						OUTWASH	trace Silt.			
		38'-40'	D	3	2	3	5		Wet, loose, brown fine to medium SAND, trace	9	24	5
40									coarse Sand, trace Gravel, trace Silt.			

GROUND SURFACE TO 78 FT., USED 4 " CASING:

THEN 3" casing to 91 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 16

HOLE NO.: PBA-6

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-6

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 19.4 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/09/21

DATE FINISHED: 11/11/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		43'-45'	D	5	4	7	8		Wet, medium dense, gray fine to coarse SAND, some	10	24	3
45		(MOIST. CONTENT: 18% / FINES: 3%), N.P.							fine to coarse Gravel, trace Silt.			
		48'-50'	D	6	8	11	13		Wet, medium dense, brown fine to coarse SAND,	11	24	3
50									trace Silt.			
55												
		58'-60'	D	3	4	9	13		Wet, medium dense, brown fine to medium SAND,	12	24	11
60								GLACIAL OUTWASH	trace Silt.			
65												
		68'-70'	D	11	11	14	12		Wet, medium dense, gray CLAYEY SILT, trace fine	13	24	16
70		(MOIST. CONTENT: 22% / FINES: 92%), P.I. Est. 1-5							Sand.			
75												
		77.5'-79.5'	D	20	17	17	20		Wet, dense, light/dark gray SILT AND fine SAND.	14	24	16
80												

GROUND SURFACE TO 78 FT., USED 4 " CASING:

THEN 3" casing to 91 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 16

HOLE NO.: PBA-6

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-6

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 19.4 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/09/21

DATE FINISHED: 11/11/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	13	19	23	32		Wet, dense, dark brown fine SAND, little Silt.	15	24	14
90		(MOIST. CONTENT: 21% / FINES: 18%), N.P.						GLACIAL OUTWASH	Bottom 1" - Wet, brown SILT, trace fine Sand.			
95												
		98'-100'	D	16	24	20	18		Wet, dense, dark brown fine to coarse SAND, some fine to coarse Gravel, some Clay and Silt.	16	24	8
100		(MOIST. CONTENT: 13% / FINES: 30%), P.I. Est. 10-20						100'	Weathered Rock in spoon tip.			
									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 78 FT., USED 4 " CASING:

THEN 3" casing to 91 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 16

HOLE NO.: PBA-6

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-7

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 10.5 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/11/21

DATE FINISHED: 11/12/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
								4"	Asphalt.			
		0.5'-2.5'	D	19	18	18	10		Wet, dense, dark/light brown fine to coarse SAND AND GRAVEL, little Silt, trace Wood/Brick.	1	24	16
		3'-5'	D	3	4	6	6	FILL	Wet, medium dense, dark brown GRAVEL, some fine to coarse Sand, little Silt, piece of coarse Gravel near bottom of spoon.	2	24	5
5												
								8'				
		8.5'-10.5'	D	WOH	5	1	2		Wet, loose, very dark brown fine to coarse SAND, little fine to coarse Gravel, little Silt, trace Roots.	3	24	11
		(MOIST. CONTENT: 21% / FINES: 15%), N.P.										
10												
		13'-15'	D	2	2	2	2		No Recovery.	4	24	0
								ORGANICS	Dark brown, Organic wash water observed, 12'-17'.			
15												
		18'-20'	D	WOH/24"					Wet, very loose, gray SILT AND CLAY, little fine to medium Sand, some Roots/Organics.	5	24	24
		(MOIST. CONTENT: 41% / FINES: 83%), P.I. Est. 5-10										
20												
								23'				
		23'-25'	D	1	1	2	3		Wet, very loose, light brown fine to coarse SAND, some fine to coarse Gravel, trace Silt.	6	24	11
		(MOIST. CONTENT: 17% / FINES: 2%), N.P.										
25												
		28'-30'	D	1	1	3	2		Wet, very loose, light brown fine to coarse SAND, some fine Gravel, trace Silt.	7	24	10
		(MOIST. CONTENT: 17% / FINES: 3%), N.P.										
30								GLACIAL OUTWASH				
		33'-35'	D	1	1	3	3		Wet, very loose, light brown fine to coarse SAND, some fine Gravel, trace Silt (3" spoon utilized for sample).	8	24	0
		(MOIST. CONTENT: 21% / FINES: 2%), N.P.										
35												
		38'-40'	D	1	3	4	5		Wet, loose, gray fine to medium SAND, trace Silt.	9	24	9
		(MOIST. CONTENT: 23% / FINES: 7%), N.P.										
40												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 83 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-7

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-7

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 10.5 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/11/21

DATE FINISHED: 11/12/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
45		43'-45'	D	1	1	1	3		Wet, very loose, brown fine SAND, trace Silt.	10	24	9
		(MOIST. CONTENT: 29% / FINES: 3%), N.P.										
		48'-50'	D	1	1	2	2		Wet, very loose, gray fine SAND AND SILT.	11	24	12
50		(MOIST. CONTENT: 28% / FINES: 37%), N.P.										
		53'-55'	D	WOH	1	3	4		Wet, very loose, gray fine SAND, some Silt.	12	24	12
55		(MOIST. CONTENT: 40% / FINES: 26%), N.P.										
		58'-60'	D	1	1	2	4		Wet, very loose, gray fine SAND, little Silt, trace	13	24	13
60		(MOIST. CONTENT: 23% / FINES: 13%), N.P.						GLACIAL OUTWASH	coarse Gravel.			
65		68'-70'	D	6	5	6	11		Wet, medium dense gray SILTY CLAY, trace fine	14	24	18
70		(MOIST. CONTENT: 27% / FINES: 82%), P.I. Est. 20-40							Sand.			
75		78'-80'	D	3	4	6	7		Wet, medium dense, gray CLAY AND SILT, trace fine	15	24	16
80		(MOIST. CONTENT: 37% / FINES: 91%), P.I. Est. 10-20							Sand.			

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 83 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH:	100
FOOTAGE IN ROCK:	---
WELL FOOTAGE:	---
NO. OF SAMPLES:	17
HOLE NO.:	PBA-7
TYPE:	Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-7

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 10.5 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/11/21

DATE FINISHED: 11/12/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	5	9	14	19		Wet, medium dense, gray SILTY CLAY, trace fine	16	24	15
90		(MOIST. CONTENT: 30% / FINES: 98%), P.I. Est. 20-40						GLACIAL OUTWASH	Sand.			
95												
		98'-100'	D	11	15	14	17		Wet, medium dense, dark gray fine to coarse SAND,	17	24	11
100		(MOIST. CONTENT: 16% / FINES: 7%), N.P.						100'	some fine to coarse Gravel, trace Silt.			
									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 83 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-7

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-8

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.1 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/17/21

DATE FINISHED: 11/18/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	3	6	8	9	**5"**	Topsoil.	1	24	21
									Dry, medium dense, brown fine to coarse SAND, little Gravel, little Silt, trace Roots.			
		3'-5'	D	2	2	4	4		Wet, loose, dark brown fine to medium SAND, little Silt, trace Wood (Organic Odor).	2	24	16
5												
								FILL				
		8'-10'	D	1	1	1	1		Wet, very loose, gray SILT AND fine to medium SAND, little fine Gravel.	3	24	14
		(MOIST. CONTENT: 25% / FINES: 49%), N.P.										
10												
		13'-15'	D	1	1	2	1		Wet, very loose, gray fine to coarse SAND, some fine Gravel, trace Silt.	4	24	6
		(MOIST. CONTENT: 18% / FINES: 7%), N.P.										
15								**16'**				
		18'-20'	D	2	2	2	4		Wet, very loose, dark brown fibrous PEAT.	5	24	17
		(MOIST. CONTENT: 386% / ORG. CONTENT: 56%)										
20								**ORGANICS**				
		23'-25'	D	WOH/21"			1		Wet, very loose, dark gray SILT, trace fine Sand, trace Roots.	6	24	24
		(MOIST. CONTENT: 53% / FINES: 92%), N.P.										
25									Wet, dark gray fine SAND, some Silt, trace Wood.			
								28'				
		28'-30'	D	WOH	1	1	2		Wet, very loose, gray fine to coarse SAND, some fine Gravel, trace Silt.	7	24	11
		(MOIST. CONTENT: 19% / FINES: 1%), N.P.										
30												
		33'-35'	D	WOH	1	1	1	**GLACIAL**	Wet, very loose, gray fine to coarse SAND, some	8	24	12
		(MOIST. CONTENT: 21% / FINES: 2%), N.P.						**OUTWASH**	fine Gravel, trace Silt.			
35												
		38'-40'	D	2	2	3	4		Wet, loose, gray fine to medium SAND, trace Silt.	9	24	8
		(MOIST. CONTENT: 23% / FINES: 2%), N.P.										
40												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-8

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-8

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.1 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/17/21

DATE FINISHED: 11/18/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		43'-45'	D	1	1	2	3		Wet, very loose, gray fine to coarse SAND, trace fine	10	24	13
45		(MOIST. CONTENT: 20% / FINES: 3%), N.P.							Gravel, trace Silt.			
		48'-50'	D	1	1	3	4		Wet, very loose, gray fine SAND, little Silt.	11	24	10
50		(MOIST. CONTENT: 27% / FINES: 13%), N.P.										
		53'-55'	D	1/12"		1	3		Wet, very loose, gray fine to medium SAND, trace Silt.	12	24	12
55		(MOIST. CONTENT: 27% / FINES: 3%), N.P.										
		58'-60'	D	5	4	5	6		Wet, loose, gray fine SILT, trace fine Sand.	13	24	18
60								GLACIAL OUTWASH				
65												
		68'-70'	D	8	9	10	8		Wet, medium dense, multi-colored GRAVEL,	14	24	3
70									little medium to coarse Sand.			
75												
		78'-80'	D	3	4	6	9		Wet, medium dense, dark gray fine to coarse SAND,	15	24	15
80		(MOIST. CONTENT: 18% / FINES: 17%), N.P.							little Clayey Silt, little fine to coarse Gravel.			

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-8

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-8

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.1 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/17/21

DATE FINISHED: 11/18/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	3	6	7	10		Wet, medium dense, brown/reddish fine to medium	16	24	11
90								GLACIAL OUTWASH	SAND, trace coarse Sand, trace Silt.			
95												
		98'-100'	D	2	5	7	8		Wet, medium dense, dark brown fine to coarse			
		(MOIST. CONTENT: 15% / FINES: 3%), N.P.						100'	SAND AND fine to coarse GRAVEL, trace Silt.	17	24	13
100									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-8

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-9

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.6 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/12/21

DATE FINISHED: 11/16/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	5	6	7	5	**3"**	Topsoil.	1	24	12
									Dry, brown/red, GRAVEL AND fine to coarse SAND, little Silt, trace Brick.			
		3'-5'	D	10	10	3	3		Wet, medium dense, brown/black SILT, some fine to coarse Sand, trace Gravel, trace Brick.	2	24	12
5								**FILL**				
		8'-10'	D	3	2	4	4		Wet, loose, very dark brown fine to coarse SAND, some fine to coarse Gravel, trace Silt, trace Glass, Wood.	3	24	13
		(MOIST. CONTENT: 20% / FINES: 9%), N.P.										
10								**13'**				
		13'-15'	D	11	6	9	22		Wet, medium dense, gray fine to medium SAND, trace Organics, trace Silt, trace Gravel (Organic Odor).	4	24	8
15												
		18'-20'	D	3	4	5	5		Wet, loose, dark brown fibrous PEAT.	5	24	11
		(MOIST. CONTENT: 321% / ORG. CONTENT: 66%)										
20								**ORGANICS**				
		23'-25'	D	4	3	2	1		Wet, loose, dark gray SILT AND CLAY, trace fine Sand, trace Organics.	6	24	22
		(MOIST. CONTENT: 36% / FINES: 92%), P.I. Est. 5-10										
25								**28'**				
		28'-30'	D	15	5	3	2		Wet, loose, dark gray CLAYEY SILT, trace fine to medium Sand.	7	24	4
		(MOIST. CONTENT: 28% / FINES: 73%), P.I. Est. 1-5										
30								**GLACIAL OUTWASH**				
		33'-35'	D	9	3	3	3		Wet, loose, light brown fine to coarse SAND, some fine to coarse Gravel, trace Silt.	8	24	0
		(MOIST. CONTENT: 16% / FINES: 2%), N.P.										
35												
		38'-40'	D	13	9	4	2		Wet, medium dense, brown fine to medium SAND, trace coarse Sand, trace Gravel, trace Silt.	9	24	4
40												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 88 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-9

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-9

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.6 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/12/21

DATE FINISHED: 11/16/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
45		43'-35'	D	2	3	4	6		Wet, loose, brown fine to coarse SAND, little fine Gravel, trace Silt.	10	24	8
		(MOIST. CONTENT: 18% / FINES: 2%), N.P.										
50		48'-50'	D	3	2	2	3		Wet, very loose, gray fine to medium SAND, little fine Gravel, trace Silt.	11	24	8
		(MOIST. CONTENT: 23% / FINES: 9%), N.P.										
55		53'-55'	D	4	4	4	4		Wet, loose, gray fine to coarse SAND, trace fine Gravel, trace Silt.	12	24	4
		(MOIST. CONTENT: 20% / FINES: 4%), N.P.										
60		58'-60'	D	1	2	2	3	GLACIAL OUTWASH	Wet, very loose, gray fine to medium SAND, trace coarse Gravel, trace Silt.	13	24	15
		(MOIST. CONTENT: 20% / FINES: 4%), N.P.										
65												
70		68'-70'	D	14	15	19	17		Wet, dense gray CLAY AND SILT, trace fine Sand.	14	24	21
		(MOIST. CONTENT: 28% / FINES: 97%), P.I. Est. 10-20										
75												
80		78'-80'	D	11	13	14	17		Wet, medium dense, gray SILT, some fine Sand (varved).	15	24	15

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 88 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-9

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-9

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.6 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/12/21

DATE FINISHED: 11/16/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	14	9	8	9		Wet, medium dense, gray SILT AND CLAY, trace	16	24	23
90		(MOIST. CONTENT: 36% / FINES: 98%), P.I. Est. 5-10						GLACIAL OUTWASH	fine Sand.			
95												
		98'-100'	D	9	7	7	7		Wet, medium dense, brown/reddish fine SAND AND	17	24	20
100								100'	SILT.			
									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 88 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-9

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-10

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 4.3 FT AFTER 0 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/15/21

DATE FINISHED: 11/16/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	4	10	9	8	**3"**	Topsoil.	1	24	7
									Dry, brown fine SAND, little Silt, trace Brick/Glass.			
		3'-5'	D	2	2	1	2		Wet, very loose, gray fine SAND, trace Silt.	2	24	22
5												
								FILL				
		8'-10'	D	1/12"		1/12"			Wet, very loose, gray fine to coarse SAND, little Silt,	3	24	8
		(MOIST. CONTENT: 30% / FINES: 11%), N.P.							trace fine Gravel, trace Roots.			
10												
								12'				
		13'-15'	D	1	1	2	2		Wet, very loose, very dark brown PEAT, SILT and fine			
		(MOIST. CONTENT: 81% / FINES: 65%), N.P.							to medium Sand.	4	24	24
15		(MOIST. CONTENT: 410% / ORG. CONTENT: 88%)							Wet, dark brown fibrous PEAT.			
		18'-20'	D	1	2	1/12"			Wet, very loose, gray fine to medium SAND, some	5	24	10
		(MOIST. CONTENT: 35% / FINES: 23%), N.P.							Silt, trace Roots.			
20												
		23'-25'	D	WOH	1	1/12"			Wet, very loose, gray fine to medium SAND AND SILT,	6	24	15
		(MOIST. CONTENT: 45% / FINES: 48%), N.P.							trace Roots.			
25												
								ORGANICS				
		28'-30'	D	WOH/24"					Wet, very loose, dark gray SILT, some fine Sand,	7	24	22
		(MOIST. CONTENT: 58% / FINES: 71%), N.P.							trace Roots.			
30												
		33'-35'	D	WOH/24"					Wet, very loose, dark gray SILT, some fine Sand,	8	24	24
		(MOIST. CONTENT: 58% / FINES: 78%), N.P.							trace Roots.			
35												
								38'				
		38'-40'	D	WOH/12"	1	2		**GLACIAL**	Wet, very loose, dark gray SILT, little fine Sand.	9	24	18
		(MOIST. CONTENT: 59% / FINES: 87%), N.P.						**OUTWASH**				
40												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-10

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-10

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 4.3 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/15/21

DATE FINISHED: 11/16/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
45		43'-45'	D	2	4	5	4		Wet, loose, dark gray fine to medium SAND AND SILT, trace fine Gravel.	10	24	11
		(MOIST. CONTENT: 24% / FINES: 35%), N.P.										
									Wet, brown fine to coarse SAND, trace Gravel, trace Silt.			
		48'-50'	D	1	1	4	11		Wet, loose, gray fine to coarse SAND, little fine to coarse Gravel, trace Silt.	11	24	14
50		(MOIST. CONTENT: 16% / FINES: 3%), N.P.										
		53'-55'	D	1	2	2	10		Wet, very loose, gray fine to coarse SAND, little fine to coarse Gravel, trace Silt.	12	24	11
55		(MOIST. CONTENT: 14% / FINES: 3%), N.P.										
		58'-60'	D	1	2	3	5		Wet, loose, gray fine to medium SAND, trace Silt.	13	24	13
60		(MOIST. CONTENT: 16% / FINES: 2%), N.P.						GLACIAL OUTWASH				
65												
		68'-70'	D	1	1	2	2		Wet, very loose, gray fine SAND, some Silt.	14	24	14
70		(MOIST. CONTENT: 27% / FINES: 24%), N.P.										
75												
		78'-80'	D	4	5	11	15		Wet, medium dense, gray CLAYEY SILT AND fine SAND.	15	24	12
80		(MOIST. CONTENT: 22% / FINES: 50%), P.I. Est. 1-5										

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-10

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-10

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 4.3 FT AFTER 0 HRS

AT ____ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		140#/300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/15/21

DATE FINISHED: 11/16/21

FOREMAN: Jerry Voight

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	3	1	1	1		Wet, loose, dark brown fine to coarse SAND, some	16	24	11
90		(MOIST. CONTENT: 21% / FINES: 4%), N.P.						GLACIAL OUTWASH	fine to coarse Gravel, trace Silt.			
95												
		98'-100'	D	20	13	19	11		Wet, dense, gray GRAVEL, little fine to coarse SAND,	17	24	10
100								100'	trace Silt.			
									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-10

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-11

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.4 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/18/21

DATE FINISHED: 11/19/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	7	8	6	7	**4"**	Topsoil.	1	24	4
									Dry, medium dense, brown SILT, some fine to coarse Sand, trace Gravel.			
		3'-5'	D	WOH/18"			1		Wet, very loose, brown SILT, trace fine Sand.	2	24	21
5												
		8'-10'	D	10	6	6	6	FILL	Wet, medium dense, gray SILT, trace fine Sand.	3	24	16
10												
		13'-15'	D	5	1	1	1		Wet, very loose, gray SILT, little fine Sand.	4	24	21
15		(MOIST. CONTENT: 56% / FINES: 83%), N.P.										
								16'				
		18'-20'	D	1	2	2	3		Wet, very loose, dark brown fibrous PEAT.	5	24	24
20		(MOIST. CONTENT: 452% / ORG. CONTENT: 90%)										
		23'-25'	D	WOH	1	3	4			6	24	24
25		(MOIST. CONTENT: 184% / ORG. CONTENT: 56%)							Wet, very loose, dark brown fibrous PEAT.			
									Wet, gray fine SAND, little varved Organics, trace Silt.			
		28'-30'	D	11	5	1/12"		ORGANICS	Wet, loose, dark gray SILT and fine SAND, trace Roots.	7	24	24
30		(MOIST. CONTENT: 44% / FINES: 55%), N.P.										
		33'-35'	D	WOH/24"					Wet, very loose, dark gray SILT, little fine Sand.	8	24	24
35		(MOIST. CONTENT: 58% / FINES: 80%), N.P.										
		38'-40'	D	3	1/18"				Wet, very loose, dark gray CLAYEY SILT, little fine Sand.	9	24	24
40		(MOIST. CONTENT: 58% / FINES: 88%), P.I. Est. 1-5										

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-11

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-11

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.4 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/18/21

DATE FINISHED: 11/19/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		43'-45'	D	5	1	1/12"		ORGANICS	Wet, very loose, very dark gray CLAYEY SILT, some fine to medium Sand (Organic Odor).	10	24	24
		(MOIST. CONTENT: 41% / FINES: 78%), P.I. Est. 1-5							Bottom 10" - Wet, gray fine to coarse SAND, some Silt, trace Roots.			
45								47'				
		48'-50'	D	1	1	1	2		Wet, very loose, gray fine to coarse SAND, some fine Gravel, trace Silt.	11	24	14
		(MOIST. CONTENT: 17% / FINES: 3%), N.P.										
50												
		53'-55'	D	3	1	2	1		Wet, very loose, light gray fine to coarse SAND, some fine to coarse Gravel, trace Silt.	12	24	13
		(MOIST. CONTENT: 13% / FINES: 3%), N.P.										
55												
		58'-60	D	8	3	2	3		Wet, loose, gray fine to medium SAND, trace fine Gravel, trace Silt.	13	24	13
		(MOIST. CONTENT: 21% / FINES: 2%), N.P.										
60								GLACIAL OUTWASH				
65												
		68'-70'	D	2	4	5	8		Wet, loose, light brown fine to coarse SAND, little fine to coarse Gravel, trace Silt.	14	24	6
		(MOIST. CONTENT: 19% / FINES: 2%), N.P.										
70												
75												
		78'-80'	D	4	5	8	12		Wet, medium dense, brown fine to coarse SAND, trace Silt.	15	24	12
		(MOIST. CONTENT: 21% / FINES: 4%), N.P.										
80												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-11

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-11

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.4 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/18/21

DATE FINISHED: 11/19/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	14	14	13	12		Wet, medium dense, gray/brown/reddish SILT, some	16	24	8
90								GLACIAL OUTWASH	fine to medium Sand, coarse Gravel at top of sample.			
95												
		98'-100'	D	8	6	8	11		Wet, medium dense, dark brown CLAYEY SILT AND	17	24	18
100		(MOIST. CONTENT: 27% / FINES: 62%), P.I. Est. 1-5						**100'**	FINE SAND.			
									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 58 FT., USED 4 " CASING:

THEN 3" casing to 98 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-11

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 1 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-12

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.5 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/16/21

DATE FINISHED: 11/17/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0'-2'	D	2	2	21	34	**4"**	Topsoil.	1	24	11
									Moist, dark brown fine to coarse SAND, little Silt, trace Gravel, trace Roots.			
		3'-5'	D	12	5	4	4		Wet, loose, brown SILT, trace fine Sand.	2	24	21
5								**FILL**				
		8'-10'	D	6	3	3	1		Wet, loose, gray SILT, some fine Sand.	3	24	19
		(MOIST. CONTENT: 44% / FINES: 80%), N.P.						**10'**				
10												
		13'-15'	D	WOH/12"	2	7			Wet, very loose dark brown ORGANIC SILT.	4	24	8
		(MOIST. CONTENT: 67% / ORG. CONTENT: 8%)										
15												
		18'-20'	D	4	1	2	3		Wet, very loose, dark brown fibrous PEAT, little	5	24	3
		(MOIST. CONTENT: 242% / ORG. CONTENT: 40%)						**ORGANICS**	coarse Gravel present in 3" spoon sample.			
20												
		23'-25'	D	12	5	3	1		Wet, loose, dark gray CLAYEY SILT, little fine Sand,	6	24	15
		(MOIST. CONTENT: 34% / FINES: 89%), P.I. Est. 1-5							trace Roots.			
25												
		28'-30'	D	11	5	6	6	**28.5'**	Wet, medium dense, brown fine to coarse SAND, some Silt, little fine Gravel, trace Roots.	7	24	12
		(MOIST. CONTENT: 18% / FINES: 34%), N.P.							Wet, dark brown fine to coarse SAND, some Silt,			
30									little fine Gravel.			
		33'-35'	D	8	6	5	7		Wet, medium dense, brown fine to medium SAND,	8	24	11
35								**GLACIAL OUTWASH**	little Gravel, trace coarse Sand, trace Silt.			
		38'-40'	D	2	2	3	3		Wet, very loose, light brown fine to coarse SAND,	9	24	15
		(MOIST. CONTENT: 15% / FINES: 6%), N.P.							some fine Gravel, trace Silt.			
40												

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN 3" casing to 78 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-12

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 2 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-12

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.5 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/16/21

DATE FINISHED: 11/17/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
45		43'-45'	D	4	4	3	5		Wet, loose, light brown fine to coarse SAND, some fine Gravel, trace Silt.	10	24	13
		(MOIST. CONTENT: 16% / FINES: 4%), N.P.										
50		48'-50'	D	1	1	1	3		Wet, very loose, gray fine to coarse SAND, some fine Gravel, trace Silt.	11	24	19
		(MOIST. CONTENT: 18% / FINES: 2%), N.P.										
55		53'-55'	D	4	2	3	4		Wet, loose, gray fine to medium SAND, trace Silt.	12	24	7
		(MOIST. CONTENT: 21% / FINES: 5%), N.P.										
60		58'-60'	D	5	3	3	4	GLACIAL OUTWASH	Wet, loose, gray fine to coarse SAND, little Silt trace fine Gravel.	13	24	8
		(MOIST. CONTENT: 15% / FINES: 11%), N.P.										
65		68'-70'	D	5	9	12	16		Wet, medium dense, light brown fine to coarse SAND, trace Silt.	14	24	12
		(MOIST. CONTENT: 18% / FINES: 3%), N.P.										
75		78'-80'	D	19	22	34	31		Wet, very dense, gray SILT AND CLAY, trace fine Sand.	15	24	17
80		(MOIST. CONTENT: 25% / FINES: 99%), P.I. Est. 5-10										

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN 3" casing to 78 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-12

TYPE: Cased

BORING CONTRACTOR: New England Boring Contractors

Taunton, MA

LOG PREPARED BY: PBA TGL

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Central Falls High School

TOWN, STATE: Central Falls, RI

PBA NO.: 21026 OFFICE: Torrado Architects

SHEET 3 OF 3

LOCATION: Refer to Fig. 2

HOLE NO.: PBA-12

BORING TYPE: Cased

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 5.5 FT AFTER 17 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	---	HW/NW	S/S	---
SIZE, I.D.	---	4"/3"	1 3/8"	---
HAMMER WT.		300#	140#	BIT
HAMMER FALL		30"	30"	

SURFACE ELEV.: Not Provided

DATE STARTED: 11/16/21

DATE FINISHED: 11/17/21

FOREMAN: Gary Twombly Jr.

INSPECTOR: T. Leidner

LOCATION OF BORING: Refer to Figure 2, Subsurface Exploration Plan; Automatic Hammer utilized for all SPT's.

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
85												
		88'-90'	D	16	23	25	25		Wet, dense, gray CLAYEY SILT, little fine Sand	16	24	18
90		(MOIST. CONTENT: 26% / FINES: 79%), P.I. Est. 1-5						GLACIAL OUTWASH	(varved).			
95												
		98'-100'	D	15	19	21	31		Wet, dense, gray CLAYEY SILT, trace fine Sand	17	24	18
100		(MOIST. CONTENT: 25% / FINES: 98%), P.I. Est. 10-20						**100'**	(varved).			
									Bottom of Boring at 100 feet.			
105												
110												
115												
120												

GROUND SURFACE TO 63 FT., USED 4 " CASING:

THEN 3" casing to 78 feet, open hole to 100 feet

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED

TP=TEST PIT A=AUGER V=VANE TEST

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US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 100

FOOTAGE IN ROCK: ---

WELL FOOTAGE: ---

NO. OF SAMPLES: 17

HOLE NO.: PBA-12

TYPE: Cased

BURMISTER SOIL DESCRIPTION SUMMARY

BURMISTER SOIL DESCRIPTION SUMMARY

GENERAL

Soils are described as to color, moisture, density or consistency, grain size distribution, and other relevant properties such as plasticity and dry strength, which have significant engineering implications. The general order followed for soil descriptions are as follows:

- Color
- Moisture
- Density or Consistency
- Grain size & Constituent percentages
- Other pertinent descriptions

The soil descriptions are based on visual-manual examination of soil samples, Standard Penetration Test results, and the results of laboratory testing on selected soil samples. Soil descriptions are developed according to the following criteria with the principal constituent written in capital letters.

STANDARD PENETRATION TEST (ASTM 01586-84)

Soil samples are frequently obtained from test borings using a split-spoon sampler during a Standard Penetration Test (SPT). In the Standard Penetration Test, a 2.0-inch outside diameter, 1.375-inch inside diameter split-spoon sampler is driven 18 in. into soil by means of a 140-pound hammer falling freely through a vertical distance of 30 inches. The sampler is normally driven in three successive 6-inch increments. The total number of blows required to drive the split-spoon sampler over 12 inches of penetration during the second and third successive 6-in. increments is the Standard Penetration Test N-Value.

DENSITY OF COHESIONLESS SOILS

Density of cohesion less soils is based upon results of Standard Penetration Tests as indicated below:

Density Term	Standard Penetration Test N-Value (Blows per foot)
Very loose	0- 4
Loose	4 -10
Medium	10 - 30
Dense	30 - 50
Very dense	Over 50

CONSISTENCY OF COHESIVE SOILS

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load as estimated in the field with the torvane, field vane, or pocket penetrometer, or determined in the laboratory by conducting shear strength tests. Consistency terms based upon undrained strength and the Standard Penetration Test results are indicated below:

Consistency Term	Standard Penetration Test N-Value (blows per foot)	Undrained Shear Strength (tsf)
Very soft	0-2	< 0.13
Soft	2-4	0.13 to 0.25
Medium	4-8	0.25 to 0.5
Stiff	8-15	0.5 to 1.0
Very stiff	15-30	1.0 to 2.0
Hard	Over 30	>2.0

Notes:

1. PP = unconfined compressive strength, in tsf, measured using a pocket penetrometer.
2. TV = undrained shear strength, in tsf, measured using a torvane.
3. FV = undrained shear strength, measured using field vane shear testing equipment.
4. See notes on logs for additional information regarding testing.

COLOR

Soil color is described in basic terms such as brown, black, blue, red, gray, and yellow. These terms are often combined in pairs such as brown-gray or yellow-brown, or given modifiers indicating the relative color shade such as dark brown or light gray.

COMPONENT DEFINITIONS BY GRAIN SIZE — SIEVE LIMITS

MATERIAL	DEFINITIONS	FRACTIONS	UPPER	LOWER
Boulders	Material too large to pass through an opening 12 in. square			
Cobbles	Material passing through a 12 in. square opening and retained on the 3 inch sieve			
Gravel	Material passing the 3 in. sieve and retained on 1/4" (No.4) sieve	Coarse	3 in.	3/4 in.
		Fine	3/4 in.	No.4 (1/4 in.)
Sand	Material passing the No.4 sieve and retained on the No. 200 sieve.	Coarse	No. 4(1/4")	No. 10(1/8")
		Medium	No. 10(1/8")	No. 40(1/32")
			No. 40(1/32")	No. 200
Silt	Material passing the No. 200 sieve which is usually non-plastic in character and exhibits little or no strength when air dried.		No. 200	
Clay	Material passing the No. 200 sieve which can also be made to exhibit plasticity within a certain range of moisture contents and which exhibits considerable strength when air dried		No. 200	

COMPONENT PROPORTIONS

Major Soil Component = Upper Case Letters
Secondary Component = "and" used (if 35-50% of total)
Third Component = "some" used (if third component comprises 20-35% of total)
Other Components = "little" used (if 10-20% of total); "trace" used (if 5-10% of total)

Note:

The word "with" is used where the proportion of a component cannot be determined. This is most commonly used in reference to cobbles and boulders when describing small samples of soil.

FILLS

The following terminology is used to describe ranges of man-made components observed within fill deposits:

Fill Terms	Sieve Range	Comparative Soil Size Terms
Specks	Less than No. 200 Sieve	Silt
Particles	No. 200 to 1/4 in.	Sand
Fragments	1/4 in. to 3 in.	Gravel
Pieces	3 in. to 12 in.	Cobbles
Blocks	Greater than 12 in.	Boulders

COBBLES AND BOULDERS

The following terminology is used to denote the estimated percentage of cobbles and/or boulders by volume that occur within a specific stratum.

Term	Estimated Percentage
Very Few	0 to 10
Few	10 to 25
Common	25 to 40
Numerous	40 to 50

If percentage cannot be estimated, then use "with" to indicate the presence of cobbles and/or boulders; e.g., gravelly SAND with cobbles and few boulders.

TERMINOLOGY RELATED TO STRATIFIED SOILS

The following terminology is used to denote the configuration of various soil units:

Term	Description
Laminate	0 to 1/16 in. thick (Cohesive)
Parting	0 to 1/16 in. thick (Granular)
Seam	1/16 to 1/2 in. thick
Layer	1/2 to 1/2 in. thick

(Continued)

Term	Description
Stratum	Greater than 12 in. thick
Pocket	Small, erratic deposits less than 12 inches
Lens	Lenticular deposits, larger than a pocket
Occasional	One or less per foot of thickness
Frequent	More than one per foot of thickness
Interbedded	Alternating soil layers of different composition
Varved	Alternating thin seams of silt and clay
Mottled	Variation in color

OTHER DESCRIPTIVE TERMS

Where appropriate, supplemental information about the soil is included after the soil description. Examples are: cemented, highly plastic, organic odor, voids present in fill or information about visual observation and/or olfactory evidence of contamination such as petroleum product staining or petroleum product smell.

GEOLOGICAL DESCRIPTIONS

Where appropriate, geological descriptions are also given (e.g., Glacial Till Deposit, Fill, etc.)

EXAMPLES OF COMPLETE SOIL DESCRIPTIONS

Light gray, dry, medium dense, fine to medium SAND, little silt, trace fine gravel with fragments of concrete, Fill

Red-brown, moist, stiff, silty CLAY, with frequent fine sand laminations, Glaciolacustrine Deposit

Brown, saturated, very dense, silty fine to coarse SAND, some fine to coarse gravel with cobbles and boulders, cemented, Glacial Till Deposit

THE UNIFIED SOIL CLASSIFICATION SYSTEM

FACSIMILE (401) 435-5569

THE UNIFIED SOIL CLASSIFICATION SYSTEM

Major divisions			Group symbol		Typical names	Classification criteria for coarse-grained soils	
Coarse-grained soils (more than half of material is larger than No. 200)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	$C_U = D_{60}/D_{10} > 4$ $C_C = 1 < D_{30}^2/D_{10} \times D_{60} < 3$	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (appreciable amount of fines)	GM	$\frac{d}{u}$	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or $I_p < 4$	Above A line with $4 < I_p < 7$ are borderline cases requiring use of dual symbols
			GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above A line with $I_p > 7$	
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_U = D_{60}/D_{10} > 6$ $C_C = 1 < D_{30}^2/D_{10} \times D_{60} < 3$	
			SP		Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (appreciable amount of fines)	SM	$\frac{d}{u}$	Silty sands, sand-silt mixtures	Atterberg limits below A line or $I_p < 4$	Limits plotting in hatched zone with $4 \leq I_p \leq 7$ are borderline cases requiring use of dual symbols
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above A line with $I_p > 7$	
Fine-grained soils (more than half of material is smaller than No. 200)	Silts and clays (liquid limit < 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain-size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5%—GW, GP, SW, SP More than 12%—GM, GC, SM, SC 5 to 12%—Borderline cases requiring dual symbols	
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL		Organic silts and organic silty clays of low plasticity		
	Silts and clays (liquid limit > 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH		Inorganic clays of high plasticity, fat clays		
			OH		Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt		Peat and other highly organic soils		

APPENDIX C

LABORATORY SOIL TESTING RESULTS

LEGEND, LABORATORY SOIL TESTING RESULTS:

- Moisture Content% 13.6 = The natural soil Moisture Content is 14%.
- Fines% 12.8 = The percent passing the No. 200 sieve is 13%, soil "Fines" content.
- P.I. (est.) NP = The soil sample is "Non-Plastic."
- P.I. (est.) 1-5 = The laboratory estimate of the sample's Plasticity Index range is 1 to 5.
- Org.% 89.9 = The soil sample's Organic Content is 90%.
- Soil Description: Brown f-c SAND, little fine Gravel, little Silt. The laboratory's soil sample description/classification utilizing Burmister System protocols.

THIELSCH ENGINEERING

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Let's Build a Solid Foundation

Client Information:
Paul B. Aldinger and Assoc., Inc.
East Providence, RI
PM: Dave Nacci
Assigned By: Dave Nacci
Collected By: Client

Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 1 of 12 (PBA-1)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-1	S-4	13-15	21-S-4665	13.6		NP			12.8											Brown f-c SAND, little fine Gravel, little Silt
PBA-1	S-5	18-20	21-S-4666	23.1		NP			41.4											Gray f-c SAND and SILT
PBA-1	S-6A	23-25	21-S-4751	448.8						89.9										Dark Brown Peat with roots and leaf matter
PBA-1	S-7A	28-30	21-S-4761	417.4						30.7										Dark Brown Fibrous Peat
PBA-1	S-8	33-35	21-S-4762	418.3						49.8										Dark Brown Fibrous Peat
PBA-1	S-9	38-40	21-S-4763	183.5						55.9										Dark Brown Peat
PBA-1	S-10	43-45	21-S-4764	129.5						11.4										Dark Brown Organic fine SAND and SILT
PBA-1	S-11	48-50	21-S-4667	35.4		NP			74.8											Brown SILT, some f-c sand, little f-c Gravel
PBA-1	S-12	53-55	21-S-4668	44.6		1-5			94.8											Light Brown CLAYEY SILT, little f-c Sand, trace fine Gravel
PBA-1	S-14	63-65	21-S-B486	21.5		NP			1.9											Brown f-c SAND, trace Silt
PBA-1	S-18	88-90	21-S-B487	23.4		NP			6.2											Brown f-c SAND, trace Silt
PBA-1	S-19	98-100	21-S-B488	16.8		NP			9.8											Dark Brown f-c SAND, trace Silt

Date Received: ***12.29.21*** Reviewed By: Date Reviewed: ***01.27.22***

Sample descriptions are based on a visual classification of the material, a full sieve analysis was not performed on the individual sample. The washed remains were retained for future sieve analysis if required.

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Assigned By: Dave Nacci
Collected By: Client

Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 2 of 12 (PBA-2)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-2	S-3	8-10	21-S-4669	22.0		NP			28.2											Gray fine SAND, some SILT, trace f-c Gravel
PBA-2	S-4	13-15	21-S-4670	17.4		NP			29.0											Gray f-c GRAVEL, some Silt, some f-c Sand
PBA-2	S-5	18-20	21-S-4671	90.5		NP			85.8											Gray SILT, some fine sand
PBA-2	S-6	23-25	21-S-4765	71.8						9.0										Dark Brown Organic f-m SAND
PBA-2	S-8	33-35	21-S-4672	12.0		NP			2.9											Brown, f-c GRAVEL, little f-c Sand, trace silt
PBA-2	S-9	38-40	21-S-4673	17.2		NP			3.2											Brown, f-c SAND, some f-c Gravel, trace silt
PBA-2	S-10	43-45	21-S-4674	12.5		NP			2.4											Brown, f-c GRAVEL, little f-c Sand, trace silt

Date Received: ***12.29.21*** Reviewed By: Date Reviewed: ***01.27.22***

Sample descriptions are based on a visual classification of the material, a full sieve analysis was not performed on the individual sample. The washed remains were retained for future sieve analysis if required.

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Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 3 of 12 (PBA-3)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-3	S-4	13-15	21-S-4675	20.8		NP			8.2											Brown f-c SAND and f-c GRAVEL, trace Silt
PBA-3	S-5	18-20	21-S-4676	22.9		NP			11.6											Gray f-c SAND, little fine Gravel, little Silt
PBA-3	S-6	23-25	21-S-4677	18.0		NP			4.2											Gray, f-c SAND, little f-c Gravel, trace Silt
PBA-3	S-7	28-30	21-S-4752	426.8						89.0										Dark Brown Peat
PBA-3	S-8	34-36	21-S-4678	16.4		NP			5.1											Brown, f-c SAND, some f-c Gravel, trace silt
PBA-3	S-9	40-42	21-S-4679	14.2		NP			4.0											Brown, f-c SAND, some f-c Gravel, trace silt
PBA-3	S-10	43-45	21-S-4680	22.3		NP			3.2											Brown, f-m SAND, some fine Gravel, trace silt
PBA-3	S-11	48-50	21-S-4681	23.6		NP			4.9											Gray f-m SAND, trace fine Gravel, trace Silt
PBA-3	S-14	63-65	21-S-B489	23.4		NP			14.0											Light Grey fine SAND, little Silt

Date Received: ***12.29.21***

Reviewed By:

Date Reviewed: ***01.27.22***

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Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 4 of 12 (PBA-4)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-4	S-4	13-15	21-S-4768	60.4						14.5										Dark Brown Organic SILT
PBA-4	S-5	18-20	21-S-4682	18.7		NP			2.0											Gray f-m SAND, little f-c Gravel, trace Silt
PBA-4	S-6	23-25	21-S-4683	16.8		NP			3.6											Gray f-c SAND, trace fine Gravel, trace Silt
PBA-4	S-7	28-30	21-S-4753	385.4						90.4										Dark Brown Peat
PBA-4	S-8	33-35	21-S-4766	323.0						54.0										Dark Brown Fibrous Peat
PBA-4	S-9	38-40	21-S-4767	132.9						18.9										Dark Brown Fibrous Peat
PBA-4	S-10	43-45	21-S-4684	34.1		NP			71.6											Dark Gray SILT, some fine Sand
PBA-4	S-14	63-65	21-S-B490	21.7		NP			1.5											Brown f-c SAND, trace Silt
PBA-4	S-17	78-80	21-S-B491	23.4		NP			5.7											Brown f-c SAND, trace Silt
PBA-4	S-19	98-100	21-S-B492	23.2		NP			6.5											Brown f-c SAND, trace Silt

Date Received: ***12.29.21*** Reviewed By: Date Reviewed: ***01.27.22***

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Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 5 of 12 (PBA-5)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-5	S-4	13-15	21-S-4685	22.2		NP			2.5											Dark Gray f-m SAND, trace Silt
PBA-5	S-5	18-20	21-S-4754	354.2						72.0										Dark Brown Sandy Peat
PBA-5	S-6	23-25	21-S-4686	40.8		NP			71.2											Very Dark Gray SILT, some f-m Sand
PBA-5	S-8	33-35	21-S-4687	17.9		NP			3.0											Gray f-c SAND, little fine Gravel, trace Silt
PBA-5	S-9	38-40	21-S-4688	17.5		NP			2.2											Gray f-m SAND, trace fine Gravel, trace Silt
PBA-5	S-10	43-45	21-S-4689	10.6		NP			7.7											Gray fine SAND, trace Silt
PBA-5	S-11	48-50	21-S-4690	21.8		NP			4.3											Gray fine SAND, trace Silt
PBA-5	S-15	68-70	21-S-B493	25.7		5-10			97.8											Grey SILT & CLAY, trace fine Sand
PBA-5	S-18	83-85	21-S-B494	15.5		NP			8.1											Dark Brown f-c SAND, little f-c Gravel, trace Silt
PBA-5	S-21	113-115	21-S-B495	22.0		NP			5.6											Brown f-c SAND, little f-c Gravel, trace Silt

Date Received: ***12.29.21***

Reviewed By:

Date Reviewed: ***01.27.22***

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Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 6 of 12 (PBA-6)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-6	S-4	13-15	21-S-4691	15.9		NP			2.8											Very Dark Brown f-c SAND, some f-c Gravel, trace Silt
PBA-6	S-5	18-20	21-S-4692	55.6		5-10			73.4											Very Dark Brown SILT & CLAY, some f-m Sand
PBA-6	S-5A	18-20	21-S-4755	116.6						30.1										Dark Brown Fibrous Peat contained porcelain debris
PBA-6	S-6	23-25	21-S-4693	36.1		1-5			95.5											Gray CLAYEY SILT, trace fine Sand
PBA-6	S-7	28-30	21-S-4694	17.7		NP			3.6											Brown f-c SAND, little f-c Gravel, trace Silt
PBA-6	S-8	33-35	21-S-4695	19.4		NP			2.4											Gray f-c SAND, little fine Gravel, trace Silt
PBA-6	S-10	43-45	21-S-4696	18.3		NP			2.9											Gray f-c SAND, some f-c Gravel, trace Silt
PBA-6	S-13	68-70	21-S-B496	21.7		1-5			91.9											Grey CLAYEY SILT, trace fine Sand
PBA-6	S-15	88-90	21-S-B497	21.3		NP			18.2											Dark Brown fine SAND, little Silt
PBA-6	S-16	98-100	21-S-B498	12.8		10-20			30.4											Dark Brown f-c SAND, some f-c Gravel, some CLAY & SILT

Date Received: ***12.29.21***

Reviewed By:

Date Reviewed: ***01.27.22***

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Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 7 of 12 (PBA-7)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-7	S-3	8.5-10.5	21-S-4697	20.5		NP			14.5											Very Dark Brown f-c SAND, little f-c Gravel, little Silt
PBA-7	S-5	18-20	21-S-4698	41.1		5-10			82.8											Dark Gray SILT & CLAY, little f-m Sand
PBA-7	S-6	23-25	21-S-4699	16.7		NP			2.1											Light Brown, f-c SAND, some f-c Gravel, trace Silt
PBA-7	S-7	28-30	21-S-4700	16.5		NP			3.2											Light Brown f-c SAND, some fine Gravel, trace Silt
PBA-7	S-8	33-35	21-S-4701	20.5		NP			2.0											Light Brown f-c SAND, some fine Gravel, trace Silt
PBA-7	S-9	38-40	21-S-4702	23.0		NP			7.0											Gray, f-m SAND, trace Silt
PBA-7	S-10	43-45	21-S-4703	29.2		NP			3.1											Brown fine SAND, trace Silt
PBA-7	S-11	48-50	21-S-4704	27.7		NP			37.3											Gray fine SAND and SILT
PBA-7	S-12	53-55	21-S-4705	40.0		NP			26.3											Gray fine SAND, some Silt
PBA-7	S-13	58-60	21-S-4706	23.1		NP			13.2											Gray fine SAND, little Silt, trace coarse Gravel
PBA-7	S-14	68-70	21-S-B499	27.0		20-40			82.0											Grey SILTY CLAY, trace fine Sand
PBA-7	S-15	78-80	21-S-B500	36.5		10-20			91.2											Grey CLAY & SILT, trace fine Sand
PBA-7	S-16	88-90	21-S-B501	29.6		20-40			97.7											Grey SILTY CLAY, trace fine Sand
PBA-7	S-17	98-100	21-S-B502	16.4		NP			7.4											Dark Grey f-c SAND, some f-c Gravel, trace Silt

Date Received: ***12.29.21*** Reviewed By: Date Reviewed: ***01.27.22***

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Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 8 of 12 (PBA-8)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-8	S-3	8-10	21-S-4707	24.7		NP			49.2											Gray SILT and f-m SAND, little fine Gravel
PBA-8	S-4	13-15	21-S-4708	17.7		NP			6.7											Gray f-c SAND, some fine Gravel, trace silt
PBA-8	S-5	18-20	21-S-4756	386.4						56.2										Dark Brown Fibrous Peat
PBA-8	S-6	23-25	21-S-4709	53.1		NP			92.4											Dark Gray SILT, trace fine Sand
PBA-8	S-7	28-30	21-S-4710	19.0		NP			1.3											Gray f-c SAND, some fine Gravel, trace silt
PBA-8	S-8	33-35	21-S-4711	21.2		NP			1.6											Gray f-c SAND, some fine Gravel, trace silt
PBA-8	S-9	38-40	21-S-4712	22.6		NP			1.9											Gray f-m SAND, trace Silt
PBA-8	S-10	43-45	21-S-4713	19.9		NP			2.6											Gray f-c SAND, trace fine Gravel, trace Silt
PBA-8	S-11	48-50	21-S-4714	27.0		NP			13.3											Gray fine Sand, little Silt
PBA-8	S-12	53-55	21-S-4715	27.4		NP			3.4											Gray f-m SAND, trace Silt
PBA-8	S-15	78-80	21-S-B503	17.8		NP			17.0											Dark Grey f-c SAND, little Clayey Silt, little f-c Gravel
PBA-8	S-17	98-100	21-S-B504	14.6		NP			2.5											Dark Brown f-c SAND and f-c GRAVEL, trace Silt

Date Received: ***12.29.21*** Reviewed By: Date Reviewed: ***01.27.22***

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Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 9 of 12 (PBA-9)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-9	S-3	8-10	21-S-4716	20.0		NP			9.4											Very Dark Brown f-c SAND, some f-c Gravel, trace silt
PBA-9	S-5	18-20	21-S-4757	321.0						65.8										Dark Brown Fibrous Peat
PBA-9	S-6	23-25	21-S-4717	36.2		5-10			92.4											Dark Gray SILT & CLAY, trace fine Sand
PBA-9	S-7	28-30	21-S-4718	27.5		1-5			72.8											Dark Gray CLAYEY SILT, trace f-m Sand
PBA-9	S-8	33-35	21-S-4719	16.3		NP			2.1											Light Brown f-c SAND, some f-c Gravel, trace Silt
PBA-9	S-10	43-45	21-S-4720	17.6		NP			2.3											Brown f-c SAND, little fine Gravel, trace Silt
PBA-9	S-11	48-50	21-S-4721	23.1		NP			9.4											Gray f-m SAND, little fine Gravel, trace Silt
PBA-9	S-12	53-55	21-S-4722	20.1		NP			4.0											Gray, f-c SAND, trace fine Gravel, trace Silt
PBA-9	S-13	58-60	21-S-4723	20.3		NP			4.4											Gray f-m SAND, trace Coarse Gravel, trace Silt
PBA-9	S-14	68-70	21-S-B505	27.8		10-20			97.4											Grey CLAY & SILT, trace fine Sand
PBA-9	S-16	88-90	21-S-B506	36.2		5-10			97.5											Grey SILT & CLAY, trace fine Sand

Date Received: ***12.29.21*** Reviewed By: Date Reviewed: ***01.27.22***

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Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 10 of 12 (PBA-10)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-10	S-3	8-10	21-S-4724	29.5		NP			11.0											Gray f-c SAND, little Silt, trace fine Gravel
PBA-10	S-4	13-15	21-S-4725	80.6		NP			64.9											Very Dark Brown PEAT, SILT and f-m SAND
PBA-10	S-4A	13-15	21-S-4758	409.6						88.1										Dark Brown Fibrous Peat
PBA-10	S-5	18-20	21-S-4726	34.6		NP			23.1											Gray f-m SAND, some Silt
PBA-10	S-6	23-25	21-S-4727	45.2		NP			47.9											Gray f-m SAND and SILT
PBA-10	S-7	28-30	21-S-4728	57.8		NP			71.2											Dark Gray SILT,some fine Sand
PBA-10	S-8	33-35	21-S-4729	58.4		NP			77.6											Dark Gray SILT, some fine Sand
PBA-10	S-9	38-40	21-S-4730	58.6		NP			86.9											Dark Gray SILT, little fine Sand
PBA-10	S-10	43-45	21-S-4731	23.9		NP			35.2											Dark Gray f-m SAND and SILT, trace fine Gravel
PBA-10	S-11	48-50	21-S-4732	15.8		NP			3.3											Gray, f-c SAND, little f-c Gravel, trace Silt
PBA-10	S-12	53-55	21-S-4733	14.1		NP			3.1											Gray, f-c SAND, little f-c Gravel, trace Silt
PBA-10	S-13	58-60	21-S-4734	15.6		NP			2.0											Gray f-m SAND, trace Silt
PBA-10	S-14	68-70	21-S-B507	27.1		NP			24.3											Grey fine SAND, some Silt
PBA-10	S-15	78-80	21-S-B508	22.4		1-5			50.3											Grey CLAYEY SILT and fine SAND
PBA-10	S-16	88-90	21-S-B509	21.1		NP			3.9											Dark Brown f-c SAND, some f-c Gravel, trace Silt

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Project Information:
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Central Falls, RI
PBA Project Number: 21074
Summary Page: 11 of 12 (PBA-11)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-11	S-4	13-15	21-S-4735	56.0		NP			83.3											Gray SILT, little fine Sand
PBA-11	S-5	18-20	21-S-4759	451.9						89.6										Dark Brown Fibrous Peat
PBA-11	S-6	23-25	21-S-4769	183.5						55.9										Dark Brown Fibrous Peat
PBA-11	S-7	28-30	21-S-4736	44.1		NP			54.9											Dark Gray SILT and fine SAND
PBA-11	S-8	33-35	21-S-4737	57.7		NP			80.3											Dark Gray SILT, little fine Sand
PBA-11	S-9	38-40	21-S-4738	58.4		1-5			87.9											Dark Gray CLAYEY SILT, little fine Sand
PBA-11	S-10	43-45	21-S-4739	41.2		1-5			78.1											Very Dark Gray CLAYEY SILT, some f-m SAND
PBA-11	S-11	48-50	21-S-4740	17.0		NP			3.0											Gray f-c SAND, some fine Gravel, trace Silt
PBA-11	S-12	53-55	21-S-4741	12.7		NP			3.0											Light Gray, f-c SAND, some f-c Gravel, trace Silt
PBA-11	S-13	58-60	21-S-4742	20.6		NP			2.4											Gray, f-m SAND, trace fine Gravel, trace Silt
PBA-11	S-14	68-70	21-S-B510	18.5		NP			2.2											Light Brown f-c SAND, little f-c Gravel, trace Silt
PBA-11	S-15	78-80	21-S-B511	21.2		NP			3.5											Brown f-c SAND, trace Silt
PBA-11	S-17	98-100	21-S-B512	27.0		1-5			62.3											Dark Brown CLAYEY SILT and fine SAND

Date Received: ***12.29.21*** Reviewed By: Date Reviewed: ***01.27.22***

Sample descriptions are based on a visual classification of the material, a full sieve analysis was not performed on the individual sample. The washed remains were retained for future sieve analysis if required.

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Let's Build a Solid Foundation

Client Information:
Paul B. Aldinger and Assoc., Inc.
East Providence, RI
PM: Dave Nacci
Assigned By: Dave Nacci
Collected By: Client

Project Information:
Central Falls High School
Central Falls, RI
PBA Project Number: 21074
Summary Page: 12 of 12 (PBA-12)
Report Date: 01.10.22

LABORATORY TESTING DATA SHEET, Report No.: 7421-M-B013/129 R5

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Moisture Content %	LL %	P.I. (est.)	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
PBA-12	S-3	8-10	21-S-4743	44.0		NP			79.7											Gray SILT, some fine Sand
PBA-12	S-4	13-15	21-S-4770	66.7						7.8										Dark Brown Organic SILT
PBA-12	S-5	18-20	21-S-4760	242.1						40.2										Dark Brown Fibrous Peat little Gravel
PBA-12	S-6	23-25	21-S-4744	34.2		1-5			89.1											Dark Gray CLAYEY SILT, little fine Sand
PBA-12	S-7	28-30	21-S-4745	17.7		NP			34.4											Dark Brown f-c SAND, some Silt, little fine Gravel
PBA-12	S-9	38-40	21-S-4746	14.8		NP			5.8											Light Brown f-c SAND, some fine Gravel, trace Silt
PBA-12	S-10	43-45	21-S-4747	16.4		NP			3.8											Light Brown f-c SAND, some fine Gravel, trace Silt
PBA-12	S-11	48-50	21-S-4748	17.9		NP			1.8											Gray f-c SAND, some fine Gravel, trace Silt
PBA-12	S-12	53-55	21-S-4749	20.8		NP			5.1											Gray f-m SAND, trace Silt
PBA-12	S-13	58-60	21-S-4750	15.3		NP			10.8											Gray f-c SAND, little Silt, trace fine Gravel
PBA-12	S-14	68-70	21-S-B513	18.3		NP			2.7											Light Brown f-c SAND, trace Silt
PBA-12	S-15	78-80	21-S-B514	24.5		5-10			98.8											Grey SILT & CLAY, trace fine Sand
PBA-12	S-16	88-90	21-S-B515	25.5		1-5			78.7											Grey CLAYEY SILT, little fine Sand
PBA-12	S-17	98-100	21-S-B516	25.0		10-20			98.0											Grey CLAYEY SILT, trace fine Sand

Date Received: *12.29.21*

Reviewed By:

Date Reviewed: *01.27.22*

Sample descriptions are based on a visual classification of the material, a full sieve analysis was not performed on the individual sample. The washed remains were retained for future sieve analysis if required.

Appendix B – LGCI's Boring and Probe Logs

LGCI
Lahlaf Geotechnical Consulting, Inc.
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BORING LOG

B-3

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 7/18/22 **DATE COMPLETED:** 7/25/22
BORING LOCATION: Northeast of the existing meat market
COORDINATES: N 0 E 1
SURFACE El.: (see note 1) **TOTAL DEPTH:** 101 ft.
WEATHER: 80's / Cloudy
GROUNDWATER LEVELS:
DURING DRILLING: 8.0 ft. Based on sample moisture
AT END OF DRILLING: 15.2 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Zac Nadar / Justin Raymond
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Air Knife / Mobile B-59 Truck Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** RF

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0.5	G1				Asphalt	0.5	Top 6": Asphalt
							Fill		G1 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 20-25% fine to coarse subrounded gravel, trace of organic soil, trace of asphalt, dark brown
5		6	S1	4-5-5-5 (10)	24/1				S1 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, trace coarse, ~10% fines, 20-25% fine to coarse subround gravel, trace of organic soil, trace of asphalt, brown, moist
		8	S2	8-6-7-8 (13)	24/13			8.0 ▽	S2 - Well Graded SAND with Silt (SW-SM), fine to coarse, 5-10% fines, 10-15% fine subrounded, gravel, light brown to orange
10		10	S3	6-6-6-6 (12)	24/3		Sand		S3 - Well Graded SAND with Gravel (SW), fine to coarse, 0-5% fines, 25-30% fine to coarse subrounded to subangular gravel, light brown, wet
		12	S4	5-6-6-7 (12)	24/10				S4 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, 0-5% fine subrounded gravel, light brown
15		14	S5	4-5-5-5 (10)	24/12			▼	S5 - Poorly Graded SAND (SP), fine to medium, 0-5% fines, trace of fine gravel, light brown
		16	S6	5-6-10-11 (16)	24/15				S6 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, trace of fine gravel, light brown
		18	S7	4-8-9-9 (17)	24/16				S7 - Poorly Graded SAND with Silt (SP-SM), fine, 5-10% fines, gray, wet
20		20	S8	7-8-10-10 (18)	24/18				S8 - Poorly Graded SAND with Silt (SP-SM), fine, 10-15% fines, gray, wet
		22	S9	10-12-13-13 (25)	24/20				S9 - Similar to S8, ~5% fines
25		24		6-6-9-10					S10 - Poorly Graded SAND (SP), fine, 0-5% fines, gray, wet

GENERAL NOTES:
1. The ground surface elevation is not available.

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BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		24	S10	(15)	24/19				
		26	S11	9-10-9-11 (19)	24/17				S11 - Poorly Graded SAND with Silt (SP-SM), fine, 5-10% fines, light brown, wet
		28	S12	6-8-10-12 (18)	24/1				S12 - Poorly Graded SAND (SP), fine, 0-5% fines, light brown, wet
30		30	S13	5-6-8-8 (14)	24/2				S13 - Similar to S12
		32	S14	5-8-9-13 (17)	24/16				S14 - Poorly Graded SAND with Silt (SP-SM), fine, ~5% fines, light brown, wet
		34	S15	6-11-11-12 (22)	24/3				S15 - Poorly Graded SAND (SP), fine, 0-5% fines, light brown, wet
35		36	S16	8-10-17-15 (27)	24/24				S16 - Poorly Graded SAND with Silt (SP-SM), fine, ~5% fines, light brown, wet
		38	S17	18-19-20-19 (39)	24/15				S17 - Silty SAND (SM), fine to medium, trace coarse, 15-20% fines, 10-15% fine to coarse subangular gravel, dark brown, wet
40		40	S18	11-14-14-14 (28)	24/9		Sand		S18 - Similar to S17, 10-15% fine to coarse subrounded gravel
		42	S19	20-19-16-40 (35)	24/14				S19 - Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, ~15% fine to coarse subrounded gravel, dark brown, wet
		44	S20	11-14-16-15 (30)	24/12				S20 - Similar to S19, 20-25% fines
45		46	S21	19-21-24-20 (45)	24/19				S21 - Similar to S19, 20-25% fines
		48	S22	9-9-12-11 (21)	24/17				S22 - Well Graded SAND with Silt (SW-SM), fine to coarse, 5-10% fines, 5-10% fine subrounded gravel, dark brown, wet
50		50	S23	10-11-13-11 (24)	24/13				S23 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, gray, wet
		52	S24	16-17-21-18 (38)	24/16				S24 - Silty SAND (SM), fine to coarse, 15-20% fines, ~5% fine subrounded gravel, gray, wet
		54	S25	10-14-12-11 (26)	24/10				S25 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 10-15% fines, 5-10% fine subrounded gravel, gray, wet
55		56	S26	12-10-11-16 (21)	24/18				S26 - Silty SAND (SM), fine to medium, ~15% fines, trace of fine gravel, gray, wet
		58	S27	8-13-16-17 (29)	24/16	1		58.0	
60		60					Silt		S27 - SILT with Sand (ML), slightly plastic, 20-25% fine sand, gray, wet REMARK 1: Started open hole drilling at 59 feet

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BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
65		64	S28	10-14-15-17 (29)	24/19		Silt		S28 - SILT (ML), slightly plastic, ~5% fine sand, gray, wet
		66							
70		69	S29	9-11-15-17 (26)	24/18				S29 - Sandy SILT (ML), non-plastic, 40-45% fine sand, brown, wet
		71							
		74						74.0	
75		74	S30	10-14-16-18 (30)	24/17		Sand		S30 - Poorly Graded SAND with Silt (SP-SM), fine, 5-10% fines, brown, wet
		76							
		79						79.0	
80		79	S31	8-10-14-14 (24)	24/22		Silt		S31 - Sandy SILT (ML), non plastic, 35-40% fine sand, brown, wet
		81							
		84						84.0	
85		84	S32	7-11-14-16 (25)	24/24		Sand		S32 - Top 12": Poorly Graded SAND with Silt (SP-SM), fine, 10-15% fines, brown, wet Bot. 12": Similar to S32 Top 12", 5-10% fines, gray
		86							
90		89	S33	9-13-20-30 (33)	24/24				S33 - Similar to S32 Top 12" , dark brown
		91							
95		94	S34	7-12-15-14 (27)	24/21				S34 - Top 10": Similar to S32 Top 12", dark brown Bot. 11": Silty SAND (SM), fine, 15-20% fines, dark gray, wet

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BORING LOG

B-3

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		96							
		99	S35	5-13-16-19 (29)	24/24		Sand		S35 - Similar to S34 Bot. 11", 15-20% fines
100		101						101.0	
									Bottom of borehole at 101.0 feet. Backfilled borehole with grout and 4 bags of gravel, and the ground surface was restored with asphalt cold patch. The grout was made with 3 bags of portland cement and 1/3 bag of Super Gel-X
105									
110									
115									
120									
125									
130									

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BORING LOG

B-4-OW

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 7/18/22 **DATE COMPLETED:** 7/21/22
BORING LOCATION: Southeast of the existing meat market
COORDINATES: N 0 E 2
SURFACE El.: (see note 1) **TOTAL DEPTH:** 101 ft.
WEATHER: 80's / Sunny
GROUNDWATER LEVELS:
DURING DRILLING: 8.0 ft. Based on moisture sample
AT END OF DRILLING: 15.5 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Zac Nadar
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Air Knife / Mobile B-59 Truck Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** RF

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0.5	G1				Asphalt	0.5	Top 6": Asphalt
									G1 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 15-20% fine subrounded gravel, trace of organic soil, trace of asphalt, brown
		4				1	Fill		REMARK 1: Encountered water utility at about 4 feet, moved 10 feet north and started a new hole
5			S1	2-2-6-6 (8)	24/5				S1 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 20-25% fine subangular gravel, brown to gray
		6	S2	8-8-4-5 (12)	24/6				S2 - Well Graded SAND with Gravel (SW), fine to coarse, 0-5% fines, 40-45% fine subrounded gravel, trace of asphalt, black
		8	S3	3-1-2-2 (3)	24/4			8.0 ▽	S3 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, 10-15% fines, ~15% fine subrounded gravel, light brown
10		10	S4	3-4-6-8 (10)	24/1				S4 - Poorly Graded GRAVEL with Silt and Sand (GP-GM), coarse, subangular, ~5% fines, 20-25% fine to coarse sand, light brown, wet
		12	S5	9-8-9-10 (17)	24/18				S5 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, 10-15% fine subrounded gravel, brown to orange
		14	S6	6-7-8-7 (15)	24/12				S6 - Poorly Graded SAND (SP), fine, trace medium, 0-5% fines, light brown, wet
15								▽	
		16	S7	8-8-9-10 (17)	24/13		Sand		S7 - Poorly Graded SAND (SP), fine, 0-5% fines, 5-10% fine to coarse subrounded gravel, light brown, wet
		18	S8	7-7-6-8 (13)	24/14				S8 - Poorly Graded SAND (SP), fine to medium, trace coarse, 0-5% fines, trace of fine gravel, light brown, wet
20		20							
		24		3-3-5-7					S9 - Similar to S8, fine, no trace of fine gravel
25									

GENERAL NOTES:
1. The ground surface elevation is not available.

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BORING LOG

B-4-OW

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		24	S9	(8)	24/7		Sand		
		26							
		29	S10	3-4-9-11 (13)	24/15				S10 - Poorly Graded SAND (SP), fine, trace medium, 0-5% fines, gray, wet
30		31							
		34	S11	4-6-7-9 (13)	24/1				S11 - Similar to S10
35		36							
		39	S12	4-6-7-8 (13)	24/10				S12 - Similar to S10
40		41							
		44	S13	5-6-9-11 (15)	24/1				S13 - Similar to S10
45		46							
		49	S14	11-15-14-13 (29)	24/19			49.0	S14 - SILT with Sand (ML), non plastic, 15-20% fine sand, gray, wet
50		51	S15	18-17-18-24 (35)	24/20	2	Silt		REMARK 2: Started open hole drilling at 51 feet S15 - SILT (ML), non plastic, 5-10% fine sand, gray, wet
		53							
		54	S16	11-10-10-11 (20)	24/17				S16 - SILT with Sand (ML), slightly plastic, ~15% fine sand, gray, wet
55		56	S17	19-15-14-15 (29)	24/22				S17 - Similar to S16
		58							
		59	S18	8-12-13-15 (25)	24/18				S18 - SILT (ML), slightly plastic, 5-10% fine sand, gray, wet
60									

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BORING LOG

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LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		61	S19	14-19-25-27 (44)	24/23		Silt		S19 - SILT (ML), slightly plastic, 10-15% fine sand, gray, wet
		63							
		64	S20	7-13-16-17 (29)	24/20				S20 - SILT with Sand (ML), slightly plastic, ~15% fine sand, gray, wet
65		66							
		69	S21	11-15-19-21 (34)	24/17				S21 - SILT (ML), slightly plastic, 5-10% fines sand, gray, wet
70		71							
		74	S22	10-14-16-14 (30)	24/12			74.0	
75		76					Sand		S22 - Poorly Graded SAND with Silt (SP-SM), fine, trace medium, 10-15% fines, brown, wet
		79	S23	9-14-16-16 (30)	24/16				S23 - Similar to S22, 5-10% fines
80		81							
		84	S24	8-11-12-13 (23)	24/15			84.0	S24 - Sandy SILT (ML), non plastic, ~30% fine sand, brown, wet
85		86							
		89	S25	9-11-13-16 (24)	24/20		Silt		S25 - Similar to S24
90		91							
		94	S26	10-14-15-18 (29)	24/24			94.0	
95							Sand		S26 - Poorly Graded SAND (SP), fine, 0-5% fine, brown, wet

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BORING LOG

B-4-OW

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		96							
		99	S27	15-28-41-36 (69)	24/21		Sand		S27 - Similar to S26
100		101						101.0	
									Bottom of borehole at 101.0 feet. Backfilled borehole up to 20' with 14 bags of gravel. Installed groundwater observation well
105									
110									
115									
120									
125									
130									

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BORING LOG

B-101

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/12/22 **DATE COMPLETED:** 12/13/22
BORING LOCATION: Near northern portion of prop. building
COORDINATES: N 0 E 3
SURFACE El.: 58 ft. (see note 1) **TOTAL DEPTH:** 96 ft.
WEATHER: 30's / Cloudy
GROUNDWATER LEVELS:
DURING DRILLING: 8.0 ft. / El. 50.0 ft. Based on sample moisture
AT END OF DRILLING: 12.0 ft. / El. 46.0 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: TG / MBH **CHECKED BY:** NP

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0	S1	42-16-18-11 (34)	24/18		Asphalt	0.3 / 57.7	S1 - Top 4": Asphalt Bot. 14": Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 15-20% fine to coarse subangular gravel, trace of organic soil, trace of asphalt, dark brown, moist
		2	S2	8-11-7-8 (18)	24/15				S2 - Similar to S1, ~15% fines
	55.0	4	S3	10-3-3-3 (6)	24/0				S3 - No recovery
5		6	S4	5-2-3-1 (5)	24/13				S4 - Top 8": Silty SAND (SM), fine to coarse, 15-20% fines, 10-15% fine to coarse subangular gravel, trace of organic soil, trace of asphalt, dark brown, moist
	50.0	8	S5	0-1-0-1 (1)	24/3				Bot. 5": Poorly Graded SAND (SP), fine to medium, 0-5% fines, 0-5% fine subangular gravel, trace of organic soil, brown, moist S5 - Silty SAND with Gravel (SM), fine to coarse, ~20% fines, 30-35% fine to coarse subangular gravel, trace of organic soil, trace of asphalt, trace of glass, dark brown, wet
10		10	S6	2-0-1-2 (1)	24/0		Fill		S6 - No recovery, drove 3" spoon and obtained sample: Similar to S5, 20-25% fines,
	45.0	12	S7	1-4-2-2 (6)	24/8				S7 - Similar to S5, piece of trash, trace of brick
15		14	S8	5-6-4-4 (10)	24/0	1			REMARK 1: Casing bouncing on obstruction at depth of 14 feet. S8 - No recovery
		16	S9	6-5-3-2 (8)	24/9				S9 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, 0-5% fine subangular gravel, trace of asphalt, trace of glass, dark brown, wet
	40.0	18	S10	2-1-3-3 (4)	24/14				S10 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, trace of peat fibers, gray, wet
20		20	S11	5-3-4-2 (7)	24/16				S11 - Top 13": Similar to S10, no peat fibers, thin layer of organic soil
		22						21.7 / 36.3	Bot. 3": Silty SAND (SM), fine to medium, 25-30% fines, trace of organic soil, trace of roots, dark brown, wet
	35.0	23	S12	7-3-6-6 (9)	24/13	2	Peat		REMARK 2: Casing dropped between depths of 23 feet and 25 feet. S12 - PEAT (PT), fibrous, slightly plastic, 0-5% fine sand, black, wet
25		25		7-8-5-9					S13 - PEAT (PT), non-fibrous, slightly plastic, black, wet

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

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BORING LOG

B-101

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		25	S13	(13)	24/13		Peat	
		27						
	30.0							
		29				3		29.0 / 29.0 REMARK 3: Drill rig chattering at depth of 29 feet.
30			S14	8-7-6-5 (13)	24/0			S14 - No recovery, drove 3" spoon and obtained sample Poorly Graded SAND with Silt (SP-SM), medium to coarse, ~5% fines, brown, wet
		31						
	25.0							
		34	S15	8-4-5-5 (9)	24/12			S15 - Poorly Graded SAND with Silt (SP-SM), fine to medium, ~10% fines, light brown, wet
35		36						
	20.0							
		39	S16	6-4-5-7 (9)	24/11			S16 - Poorly Graded SAND (SP), fine to medium, trace coarse, 0-5% fines, 0-5% fine subrounded gravel, light brown, wet
40		41						
	15.0							
		44	S17	10-6-5-6 (11)	24/7			S17 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, light brown, wet
45		46					Sand	
	10.0							
		49	S18	18-11-8-17 (19)	24/12			S18 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, ~10% fines, 15-20% fine subangular gravel, gray, wet
50		51						
	5.0							
		54	S19	14-14-16-28 (30)	24/12			S19 - Similar to S18
55		56						
	0.0							
		59	S20	16-12-12-16 (24)	24/4			S20 - Poorly Graded SAND with Silt (SP-SM), fine to medium, ~5% fines, gray, wet
60		61						

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BORING LOG

B-101

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
65		64	S21	5-3-5-13 (8)	24/24				S21 - Top 16": Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, trace of organic soil, gray, wet
		66							Bot. 8": Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, light brown to gray, wet
	-10.0								
						4			REMARK 4: After flushing out the borehole at depth of 69 feet, the casing dropped to depth of 71 feet.
70									
		72	S22	3-6-8-14 (14)	24/16				S22 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, wet
	-15.0	74							
75									
	-20.0								
		79	S23	12-7-15-24 (22)	24/9	5	Sand		REMARK 5: Used garden hose to maintain positive head at depth of 79 feet. S23 - Similar to S22, trace of organic soil
80		81							
	-25.0								
		84	S24	12-9-13-16 (22)	24/17				S24 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, wet
85		86							
	-30.0								
		89	S25	18-22-14-23 (36)	24/24				S25 - Similar to S24, 0-5% fine subangular gravel
90		91							
	-35.0								
		94	S26	11-10-11-15 (21)	24/7				S26 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, wet
95		96						96.0	
	-40.0								Bottom of borehole at 96.0 feet. Backfilled borehole with grout and 5.5 bags of gravel. Ground surface restored with asphalt cold patch.

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BORING LOG

B-102

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/14/22 **DATE COMPLETED:** 12/15/22
BORING LOCATION: Near western side of prop. building
COORDINATES: N 0 E 4
SURFACE El.: 61.5 ft. (see note 1) **TOTAL DEPTH:** 61 ft.
WEATHER: 30's / Sunny
GROUNDWATER LEVELS:
DURING DRILLING: 4.0 ft. / El. 57.5 ft. Based on sample moisture
AT END OF DRILLING: 9.0 ft. / El. 52.5 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0.5					Asphalt	0.3 / 61.2	Top 4": Asphalt
	60.0		S1	12-12-9 (21)	18/12				S1 - Silty SAND with Gravel (SM), fine to medium, trace coarse, 15-20% fines, 20-25% fine to coarse subangular gravel, trace of organic soil, trace of asphalt, brown, wet
		2	S2	6-6-7-11 (13)	24/5				S2 - Similar to S1
		4	S3	11-6-5-3 (11)	24/3				S3 - Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, subangular, 5-10% fines, ~15% fine to coarse sand, trace of organic soil, brown, wet
5									
	55.0	6	S4	5-3-3-3 (6)	24/10				S4 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, 10-15% fine subrounded gravel, trace of organic soil, brown, wet
		8	S5	3-2-2-2 (4)	24/8				S5 - Poorly Graded SAND with Silt (SP-SM), fine to medium, ~5% fines, gray, wet (possible fill)
10									
		10	S6	4-2-3-3 (5)	24/13		Fill		S6 - Similar to S5, fine to medium, trace coarse, trace of organic soil (possible fill)
	50.0	12							
		14	S7	3-2-3-2 (5)	24/11				S7 - Similar to S5, 5-10% fine subangular gravel (possible fill)
15									
	45.0	16							
		19	S8	3-3-5-6 (8)	24/7				S8 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, wet (possible fill)
20									
	40.0	21						22.5 / 39.0	
						1	Peat	23.5 / 38.0	REMARK 1: Peat was observed in drill cuttings between depths of 22.5' to 23.5'.
		24	S9	9-11-9-8 (20)	24/14		Sand		S9 - Well Graded SAND with Silt (SW-SM), fine to coarse, 5-10% fines, 0-5% fine subangular gravel, light brown, wet
25									

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

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BORING LOG

B-102

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	35.0	26	S10	12-11-13-11 (24)	24/15			S10 - Similar to S9
		28	S11	7-7-7-7 (14)	24/2			S11 - Poorly Graded SAND with Silt (SP-SM), fine to medium, ~5% fines, brown, wet
30		30	S12	9-9-9-8 (18)	24/13			S12 - Similar to S11, 0-5% fine subangular gravel
	30.0	32						
		34	S13	4-5-7-7 (12)	24/16			S13 - Similar to S11
35		36						
	25.0							
		39	S14	8-13-12-11 (25)	24/19			S14 - Similar to S11
40		41						
	20.0						Sand	
		44	S15	7-10-18-20 (28)	24/24			S15 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, brown, wet
45		46						
	15.0							
		49	S16	6-7-9-10 (16)	24/21			S16 - Similar to S15
50		51						
	10.0							
		54	S17	6-9-13-18 (22)	24/24			S17 - Similar to S15
55		56						
	5.0							
		59	S18	8-12-17-23 (29)	24/14			S18 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, brown, wet
60		61						61.0
	0.0							Bottom of borehole at 61.0 feet. Backfilled borehole with grout and 4 bags of gravel. Ground surface restored with asphalt cold patch.

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BORING LOG

B-103

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/19/22 **DATE COMPLETED:** 12/19/22
BORING LOCATION: Near SW corner of prop. building
COORDINATES: N 0 E 5
SURFACE El.: (see note 1) **TOTAL DEPTH:** 61 ft.
WEATHER: 40's / Sunny
GROUNDWATER LEVELS:
DURING DRILLING: 4.0 ft. Based on sample moisture
AT END OF DRILLING: 12.5 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0.5					Asphalt	0.3	Top 4": Asphalt
			S1	5-4-3 (7)	18/10				S1 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, trace of asphalt, trace of organic soil, brown, moist
		2	S2	5-3-2-2 (5)	24/15				S2 - Similar to S1, 0-5% fine subrounded gravel
		4	S3	2-1-1-1 (2)	24/6				S3 - Silty SAND (SM), fine to medium, trace coarse, 20-25% fines, trace of organic soil, brown, wet
5		6	S4	1-1-2-2 (3)	24/9				S4 - Similar to S3, 0-5% fine subrounded gravel
		8	S5	3-1-1-1 (2)	24/3				S5 - Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 20-25% fine to coarse gravel, trace of asphalt, trace of organic soil, brown, wet
10		10	S6	1-1-1-1 (2)	24/12				S6 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 25-30% mostly fine subrounded gravel, trace of asphalt, brown, wet
		12	S7	1-1-1-1 (2)	24/0		Fill		S7 - No recovery
		14	S8	1-1-1-1 (2)	24/4				S8 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 10-15% fines, 0-5% fine subrounded gravel, trace of organic soil, trace of roots, brown, wet
15		16	S9	1-2-2-2 (4)	24/11				S9 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 15-20% fine subrounded gravel, trace of organic soil, brown, wet
		18	S10	2-1-2-2 (3)	24/6				S10 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 20-25% fine subrounded gravel, trace of glass, brown, wet
20		20	S11	6-6-6-5 (12)	24/13				S11 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, 0-5% fine subrounded gravel, trace of organic soil, gray, wet
		22	S12	2-3-3-4 (6)	24/10				S12 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, 5-10% fine subrounded gravel, trace of organic soil, gray, wet
25		24	S13	1-2-3-2 (5)	24/16		Peat	24.0	S13 - PEAT (PT), fibrous, non-plastic, black, wet

GENERAL NOTES:
1. The ground surface elevation is not available.

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BORING LOG

B-103

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		26							
			S14	3-3-4-4 (7)	24/20		Peat		S14 - Top 18": Similar to S13
		28						27.5	
			S15	2-2-2-3 (4)	24/19		Silt		Bot 2": Poorly Graded SAND (SP-SM), fine to medium, 5-10% fines, organic odor, gray, wet S15 - Sandy SILT (ML), non-plastic, ~30% fine sand, trace of organic soil, trace of roots, gray, wet
30		30							
			S16	4-3-3-3 (6)	24/22				S16 - Similar to S15, no organic soil, no roots
		32						32.0	
			S17	1-1-1-2 (2)	24/2		Sand		S17 - Silty SAND (SM), fine to coarse, 20-25% fines, 0-5% fine subrouned gravel, gray, wet
		34							
35			S18	3-4-6-6 (10)	24/17				S18 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, light brown, wet
		36							
		39							
40			S19	6-6-7-7 (13)	24/3				S19 - Similar to S18
		41							
		44							
45			S20	6-6-7-10 (13)	24/13				S20 - Similar to S18
		46							
		49							
50			S21	7-8-9-12 (17)	24/11				S21 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, 0-5% fine subrounded gravel, light brown, wet
		51							
		54							
55			S22	9-12-13-13 (25)	24/3				S22 - Poorly Graded SAND with Silt (SP-SM), fine, 10-15% fines, light brown, wet
		56							
		59							
60			S23	9-13-14-14 (27)	24/17				S23 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, brown, wet
		61						61.0	
									Bottom of borehole at 61.0 feet. Backfilled borehole with grout and 5 bags of gravel. Ground surface restored with asphalt cold patch.

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BORING LOG

B-104

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/15/22 **DATE COMPLETED:** 12/16/22
BORING LOCATION: Near center of prop. building
COORDINATES: N 0 E 6
SURFACE El.: 59.5 ft. (see note 1) **TOTAL DEPTH:** 61 ft.
WEATHER: 30's / Cloudy
GROUNDWATER LEVELS:
DURING DRILLING: 6.0 ft. / El. 53.5 ft. Based on sample moisture
AT END OF DRILLING: 12.0 ft. / El. 47.5 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
							Asphalt (0.3 / 59.2)	Top 4": Asphalt
		0.5	S1	12-9-8 (17)	18/12			S1 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 40-45% fine to coarse subrounded gravel, trace of asphalt, dark brown, moist
		2	S2	4-3-3-3 (6)	24/21			S2 - Similar to S1
	55.0	4	S3	2-2-2-4 (4)	24/6			S3 - Silty SAND (SM), fine to medium, ~15% fines, 0-5% fine subrounded gravel, trace of organic soil, trace of asphalt, dark brown, moist
5		6	S4	13-4-8-4 (12)	24/13			S4 - Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, subangular, 5-10% fines, 25-30% fine to medium sand, trace of asphalt, dark brown, wet
		8	S5	4-3-4-4 (7)	24/16		Fill	S5 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, trace coarse, 10-15% fines, ~15% fine subrounded gravel, trace of organic soil, dark brown, wet
	50.0	10	S6	4-3-3-3 (6)	24/8			S6 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, trace of organic soil, brown, wet
10		12	S7	3-3-3-3 (6)	24/11			S7 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, light brown, wet
	45.0	14	S8	3-2-3-1 (5)	24/4			S8 - Similar to S7, 5-10% fine to coarse subrounded gravel, trace of organic soil
15		16	S9	2-4-5-4 (9)	24/14			S9 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, light brown to gray, petroleum odor, trace of organic soil, wet
		18	S10	3-2-2-3 (4)	24/12		Peat (18.0 / 41.5)	S10 - PEAT (PT), fibrous, non-plastic, black, wet
	40.0	20	S11	9-8-12-12 (20)	24/17		Sand (20.0 / 39.5)	S11 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, gray, wet
20		22	S12	7-6-9-7 (15)	24/4			S12 - Similar to S11, gray to brown
	35.0	24	S13	10-10-8-8 (18)	24/12			S13 - Similar to S11, 0-5% fine subrounded gravel, brown
25								

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

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BORING LOG

B-104

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
		26						
	30.0	29	S14	2-4-3-6 (7)	24/15			S14 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, brown, wet
30		31						
	25.0	34	S15	5-6-6-6 (12)	24/18			S15 - Similar to S14, fine
35		36						
	20.0	39	S16	5-5-8-8 (13)	24/13			S16 - Similar to S14, fine
40		41						
		44					Sand	
	15.0		S17	4-6-6-11 (12)	24/20			S17 - Poorly Graded SAND with Silt (SP-SM), fine, 10-15% fines, light brown, wet
45		46						
	10.0	49	S18	7-6-7-8 (13)	24/16			S18 - Similar to S17, fine to medium, trace coarse, 10-15% fine subrounded gravel
50		51						
	5.0	54	S19	5-6-6-7 (12)	24/14			S19 - Silty SAND (SM), fine to medium, 20-25% fines, gray, wet
55		56						
	0.0	59	S20	7-7-9-9 (16)	24/11			S20 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, gray, wet
60		61						
								61.0
								Bottom of borehole at 61.0 feet. Backfilled borehole with grout and 4 bags of gravel. Ground surface restored with asphalt cold patch.

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BORING LOG

B-105

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/20/22 **DATE COMPLETED:** 12/21/22
BORING LOCATION: Near northern portion of prop. building
COORDINATES: N 0 E 13
SURFACE El.: 57.5 ft. (see note 1) **TOTAL DEPTH:** 61 ft.
WEATHER: 40's / Sunny
GROUNDWATER LEVELS:
DURING DRILLING: 4.0 ft. / El. 53.5 ft. Based on sample moisture
AT END OF DRILLING: 9.0 ft. / El. 48.5 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0					Topsoil	0.3 / 57.2	S1 - Top 3": Topsoil Bot. 15": Silty SAND (SM), fine to medium, 20-25% fines, trace of organic soil, black, moist
	55.0	2	S1	1-1-2-1 (3)	24/18				S2 - Silty SAND (SM), fine to medium, 20-25% fines, 10-15% fine subrounded gravel, trace of organic soil, trace of brick, dark brown, moist
5		4	S2	2-7-6-4 (13)	24/22				S3 - Similar to S2, wet
	50.0	6	S3	4-3-2-2 (5)	24/19				S4 - Similar to S2, 15-20% fines, trace of nail, wet
10		8	S4	3-3-3-3 (6)	24/11				S5 - Well Graded Gravel with Silt and Sand (GW-GM), fine to coarse, subangular, 5-10% fines, 15-20% fine to coarse sand, trace of bricks, brown, wet
	45.0	10	S5	5-6-4-5 (10)	24/6				S6 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, trace of organic soil, gray to brown, wet
15		12	S6	5-3-1-1 (4)	24/4		Fill		
	40.0	14	S7	1-1-1-2 (2)	24/14				S7 - Similar to S6, 0-5% fine subrounded gravel
20		16							
	35.0	19	S8	11-14-13-13 (27)	24/16				S8 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, trace of organic soil, gray, wet
25		21							
		24	S9	1-1-2-5 (3)	24/3			26.0	S9 - Silty SAND (SM), fine to coarse, 20-25% fines, 10-15% fine subrounded gravel, trace of organic soil, gray, wet

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

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BORING LOG

B-105

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Material Description
	30.0	26	S10	3-3-4-7 (7)	24/4		Peat	S10 - PEAT (PT), non-fibrous, non-plastic, black, wet
		28	T1		24/14			T1 - Undisturbed tube sample obtained between depths of 28 feet and 30 feet in PEAT.
30		30	S11	3-4-4-7 (8)	24/24			S11 - PEAT (PT), non-fibrous, non-plastic, black, wet
	25.0	32						
		34	S12	1-1-2-4 (3)	24/24			S12 - Similar to S11
35		36	T2		24/16	1	Silt	REMARK 1: Strata change assumed based on material in undisturbed tube sample. T2 - Undisturbed tube sample obtained between depths of 36 feet and 38 feet in SILT.
	20.0	38	S13	1-1-1-1 (2)	24/24			S13 - SILT (ML), slightly to moderately plastic, trace of organic soil, gray to black, wet
40		40						
	15.0	44	S14	1-1-1-1 (2)	24/24			S14 - SILT (ML), slightly to moderately plastic, trace of organic soil, gray, wet
45		46						
	10.0	49	S15	5-6-6-6 (12)	24/18		Sand	S15 - Poorly Graded SAND (SP), fine to medium, 0-5% fines, light brown, wet
50		51						
	5.0	54	S16	6-7-7-7 (14)	24/13			S16 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, 0-5% fine subrounded gravel, light brown, wet
55		56						
	0.0	59	S17	9-10-10-11 (20)	24/20			S17 - Similar to S16
60		61						
	-5.0							Bottom of borehole at 61.0 feet. Backfilled borehole with grout and 5 bags of gravel.

Strata Depth El.(ft.): 31.5; 36.0 / 21.5; 49.0 / 8.5; 61.0 / -3.5

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BORING LOG

B-106-OW

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/21/22 **DATE COMPLETED:** 12/22/22
BORING LOCATION: Near northern portion of prop. building
COORDINATES: N 0 E 8
SURFACE El.: 56 ft. (see note 1) **TOTAL DEPTH:** 61 ft.
WEATHER: 40's / Sunny
GROUNDWATER LEVELS:
DURING DRILLING: 6.0 ft. / El. 50.0 ft. Based on sample moisture
AT END OF DRILLING: 9.0 ft. / El. 47.0 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
	55.0	0	S1	6-4-4-5 (8)	24/18		Topsoil	0.3 55.7	S1 - Top 4": Topsoil Bot. 14": Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, trace of organic soil, brown, moist
		2	S2	3-4-5-6 (9)	24/13				S2 - Similar to S1 Bot. 14", 0-5% fine subrounded gravel
5		4	S3	4-4-3-3 (7)	24/16				S3 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, moist
	50.0	6	S4	1-1-1-1 (2)	24/6				S4 - Similar to S3, wet
		8	S5	0-1-1-1 (2)	24/18		Fill		S5 - Similar to S3, trace of organic soil, wet
10		10	S6	1-1-2-1 (3)	24/8				S6 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, 0-5% fine subrounded gravel, trace of organic soil, trace of wood, gray, wet
	45.0	12	S7	13-4-2-1 (6)	24/2				S7 - Piece of wood
		14	S8	2-2-2-1 (4)	24/10				S8 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 10-15% fines, 0-5% fine subrounded gravel, trace of wood, gray, wet
15	40.0	16	S9	2-2-1-1 (3)	24/13				S9 - Similar to S8
		18	S10	1-1-1-2 (2)	24/17			18.0 38.0	S10 - Poorly Graded SAND with Silt (SP-SM), fine, 10-15% fines, trace of organic soil, gray, wet
20		20	S11	1-1-1-1 (2)	24/21		Buried Organic Soil		S11 - Sandy SILT (ML), non-plastic, 30-35% fine sand, trace of organic soil, gray, wet
	35.0	22	S12	1-1-2-3 (3)	24/15				S12 - Silty SAND (SM), fine, 15-20% fines, trace of organic soil, gray, wet
		24	S13	1-1-1-1 (2)	24/22				S13 - Similar to S12
25	30.0								

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

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BORING LOG

B-106-OW

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		26	S14	1-2-3-7 (5)	24/12		Buried Organic Soil		S14 - Silty SAND (SM), fine to medium, 25-30% fines, trace of organic soil, gray, wet
		28	S15	5-6-6-6 (12)	24/18			28.0	
30		30	S16	6-6-8-7 (14)	24/23			28.0	S15 - Silty SAND (SM), fine, 20-25% fines, gray, wet
	25.0	32							S16 - Similar to S15
		34	S17	6-7-6-7 (13)	24/21				S17 - SILT (ML), slightly plastic, 10-15% fine sand, gray, wet
35		36							
	20.0								
		39	S18	4-5-4-4 (9)	24/9				S18 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, wet
40		41							
	15.0								
		44	S19	4-4-5-5 (9)	24/4		Sand		S19 - Well Graded GRAVEL with Silt and Sand (GW-GM), fine to coarse, subrounded, 5-10% fines, 15-20% fine to coarse sand, gray, wet
45		46							
	10.0								
		49	S20	10-15-10-10 (25)	24/16				S20 - Similar to S19
50		51							
	5.0								
		54	S21	6-6-6-8 (12)	24/20				S21 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 25-30% fine to coarse subangular gravel, gray, wet
55		56							
	0.0								
		59	S22	9-6-7-8 (13)	24/21				S22 - Similar to S21
60		61						61.0	
	-5.0							-5.0	Bottom of borehole at 61.0 feet. Backfilled borehole with grout and 5 bags of gravel. Installed groundwater observation well.

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BORING LOG

B-107

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/27/22 **DATE COMPLETED:** 12/27/22
BORING LOCATION: Near southern portion of prop. building
COORDINATES: N 0 E 9
SURFACE El.: 56 ft. (see note 1) **TOTAL DEPTH:** 51 ft.
WEATHER: 30's / Cloudy
GROUNDWATER LEVELS:
DURING DRILLING: 8.0 ft. / El. 48.0 ft. Based on sample moisture
AT END OF DRILLING: 8.0 ft. / El. 48.0 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0					Topsoil	0.5	S1 - Top 6": Topsoil
	55.0		S1	10-4-4-2 (8)	24/18			55.5	Bot. 12": Silty SAND (SM), fine to medium, 20-25% fines, trace of organic soil, trace of roots, dark brown, moist
		2	S2	2-2-2-4 (4)	24/10				S2 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, trace of organic soil, brown, moist
		4	S3	4-2-3-3 (5)	24/17				S3 - Silty SAND (SM), fine to medium, trace coarse, 20-25% fines, trace of organic soil, trace of asphalt, black, moist
5	50.0	6	S4	3-2-2-2 (4)	24/19				S4 - Similar to S3
		8	S5	4-3-1-1 (4)	24/6		Fill		S5 - Poorly Graded SAND with Silt (SP-SM), fine, 10-15% fines, organic odor, gray, wet
10	45.0	10	S6	6-6-6-8 (12)	24/13				S6 - Similar to S5
		12	S7	3-5-5-3 (10)	24/4				S7 - Similar to S5, trace of organic soil
		14	S8	2-1-2-2 (3)	24/5				S8 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, gray, wet
15	40.0	16	S9	3-3-2-3 (5)	24/10				S9 - Similar to S8, 10-15% fines, trace of organic soil
		18	S10	1-2-3-4 (5)	24/23			18.0 38.0	S10 - PEAT (PT), non-plastic, fibrous, black, wet
20	35.0	20	T1		24/16		Peat		T1 - Undisturbed tube sample obtained between depths of 20 feet and 22 feet in PEAT.
		22	S11	1-2-3-2 (5)	24/22			22.0 34.0	S11 - SILT with Sand (ML), slightly plastic, 15-20% fine sand, trace of organic soil, gray, wet
		24	S12	1-1-1-1 (2)	24/24		Buried Organic Soil		S12 - SILT (ML), slightly to moderately plastic, trace of organic soil, gray, wet
25	30.0								

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

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BORING LOG

B-107

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		26	T2		24/19		Buried Organic Soil	28.0	T2 - Undisturbed tube sample obtained between depths of 26 feet and 28 feet in buried organic soil
		28	S13	2-3-4-5 (7)	24/4			28.0	S13 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, brown, wet
30		30							
	25.0								
		34	S14	3-3-3-4 (6)	24/3				S14 - Well Graded SAND with Gravel (SW), fine to coarse, 0-5% fines, 15-20% fine subrounded gravel, brown, wet
35		36							
	20.0								
		39	S15	4-4-5-5 (9)	24/14		Sand		S15 - Similar to S13
40		41							
	15.0								
		44	S16	5-6-6-6 (12)	24/11				S16 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, light brown, wet
45		46							
	10.0								
		49	S17	6-6-6-6 (12)	24/16				S17 - Similar to S16, 0-5% fine subrounded gravel
50		51						51.0	
	5.0							5.0	Bottom of borehole at 51.0 feet. Backfilled borehole with grout and 3 bags of gravel.
55									
	0.0								
60									
	-5.0								

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BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/14/22 **DATE COMPLETED:** 12/14/22
BORING LOCATION: Near NE corner of prop. building
COORDINATES: N 0 E 10
SURFACE El.: 61.5 ft. (see note 1) **TOTAL DEPTH:** 32 ft.
WEATHER: 30's / Sunny
GROUNDWATER LEVELS:
DURING DRILLING: 4.0 ft. / El. 57.5 ft. Based on sample moisture
AT END OF DRILLING: 15.0 ft. / El. 46.5 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0.5					Asphalt	0.3 / 61.2	Top 4": Asphalt
	60.0		S1	11-9-7 (16)	18/13				S1 - Silty SAND (SM), fine, trace medium, 15-20% fines, 0-5% fine subangular gravel, trace of brick, trace of asphalt, gray, moist
		2	S2	2-4-14-31 (18)	24/8		Fill		S2 - Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 30-35% fine to coarse subangular gravel, trace of trash, trace of organic soil, trace of asphalt, dark brown to gray, moist
		4	S3	8-6-21-15 (27)	24/6				S3 - Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 30-35% fine to coarse subangular gravel, trace of organic soil, trace of asphalt, dark brown to gray, wet
5								6.0 / 55.5	
	55.0	6	S4	15-9-16-15 (25)	24/17				S4 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, trace coarse, 5-10% fines, ~15% fine subangular gravel, gray, wet
		8	S5	10-8-10-8 (18)	24/2				S5 - Similar to S4, 20-25% fine to coarse subangular gravel
10		10	S6	9-8-11-11 (19)	24/23				S6 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 10-15% fines, light brown, wet
	50.0	12	S7	8-1-1-1 (2)	24/6				S7 - Similar to S6, fine to medium, trace coarse
		14	S8	1-1-1-1 (2)	24/2				S8 - Similar to S6, fine to medium, trace coarse, petroleum odor
15							Sand		
	45.0	16	S9	8-9-9-9 (18)	24/24				S9 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, wet
		18	S10	4-4-4-5 (8)	24/9				S10 - Similar to S9
20		20	S11	6-8-9-8 (17)	24/19				S11 - Similar to S9
	40.0	22	S12	5-5-7-7 (12)	24/13				S12 - Similar to S9
		24	S13	6-7-8-9 (15)	24/14				S13 - Poorly Graded SAND with Silt (SP-SM), fine, ~5% fines, light brown, wet
25									

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

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BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
30	35.0	26	S14	10-10-9-10 (19)	24/12		Sand		S14 - Similar to S13
		28	S15	6-7-9-9 (16)	24/11				S15 - Similar to S13
	30.0	30	S16	10-8-10-11 (18)	24/17				S16 - Similar to S13
35		32						32.0 29.5	Bottom of borehole at 32.0 feet. Backfilled borehole with grout and 3 bags of gravel. Ground surface restored with asphalt cold patch.
	25.0								
40									
	20.0								
45									
	15.0								
50									
	10.0								
55									
	5.0								
60									
	0.0								

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BORING LOG

P-2

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/16/22 **DATE COMPLETED:** 12/16/22
BORING LOCATION: Near eastern edge of prop. building
COORDINATES: N 0 E 11
SURFACE El.: 62 ft. (see note 1) **TOTAL DEPTH:** 31 ft.
WEATHER: 40's / Rainy
GROUNDWATER LEVELS:
DURING DRILLING: 14.0 ft. / El. 48.0 ft. Based on sample moisture
AT END OF DRILLING: 11.0 ft. / El. 51.0 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
							Asphalt	0.3 / 61.7	Top 4": Asphalt
		0.5	S1	5-3-3 (6)	18/15				S1 - Poorly Graded SAND with Silt (SP-SM), fine to medium, ~5% fines, trace of asphalt, light brown, most
	60.0	2							
		4	S2	2-2-10-7 (12)	24/13		Fill		S2 - Silty SAND (SM), fine to coarse, 15-20% fines, 5-10% fine subrounded gravel, trace of organic soil, trace of brick, brown, moist
5		6							
	55.0							8.0 / 54.0	
						1			REMARK 1: Strata change assumed based on drill effort
		9	S3	8-7-8-14 (15)	24/21				S3 - Poorly Graded SAND (SP), fine to medium, trace coarse, 0-5% fines, light brown, moist
10		11							
	50.0								
		14	S4	4-4-4-5 (8)	24/10				S4 - Well Graded SAND (SW), fine to coarse, 0-5% fines, petroleum odor, light brown, wet
15		16							
	45.0						Sand		
		19	S5	4-5-5-5 (10)	24/12				S5 - Poorly Graded SAND (SP), fine, 0-5% fines, gray, wet
20		21	S6	6-6-6-7 (12)	24/14				S6 - Similar to S5, fine to medium
	40.0	23	S7	5-5-7-8 (12)	24/19				S7 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, gray, wet
25		25		6-7-8-8					S8 - Similar to S7

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

LGCI
Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Rd Suite 2
Billerica, MA 01862
Telephone: 9783305912
Fax: 9783305056

BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
	35.0	25	S8	(15)	24/11				
		27	S9	8-8-10-9 (18)	24/22		Sand		S9 - Similar to S7
30		29	S10	8-8-10-13 (18)	24/24				S10 - Similar to S7
	30.0	31						31.0 31.0	Bottom of borehole at 31.0 feet. Backfilled borehole with grout and 4 bags of gravel. Ground surface restored with asphalt cold patch.
35									
	25.0								
40									
	20.0								
45									
	15.0								
50									
	10.0								
55									
	5.0								
60									
	0.0								

LGCI
Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Rd Suite 2
Billerica, MA 01862
Telephone: 9783305912
Fax: 9783305056

BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/15/22 **DATE COMPLETED:** 12/15/22
BORING LOCATION: Near eastern portion of prop. building
COORDINATES: N 0 E 12
SURFACE El.: 62.5 ft. (see note 1) **TOTAL DEPTH:** 31 ft.
WEATHER: 30's / Cloudy
GROUNDWATER LEVELS:
DURING DRILLING: 9.0 ft. / El. 53.5 ft. Based on sample moisture
AT END OF DRILLING: 12.0 ft. / El. 50.5 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
							Asphalt	0.3 / 62.2	Top 4": Asphalt
		0.5	S1	6-7-6 (13)	18/17				S1 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, trace of asphalt, brown, moist
	60.0	2							
		4	S2	1-1-1-1 (2)	24/4				S2 - Similar to S1
5		6							
	55.0					1			REMARK 1: Strata change assumed based on drilling effort.
		9	S3	1-0-1-1 (1)	24/9		Fill		S3 - Poorly Graded SAND (SP), fine to medium, trace coarse, 0-5% fines, 0-5% subrounded gravel, light brown, wet (possible fill)
10		11							
	50.0								
		14	S4	1-0-0-1 (0)	24/4				S4 - Silty SAND (SM), fine to medium, trace coarse, 15-20% fines, 10-15% fine subrounded gravel, light brown, wet (possible fill)
15		16							
	45.0								
		19	S5	1-1-1-6 (2)	24/18		Peat	19.0 / 43.5	S5 - PEAT (PT), non-fibrous, non-plastic, black, wet
20		21	S6	17-12-13-12 (25)	24/22		Sand	21.0 / 41.5	S6 - Well Graded SAND with Silt (SW-SM), fine to coarse, 5-10% fines, 0-5% fine subrounded gravel, gray, wet
	40.0	23	S7	9-10-12-11 (22)	24/13				S7 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace of coarse, 5-10% fines, 0-5% fine subrounded gravel, brown to gray, wet
25		25		11-13-11-12					S8 - Similar to S7

GENERAL NOTES:

1. The ground surface elevation was interpolated to the nearest 1/2 foot from drawing titled: "Existing Conditions Plan, Assessor's Plat 9 Lot 50, Higginson Ave., Central Falls, Rhode Island," prepared by Canavan & Associates, Inc., dated December 8, 2021, and provided to LGCI by Ai3 Architects, LLC via e-mail on July 28, 2022.

LGCI
Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Rd Suite 2
Billerica, MA 01862
Telephone: 9783305912
Fax: 9783305056

BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		25	S8	(24)	24/15				
	35.0	27	S9	5-6-8-9 (14)	24/18		Sand		S9 - Similar to S7, ~5% fines
30		29	S10	12-10-12-13 (22)	24/17				S10 - Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, brown, wet
		31						31.0	
	30.0								Bottom of borehole at 31.0 feet. Backfilled borehole with grout and 3 bags of gravel. Ground surface restored with asphalt cold patch.
35									
	25.0								
40									
	20.0								
45									
	15.0								
50									
	10.0								
55									
	5.0								
60									
	0.0								

LGCI Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Rd Suite 2
Billerica, MA 01862
Telephone: 9783305912
Fax: 9783305056

BORING LOG

P-4

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

DATE STARTED: 12/20/22 **DATE COMPLETED:** 12/20/22
BORING LOCATION: Near SE corner of prop. building
COORDINATES: N 0 E 7
SURFACE El.: (see note 1) **TOTAL DEPTH:** 32 ft.
WEATHER: 40's / Sunny
GROUNDWATER LEVELS:
DURING DRILLING: 4.0 ft. Based on sample moisture
AT END OF DRILLING: 11.0 ft.
OTHER: -

DRILLING SUBCONTRACTOR: Northern Drill Service, Inc.
DRILLING FOREMAN: Jon Beirholm
DRILLING METHOD: Drive and wash with 4-inch casing
DRILL RIG TYPE/MODEL: Mobile B-48 ATV Rig
HAMMER TYPE: Automatic
HAMMER WEIGHT: 140 lb. **HAMMER DROP:** 30 in.
SPLIT SPOON DIA.: 1.375 in. I.D., 2 in. O.D.
CORE BARREL SIZE: NA
LOGGED BY: NP **CHECKED BY:** TG

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		0.5					Asphalt	0.3	Top 4": Asphalt
			S1	7-7-3 (10)	18/13				S1 - Poorly Graded SAND with Silt (SP-SM), fine to medium, ~10% fines, trace of organic soil, trace of asphalt, dark brown, moist
		2	S2	4-3-3-3 (6)	24/19		Fill		S2 - Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, trace coarse, 5-10% fines, 15-20% fine to coarse subrounded gravel, dark brown, moist
		4	S3	1-1-1-1 (2)	24/6				S3 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, 0-5% fine subrounded gravel, light brown, wet
5		6	S4	2-2-3-3 (5)	24/12			6.0	S4 - Similar to S3
		8	S5	6-5-5-5 (10)	24/3				S5 - Similar to S3
10		10	S6	6-3-3-3 (6)	24/18				S6 - Similar to S3
		12	S7	1-1-2-2 (3)	24/4				S7 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, light brown, wet
		14	S8	3-3-3-3 (6)	24/17				S8 - Silty SAND (SM), fine to medium, trace coarse, 15-20% fines, 5-10% fine subrounded gravel, light brown, wet
15		16	S9	3-1-1-1 (2)	24/21		Sand		S9 - Well Graded SAND with Silt (SW-SM), fine to coarse, 5-10% fines, 5-10% fine subrounded gravel, light brown, wet
		18	S10	2-2-3-6 (5)	24/19				S10 - Silty SAND (SM), fine to medium, 15-20% fines, brown, wet
20		20	S11	7-7-7-9 (14)	24/22				S11 - Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, light brown, wet
		22	S12	5-5-6-7 (11)	24/15				S12 - Similar to S11, 0-5% fine subrounded gravel
25		24	S13	4-5-6-8 (11)	24/20				S13 - Poorly Graded SAND with Silt (SP-SM), fine, trace medium, 5-10% fines, light brown, wet

GENERAL NOTES:
1. The ground surface elevation is not available.

LGCI
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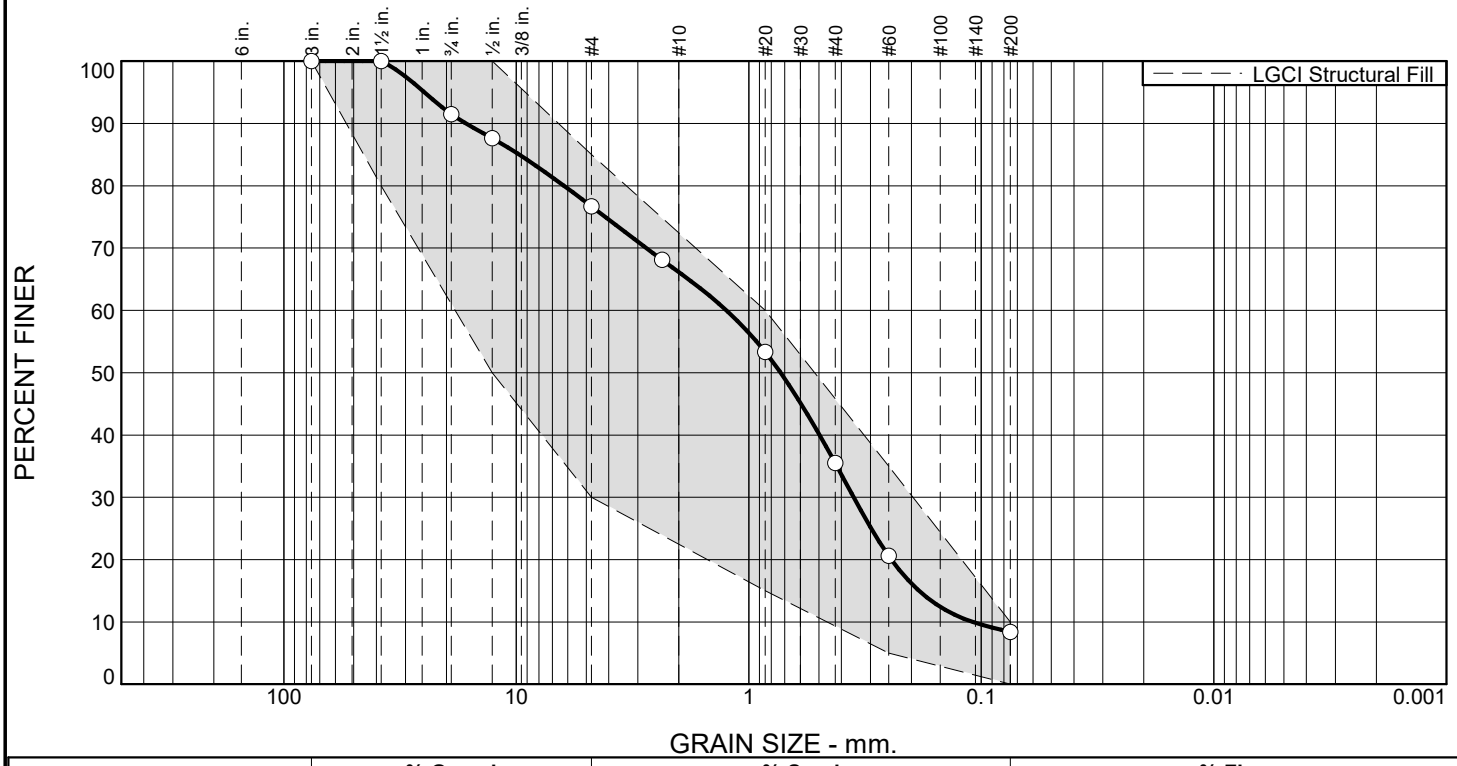
BORING LOG

CLIENT: Ai3 Architects LLC
PROJECT NAME: Proposed Central Falls High School
LGCI PROJECT NUMBER: 2232
PROJECT LOCATION: Central Falls, Rhode Island

Depth (ft.)	El. (ft.)	Sample Interval (ft.)	Sample Number	Blow Counts (N Value)	Pen./Rec. (in.)	Remark	Strata	Depth El.(ft.)	Material Description
		26							
			S14	7-7-10-10 (17)	24/16				S14 - Similar to S13
		28							
			S15	5-7-8-10 (15)	24/19		Sand		S15 - Similar to S13, dark brown
30		30							
			S16	12-13-11-13 (24)	24/23				S16 - Similar to S13, brown
		32						32.0	
									Bottom of borehole at 32.0 feet. Backfilled borehole with grout and 3 bags of gravel. Ground surface restored with asphalt cold patch.
35									
40									
45									
50									
55									
60									

Appendix C – Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.5	14.8	10.6	30.6	27.1	8.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	91.5		
0.5"	87.6	50.0 - 100.0	
#4	76.7	30.0 - 85.0	
#8	68.1		
#20	53.3	15.0 - 60.0	
#40	35.5		
#60	20.6	5.0 - 35.0	
#200	8.4	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 20-25% fine to coarse subrounded gravel, trace of organic soil, trace of asphalt, dark brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 16.4984 D_{85}= 9.7070 D_{60}= 1.2469
D_{50}= 0.7302 D_{30}= 0.3535 D_{15}= 0.1852
D_{10}= 0.1091 C_u= 11.43 C_c= 0.92

Remarks

Fill Sample

Date Received: 7/18/2022 **Date Tested:** 7/27/2022

Tested By: YSP

Checked By: RF

Location: Boring B-101 **Date Sampled:** 7/18/2022

Sample Number: G1 **Depth:** 0.5'-6.0'

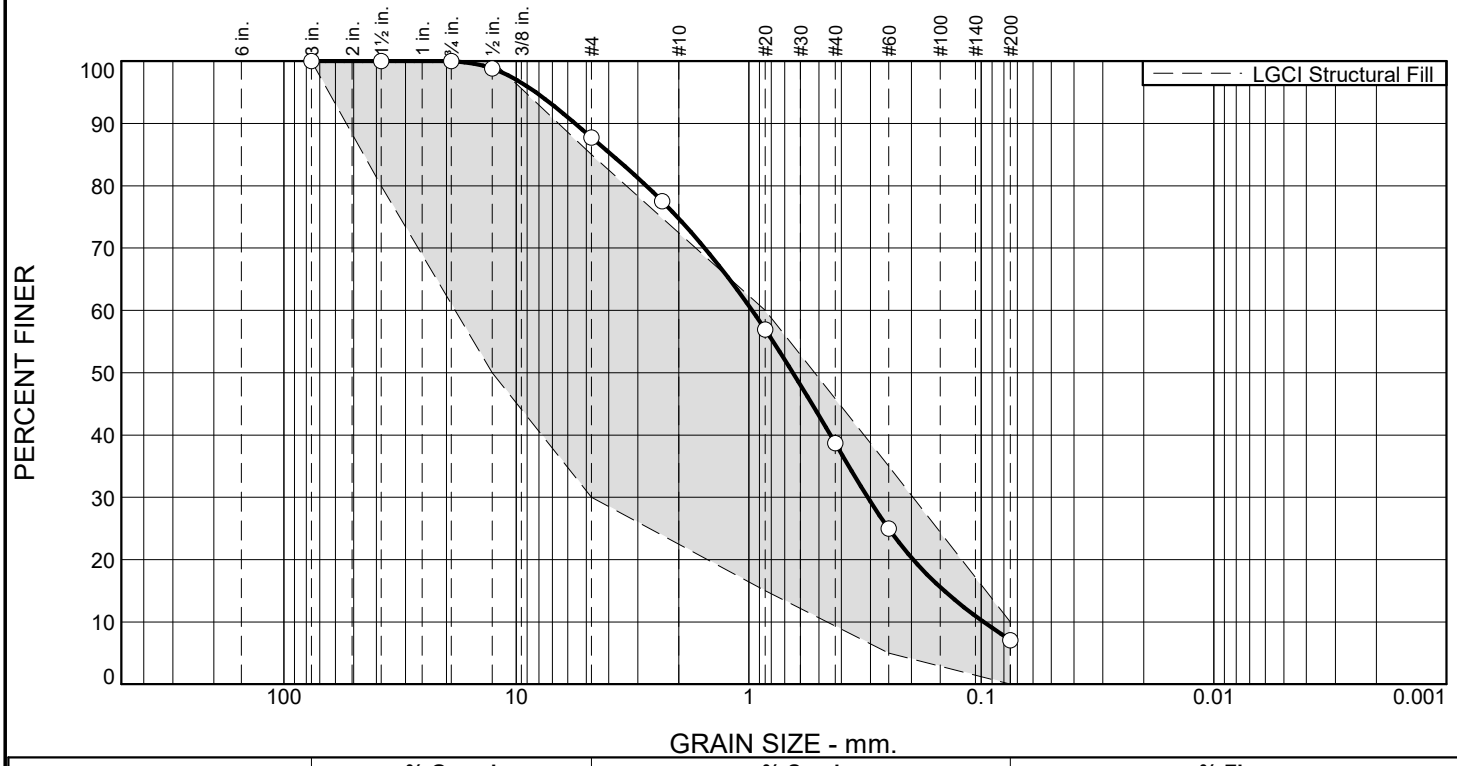
LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC

Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.2	13.1	36.0	31.7	7.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	98.8	50.0 - 100.0	
#4	87.8	30.0 - 85.0	X
#8	77.5		
#20	56.9	15.0 - 60.0	
#40	38.7		
#60	25.0	5.0 - 35.0	
#200	7.0	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt (SW-SM), fine to coarse, 0-10% fines, 10-15% fine subrounded gravel, light brown to orange

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 5.5775 D_{85}= 3.8939 D_{60}= 0.9680
D_{50}= 0.6466 D_{30}= 0.3077 D_{15}= 0.1443
D_{10}= 0.0977 C_u= 9.91 C_c= 1.00

Remarks

Fill Sample

Date Received: 7/21/2022 **Date Tested:** 7/26/2022

Tested By: YSP

Checked By: RF

Location: Boring B-101
Sample Number: S2 **Depth:** 8.0'-10.0'

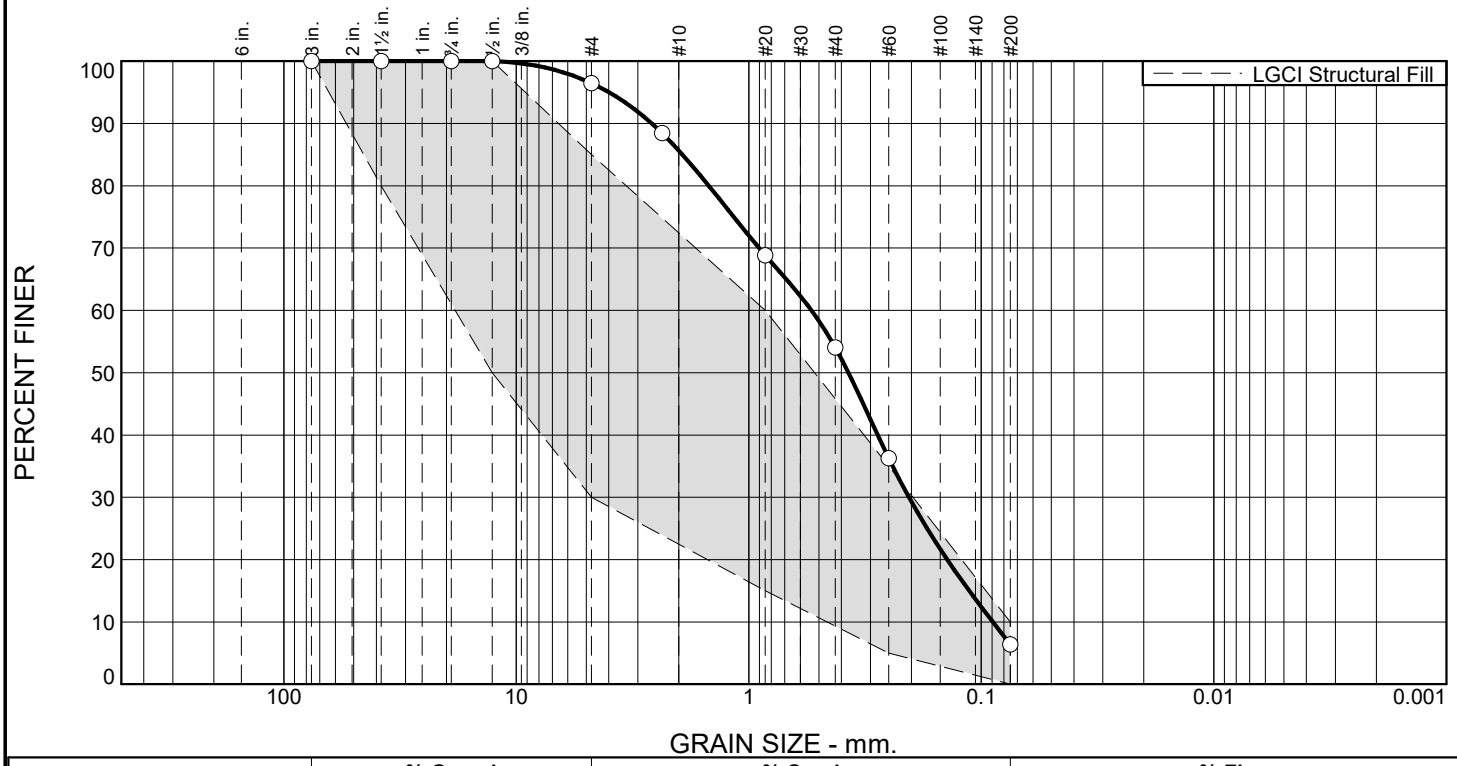
Date Sampled: 7/21/2022

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.5	10.8	31.6	47.7	6.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	96.5	30.0 - 85.0	X
#8	88.5		
#20	68.9	15.0 - 60.0	X
#40	54.1		
#60	36.3	5.0 - 35.0	X
#200	6.4	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines, 0-5% fine subrounded gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.6146 D_{85}= 1.9278 D_{60}= 0.5379
D_{50}= 0.3727 D_{30}= 0.2043 D_{15}= 0.1126
D_{10}= 0.0892 C_u= 6.03 C_c= 0.87

Remarks

Sand and Gravel Sample

Date Received: 7/21/2022 **Date Tested:** 7/26/2022

Tested By: YSP

Checked By: RF

Location: Boring B-101
Sample Number: S4 **Depth:** 12.0'-14.0'

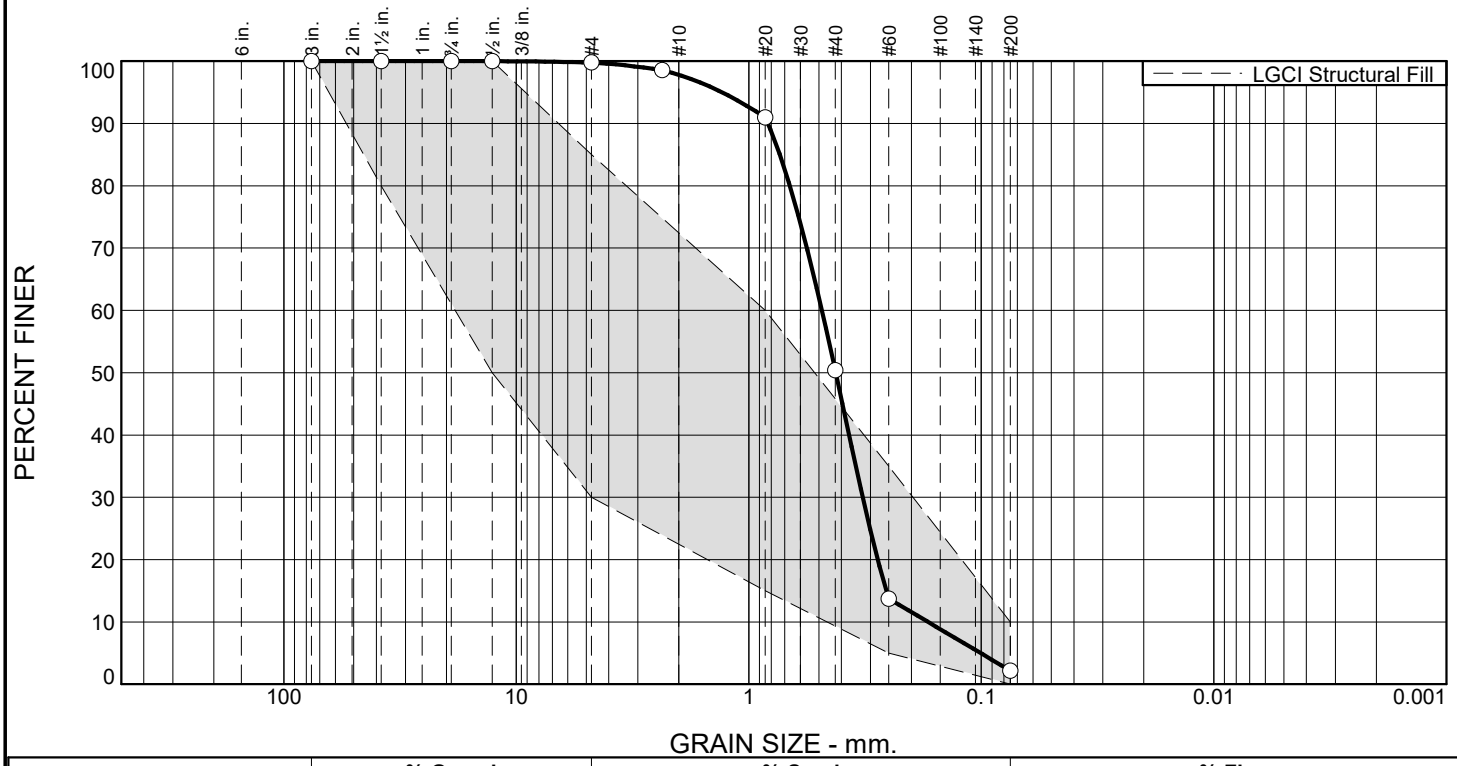
Date Sampled: 7/21/2022

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	2.0	47.4	48.2	2.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	99.8	30.0 - 85.0	X
#8	98.6		
#20	91.0	15.0 - 60.0	X
#40	50.4		
#60	13.7	5.0 - 35.0	
#200	2.2	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND (SP), fine to medium, 0-5% fines, trace of fine gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 0.8274 D_{85}= 0.7353 D_{60}= 0.4852
D_{50}= 0.4227 D_{30}= 0.3232 D_{15}= 0.2560
D_{10}= 0.1694 C_u= 2.86 C_c= 1.27

Remarks

Sand and Gravel Sample

Date Received: 7/21/2022 **Date Tested:** 7/26/2022

Tested By: YSP

Checked By: RF

Location: Boring B-101
Sample Number: S5 **Depth:** 14.0'-16.0'

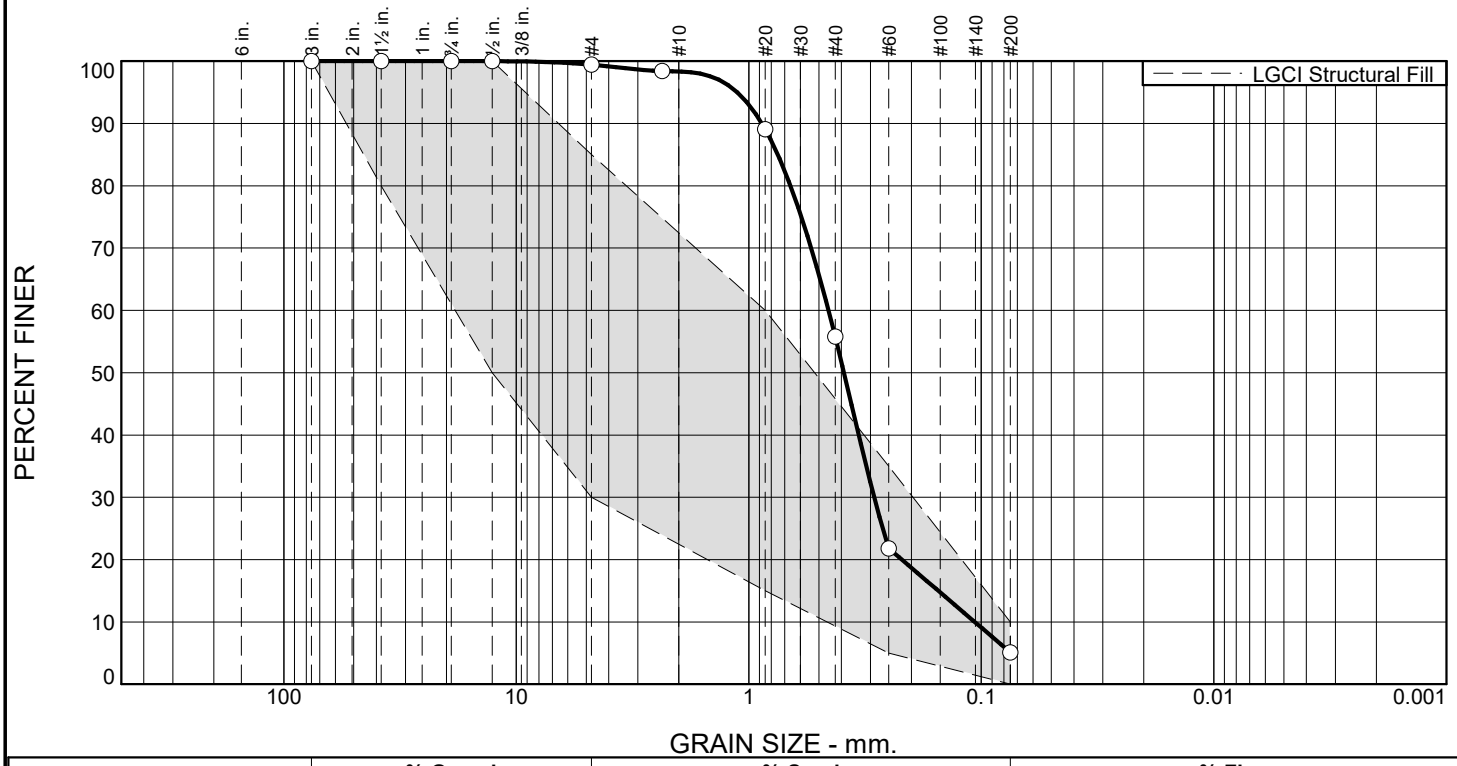
Date Sampled: 7/21/2022

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	1.1	42.6	50.7	5.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	99.5	30.0 - 85.0	X
#8	98.4		
#20	89.1	15.0 - 60.0	X
#40	55.8		
#60	21.8	5.0 - 35.0	
#200	5.1	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND with Silt (SP-SM), fine to medium, trace coarse, 5-10% fines trace of fine gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.8782 D_{85}= 0.7505 D_{60}= 0.4542
D_{50}= 0.3895 D_{30}= 0.2886 D_{15}= 0.1531
D_{10}= 0.1067 C_u= 4.26 C_c= 1.72

Remarks

Sand and Gravel Sample

Date Received: 7/21/2022 **Date Tested:** 7/26/2022

Tested By: YSP

Checked By: RF

Location: Boring B-101
Sample Number: S6 **Depth:** 16.0'-18.0'

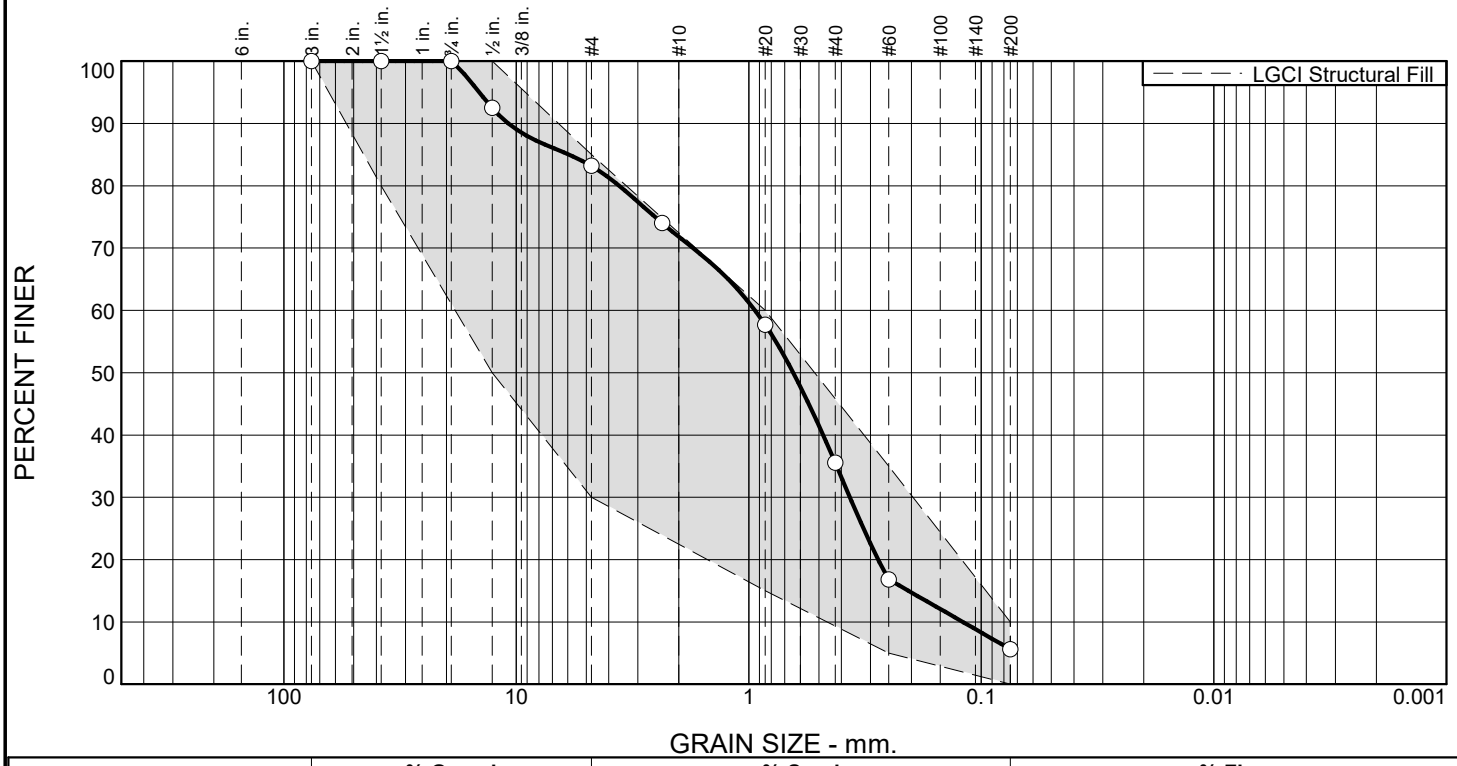
Date Sampled: 7/21/2022

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.8	11.3	36.3	30.0	5.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	92.5	50.0 - 100.0	
#4	83.2	30.0 - 85.0	
#8	74.0		
#20	57.7	15.0 - 60.0	
#40	35.6		
#60	16.8	5.0 - 35.0	
#200	5.6	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 15-20% fine subrounded gravel, trace of organic soil, trace of asphalt, brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 10.7905 D_{85}= 5.9332 D_{60}= 0.9397
D_{50}= 0.6446 D_{30}= 0.3671 D_{15}= 0.2055
D_{10}= 0.1202 C_u= 7.82 C_c= 1.19

Remarks

Fill Sample

Date Received: 7/18/2022 **Date Tested:** 7/27/2022

Tested By: YSP

Checked By: RF

Location: Boring B-102
Sample Number: G1 **Depth:** 0.5'-5.0'

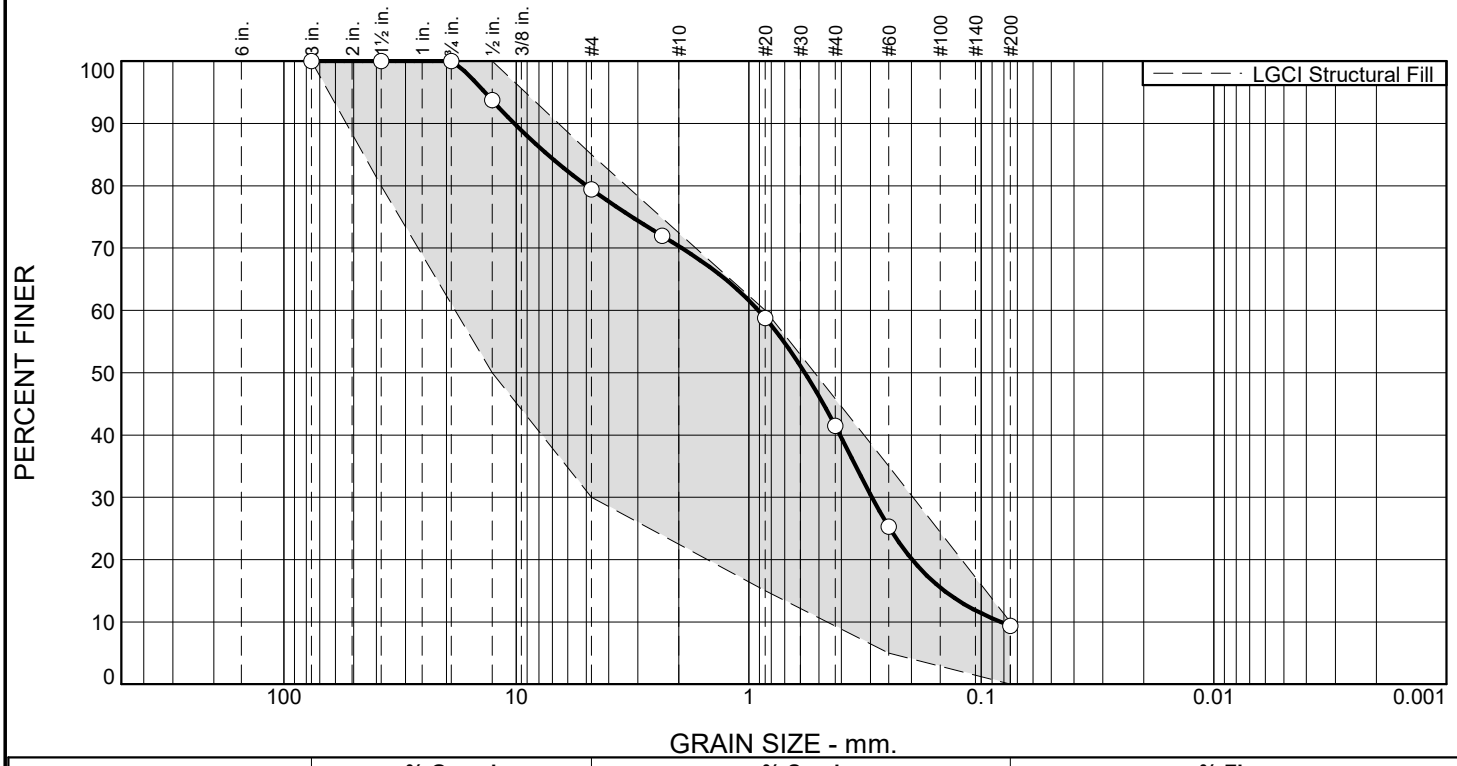
Date Sampled: 7/18/2022

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.6	9.1	28.8	32.2	9.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	93.7	50.0 - 100.0	
#4	79.4	30.0 - 85.0	
#8	72.0		
#20	58.8	15.0 - 60.0	
#40	41.5		
#60	25.3	5.0 - 35.0	
#200	9.3	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 20-25% fine subangular gravel, brown to gray

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 10.1816 D_{85}= 7.3098 D_{60}= 0.9093
D_{50}= 0.5747 D_{30}= 0.2951 D_{15}= 0.1442
D_{10}= 0.0826 C_u= 11.01 C_c= 1.16

Remarks

Sand and Gravel Sample

Date Received: 7/19/2022 **Date Tested:** 7/27/2022

Tested By: YSP

Checked By: RF

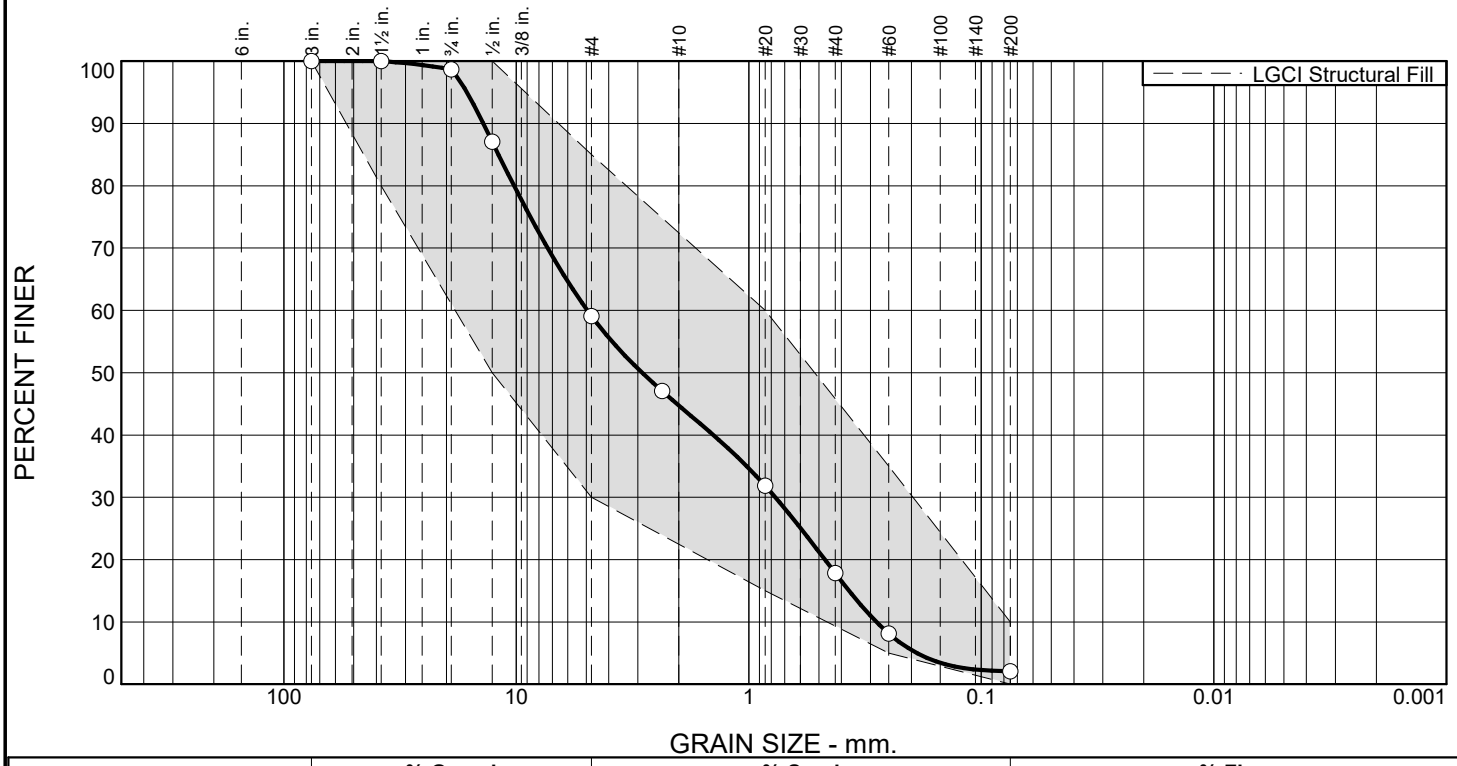
Location: Boring B-102 **Date Sampled:** 7/19/2022
Sample Number: S1 **Depth:** 4.0'-6.0'

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.3	39.6	14.4	26.9	15.7	2.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	98.7		
0.5"	87.1	50.0 - 100.0	
#4	59.1	30.0 - 85.0	
#8	47.1		
#20	31.9	15.0 - 60.0	
#40	17.8		
#60	8.1	5.0 - 35.0	
#200	2.1	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Gravel (SW), fine to coarse, 0-5% fines, 40-45% fine subrounded gravel, trace of asphalt, black

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 13.8693 D_{85}= 11.9217 D_{60}= 4.9473
D_{50}= 2.8787 D_{30}= 0.7686 D_{15}= 0.3700
D_{10}= 0.2825 C_u= 17.51 C_c= 0.42

Remarks

Fill Sample

Date Received: 7/19/2022 **Date Tested:** 7/27/2022

Tested By: YSP

Checked By: RF

Location: Boring B-102
Sample Number: S2 **Depth:** 6.0'-8.0'

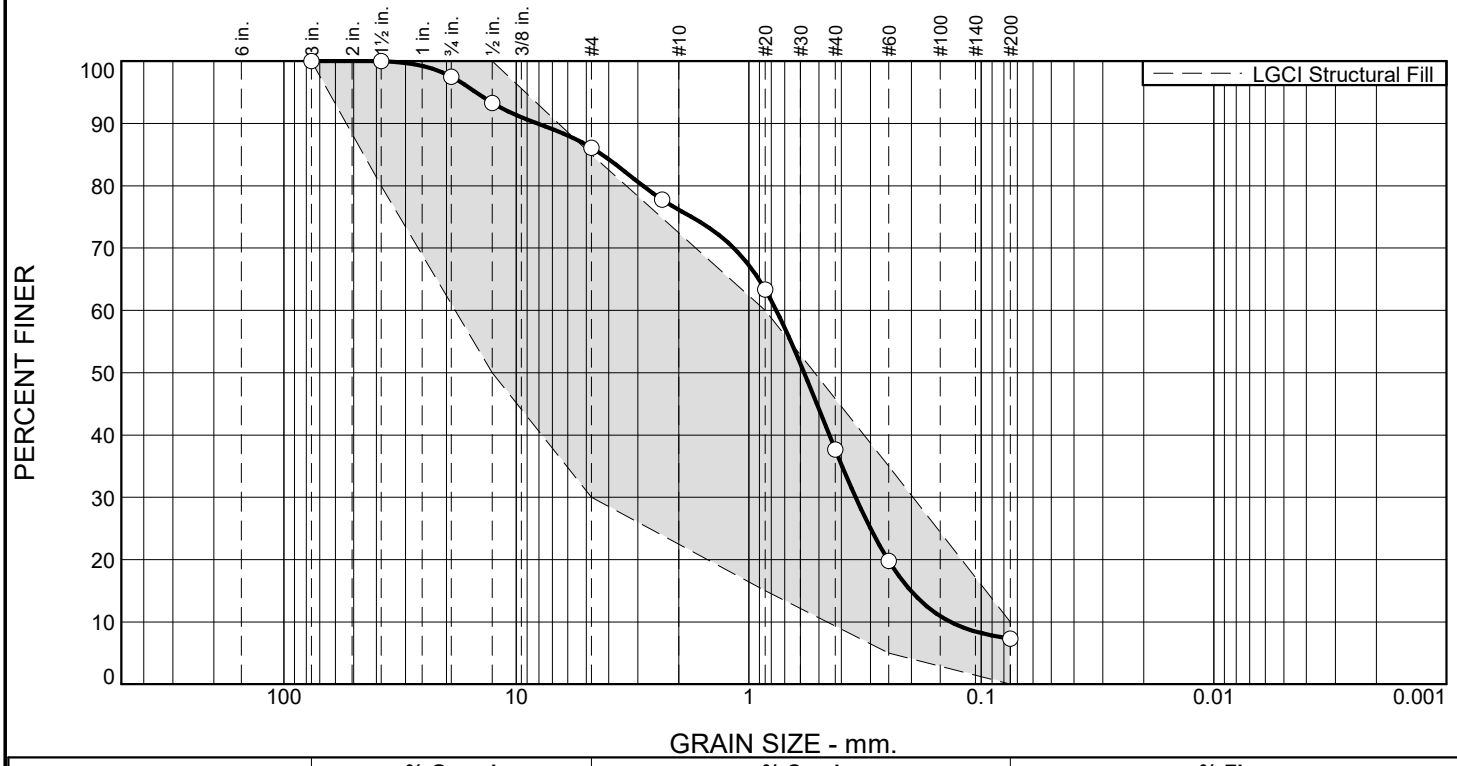
Date Sampled: 7/19/2022

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.5	11.4	9.9	38.5	30.4	7.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	97.5		
0.5"	93.3	50.0 - 100.0	
#4	86.1	30.0 - 85.0	X
#8	77.8		
#20	63.3	15.0 - 60.0	X
#40	37.7		
#60	19.8	5.0 - 35.0	
#200	7.3	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND with Silt (SP-SM), fine to medium, 5-10% fines, 10-15% fine subrounded gravel, brown to orange

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 8.1180 D_{85}= 4.2709 D_{60}= 0.7613
D_{50}= 0.5783 D_{30}= 0.3467 D_{15}= 0.2007
D_{10}= 0.1357 C_u= 5.61 C_c= 1.16

Remarks

Sand and Gravel Sample

Date Received: 7/19/2022 **Date Tested:** 7/27/2022

Tested By: YSP

Checked By: RF

Location: Boring B-102 **Depth:** 12.0'-14.0' **Date Sampled:** 7/19/2022

Sample Number: S5

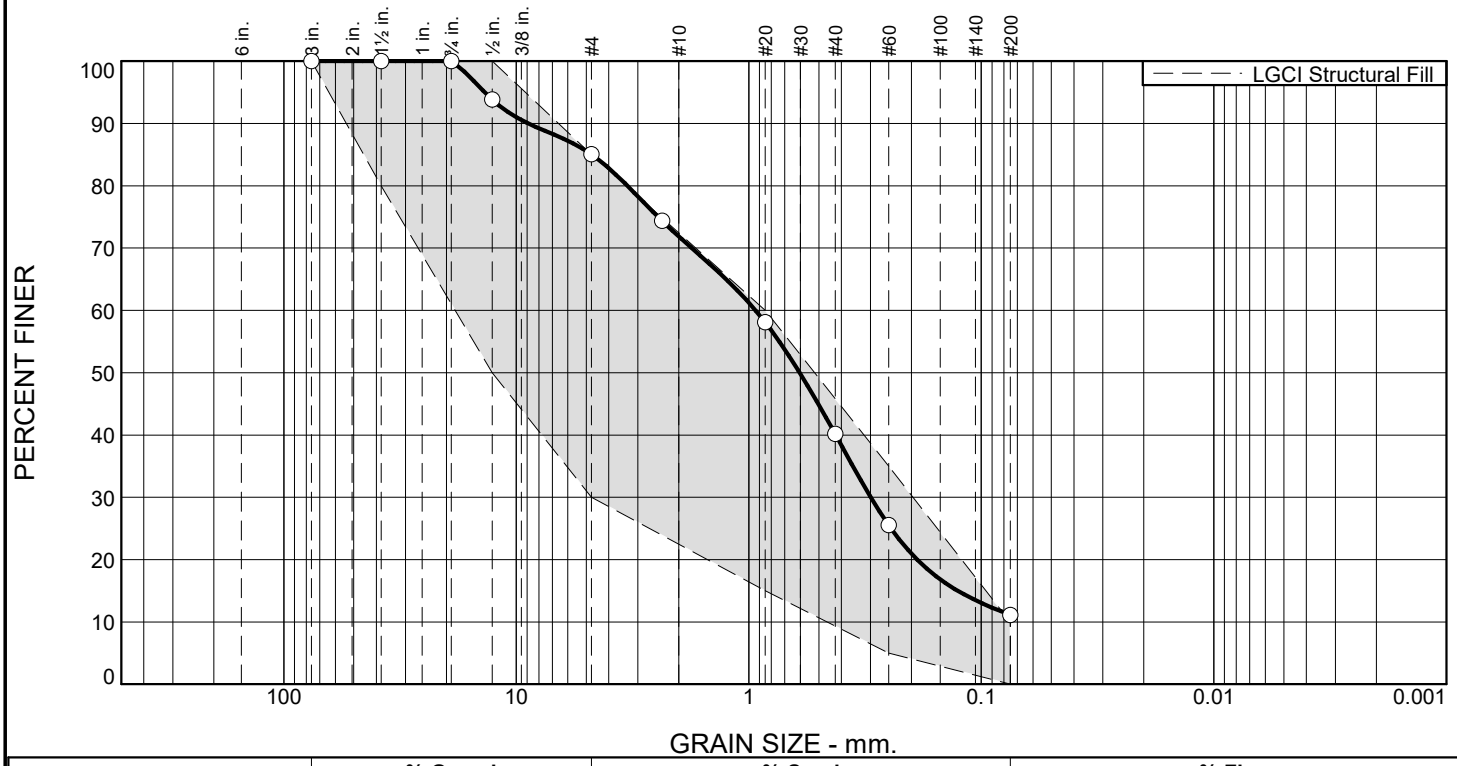
LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC

Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.0	13.1	31.7	29.1	11.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	93.9	50.0 - 100.0	
#4	85.0	30.0 - 85.0	
#8	74.4		
#20	58.1	15.0 - 60.0	
#40	40.2		
#60	25.5	5.0 - 35.0	
#200	11.1	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, 10-15% fines, 15% fine subrounded gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 8.8701 D_{85}= 4.7296 D_{60}= 0.9354
D_{50}= 0.6048 D_{30}= 0.2986 D_{15}= 0.1264
D_{10}= C_u= C_c=

Remarks

Sand and Gravel Sample

Date Received: 7/19/2022 **Date Tested:** 7/27/2022

Tested By: YSP

Checked By: RF

Location: Boring B-102
Sample Number: S3 **Depth:** 8.0'-10.0'

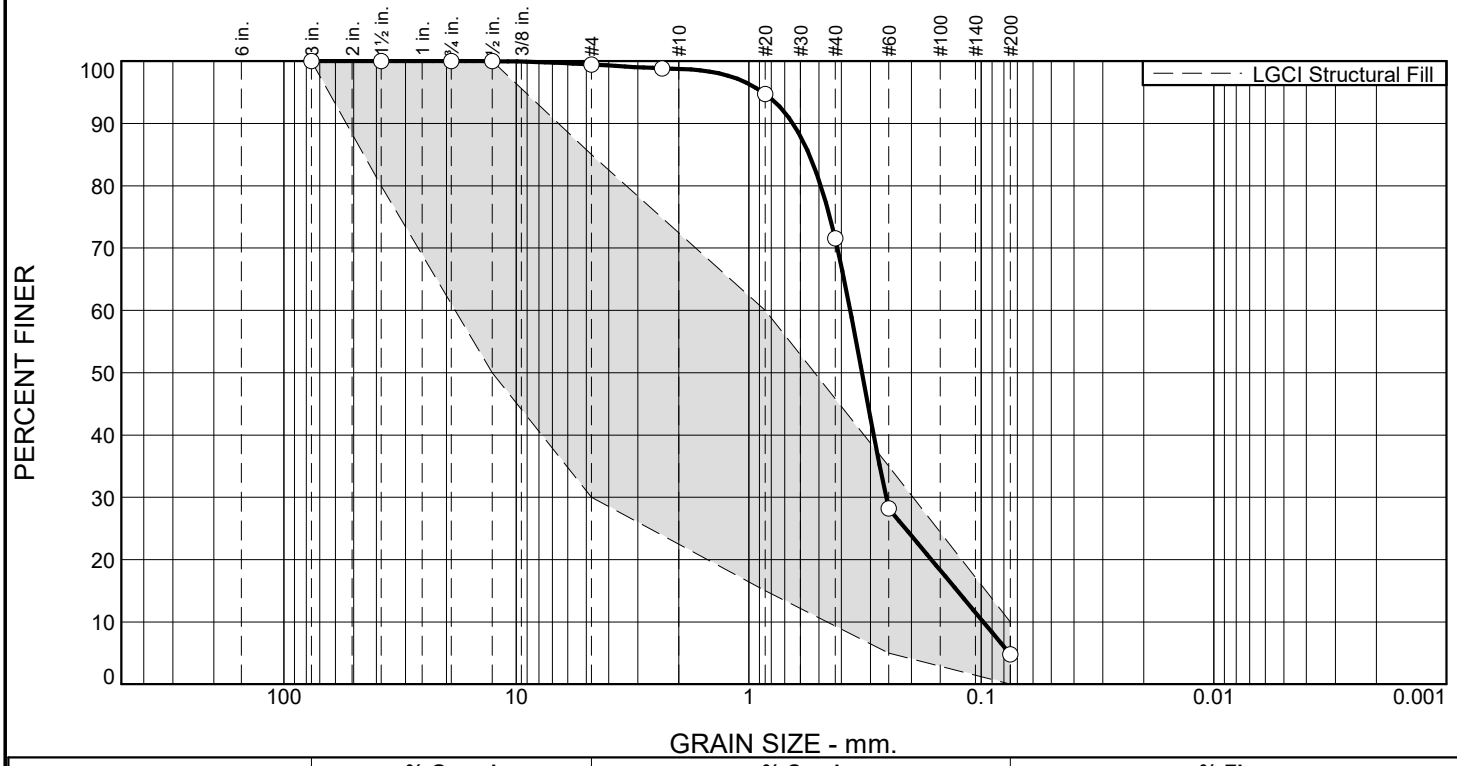
Date Sampled: 7/19/2022

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects LLC
Project: Proposed High School

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	0.7	27.3	66.7	4.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	99.5	30.0 - 85.0	X
#8	98.9		
#20	94.7	15.0 - 60.0	X
#40	71.5		
#60	28.2	5.0 - 35.0	
#200	4.8	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND (SP), fine to medium, trace coarse, 0-5% fines, 0-5% fine subrounded gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=**

Coefficients

D_{90}= 0.6459 D_{85}= 0.5497 D_{60}= 0.3658
D_{50}= 0.3257 D_{30}= 0.2562 D_{15}= 0.1267
D_{10}= 0.0980 C_u= 3.73 C_c= 1.83

Remarks

Natural sand sample.

Date Received: 12/12/22 **Date Tested:** 12/16/22

Tested By: MBH

Checked By: NP

Location: Boring B-101
Sample Number: .S16 **Depth:** 39.0'-41.0'

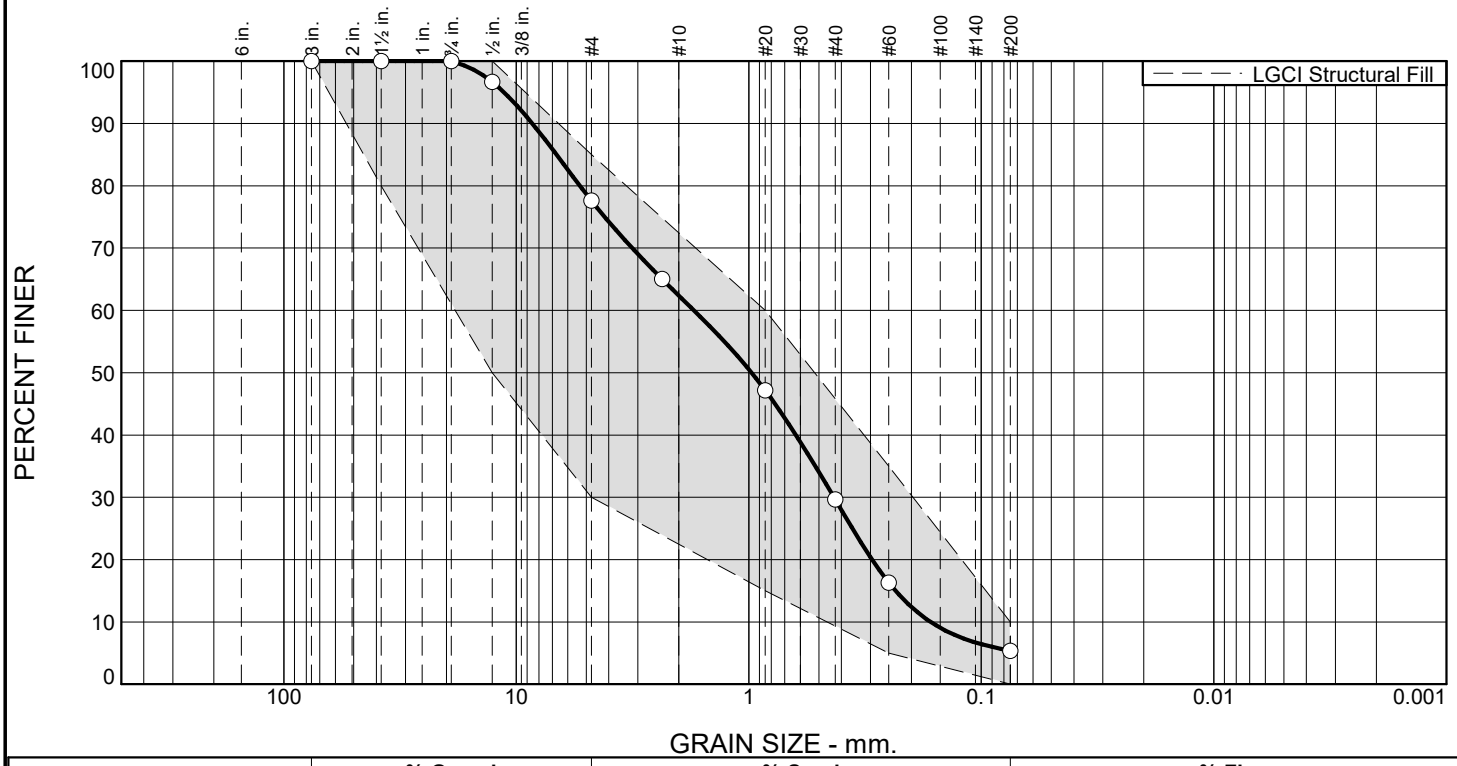
Date Sampled: 12/12/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.4	15.2	32.7	24.4	5.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	96.7	50.0 - 100.0	
#4	77.6	30.0 - 85.0	
#8	65.0		
#20	47.2	15.0 - 60.0	
#40	29.7		
#60	16.3	5.0 - 35.0	
#200	5.3	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 20-25% fine subrounded gravel, trace of glass, brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 8.5298 D_{85}= 6.7136 D_{60}= 1.7203
D_{50}= 0.9727 D_{30}= 0.4304 D_{15}= 0.2337
D_{10}= 0.1651 C_u= 10.42 C_c= 0.65

Remarks

Fill sample.

Date Received: 12/19/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Boring B-103
Sample Number: S10 **Depth:** 18.0'-20.0'

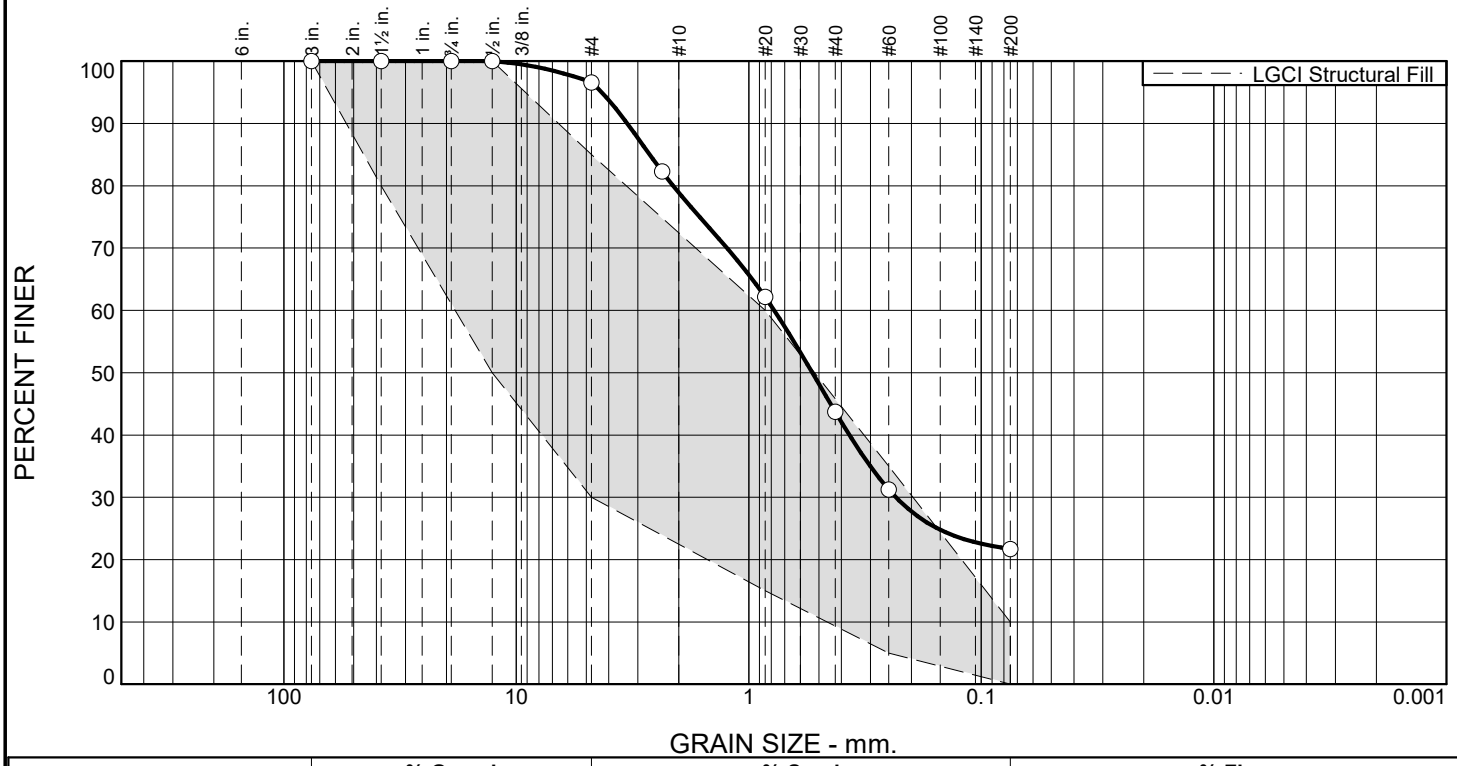
Date Sampled: 12/19/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.4	17.7	35.1	22.1	21.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	96.6	30.0 - 85.0	X
#8	82.3		
#20	62.2	15.0 - 60.0	X
#40	43.8		
#60	31.3	5.0 - 35.0	
#200	21.7	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND (SM), fine to coarse, 20-25% fines, 0-5% fine subrounded gravel, gray

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 3.3345 D_{85}= 2.6692 D_{60}= 0.7772
D_{50}= 0.5336 D_{30}= 0.2327 D_{15}=
D_{10}= C_u= C_c=

Remarks

Natural sand sample.

Date Received: 12/19/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Boring B-103
Sample Number: S17 **Depth:** 32.0'-34.0'

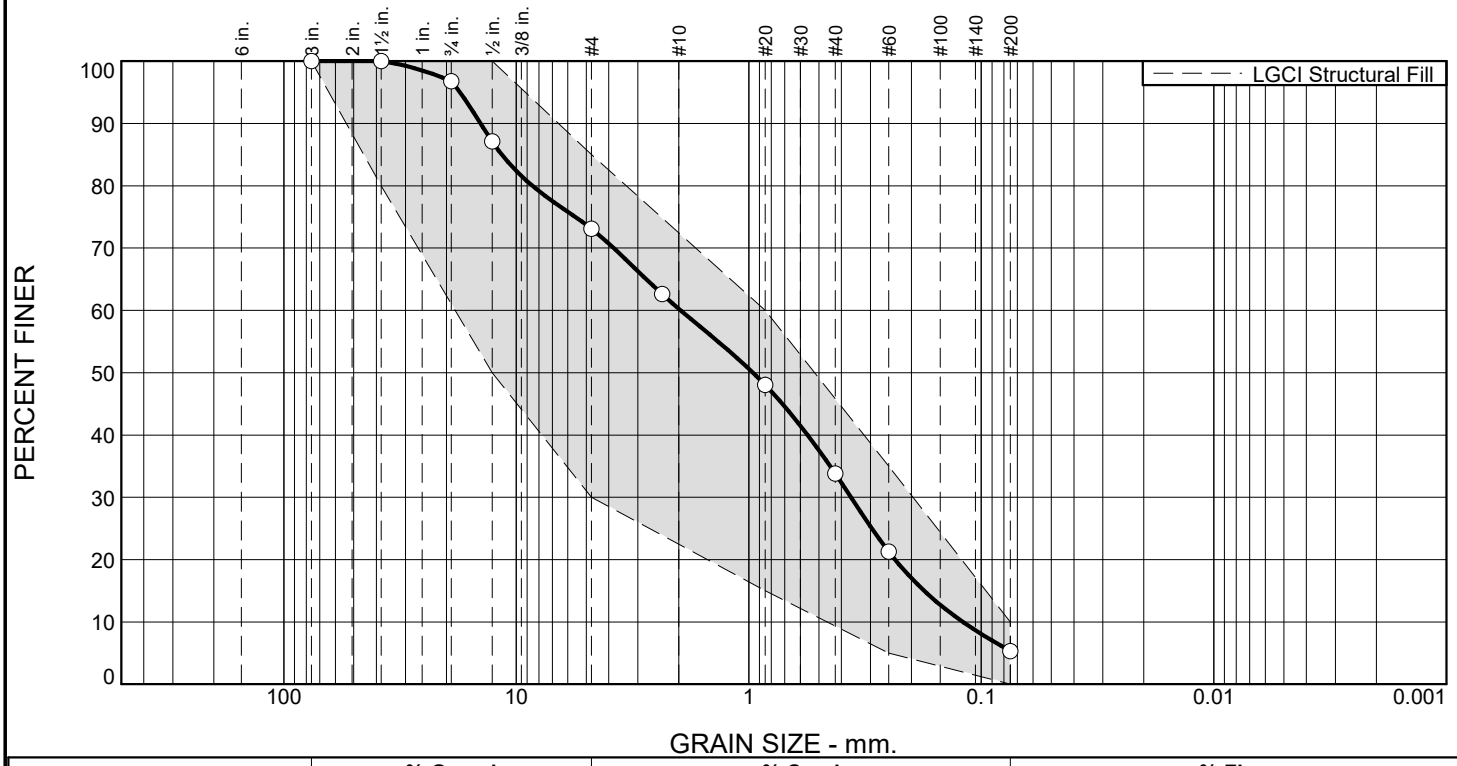
Date Sampled: 12/19/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.2	23.7	12.9	26.4	28.5	5.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	96.8		
0.5"	87.1	50.0 - 100.0	
#4	73.1	30.0 - 85.0	
#8	62.6		
#20	48.0	15.0 - 60.0	
#40	33.8		
#60	21.3	5.0 - 35.0	
#200	5.3	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 25-30% mostly fine subrounded gravel, trace of asphalt, brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 14.2696 D_{85}= 11.5288 D_{60}= 1.9645
D_{50}= 0.9593 D_{30}= 0.3631 D_{15}= 0.1761
D_{10}= 0.1200 C_u= 16.38 C_c= 0.56

Remarks

Fill sample.

Date Received: 12/19/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Boring B-103
Sample Number: S6 **Depth:** 10.0'-12.0'

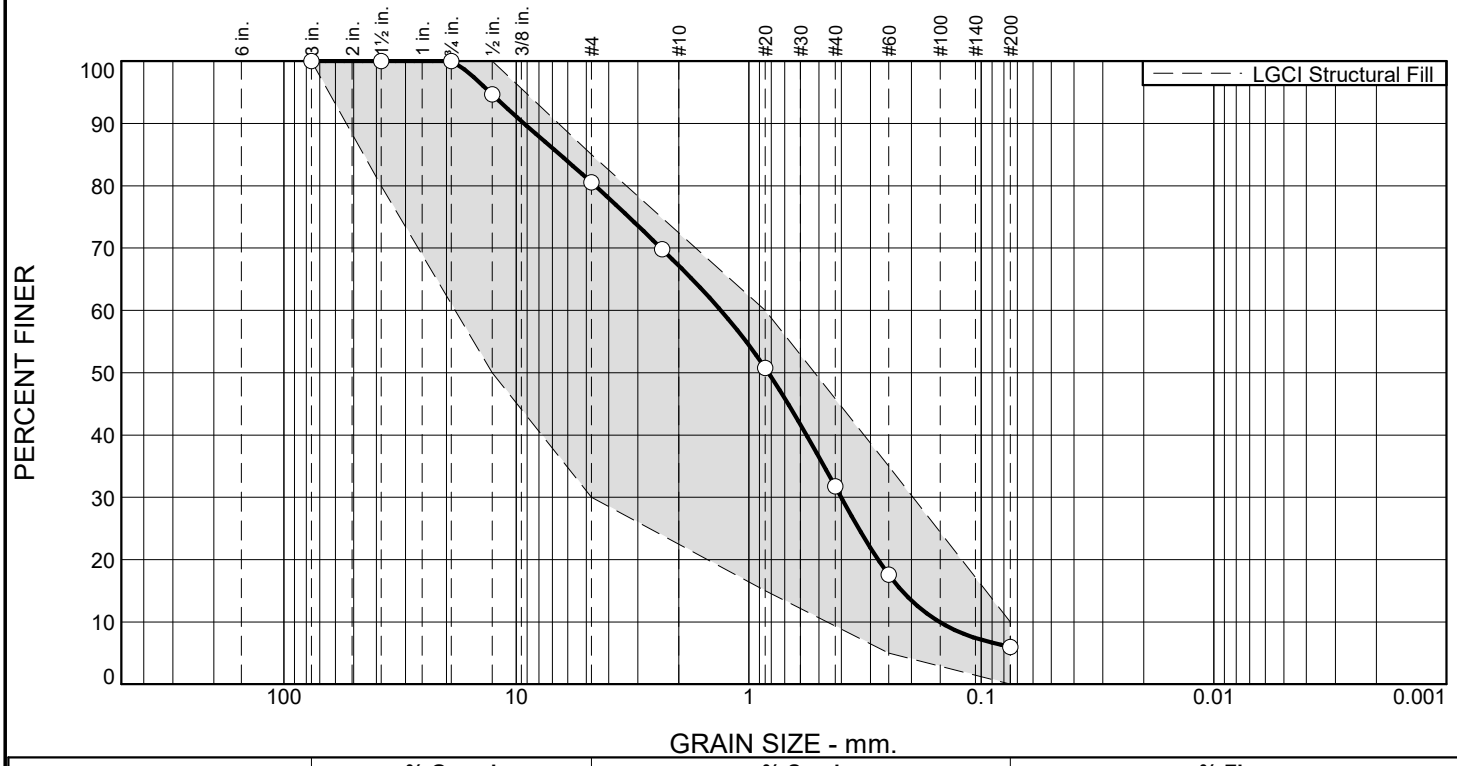
Date Sampled: 12/19/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	19.5	13.3	35.5	25.7	6.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	94.7	50.0 - 100.0	
#4	80.5	30.0 - 85.0	
#8	69.8		
#20	50.8	15.0 - 60.0	
#40	31.7		
#60	17.6	5.0 - 35.0	
#200	6.0	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 15-20% fine subrounded gravel, trace of organic soil, brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 9.2460 D_{85}= 6.4892 D_{60}= 1.3180
D_{50}= 0.8240 D_{30}= 0.4004 D_{15}= 0.2192
D_{10}= 0.1515 C_u= 8.70 C_c= 0.80

Remarks

Fill sample.

Date Received: 12/19/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Boring B-103 **Depth:** 16.0'-18.0' **Date Sampled:** 12/19/22

Sample Number: S9

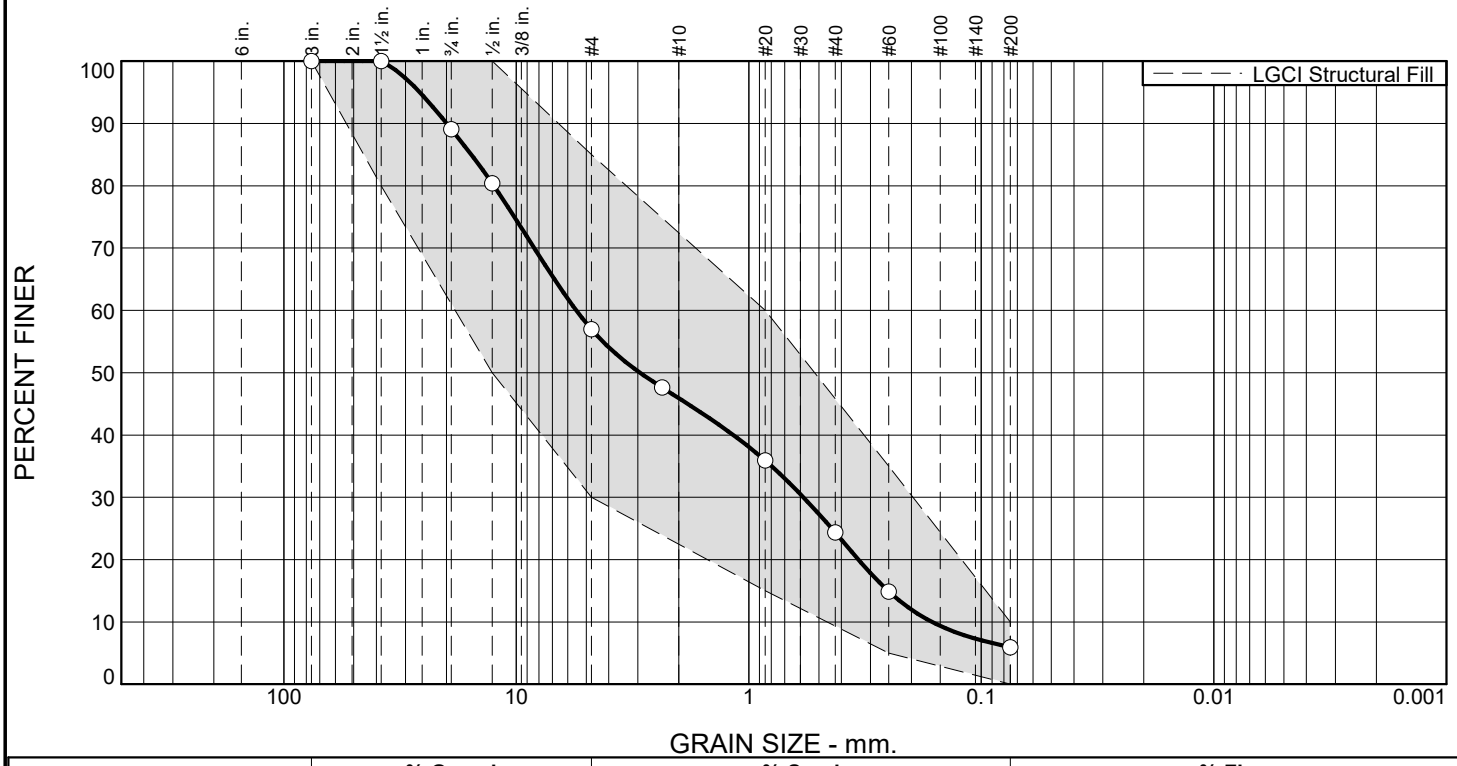
LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC

Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.9	32.1	11.1	21.5	18.5	5.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	89.1		
0.5"	80.4	50.0 - 100.0	
#4	57.0	30.0 - 85.0	
#8	47.6		
#20	35.9	15.0 - 60.0	
#40	24.4		
#60	14.9	5.0 - 35.0	
#200	5.9	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 5-10% fines, 40-45% fine to coarse subrounded gravel, trace of asphalt, dark brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 19.9454 D_{85}= 15.6327 D_{60}= 5.5200
D_{50}= 2.9375 D_{30}= 0.5827 D_{15}= 0.2520
D_{10}= 0.1630 C_u= 33.87 C_c= 0.38

Remarks

Fill sample.

Date Received: 12/15/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Boring B-104
Sample Number: S1 **Depth:** 0.5'-2.0'

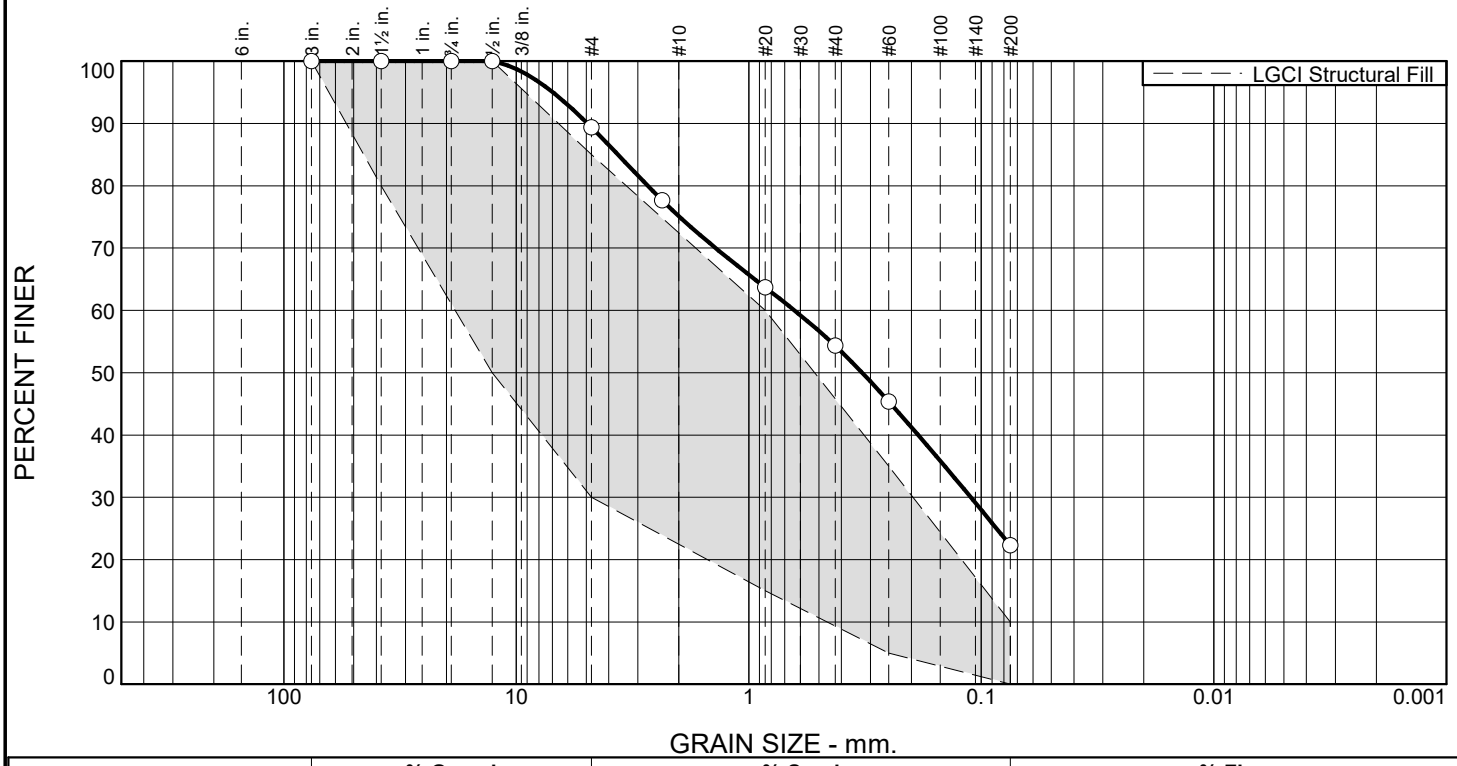
Date Sampled: 12/15/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.6	14.2	20.9	32.0	22.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	89.4	30.0 - 85.0	X
#8	77.7		
#20	63.7	15.0 - 60.0	X
#40	54.3		
#60	45.4	5.0 - 35.0	X
#200	22.3	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND (SM), fine to coarse, 20-25% fines, 10-15% fine subrounded gravel, trace of organic soil, gray

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 4.9378 D_{85}= 3.6541 D_{60}= 0.6369
D_{50}= 0.3251 D_{30}= 0.1109 D_{15}=
D_{10}= C_u= C_c=

Remarks

Fill sample.

Date Received: 12/20/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Boring B-105
Sample Number: S9 **Depth:** 24.0'-26.0'

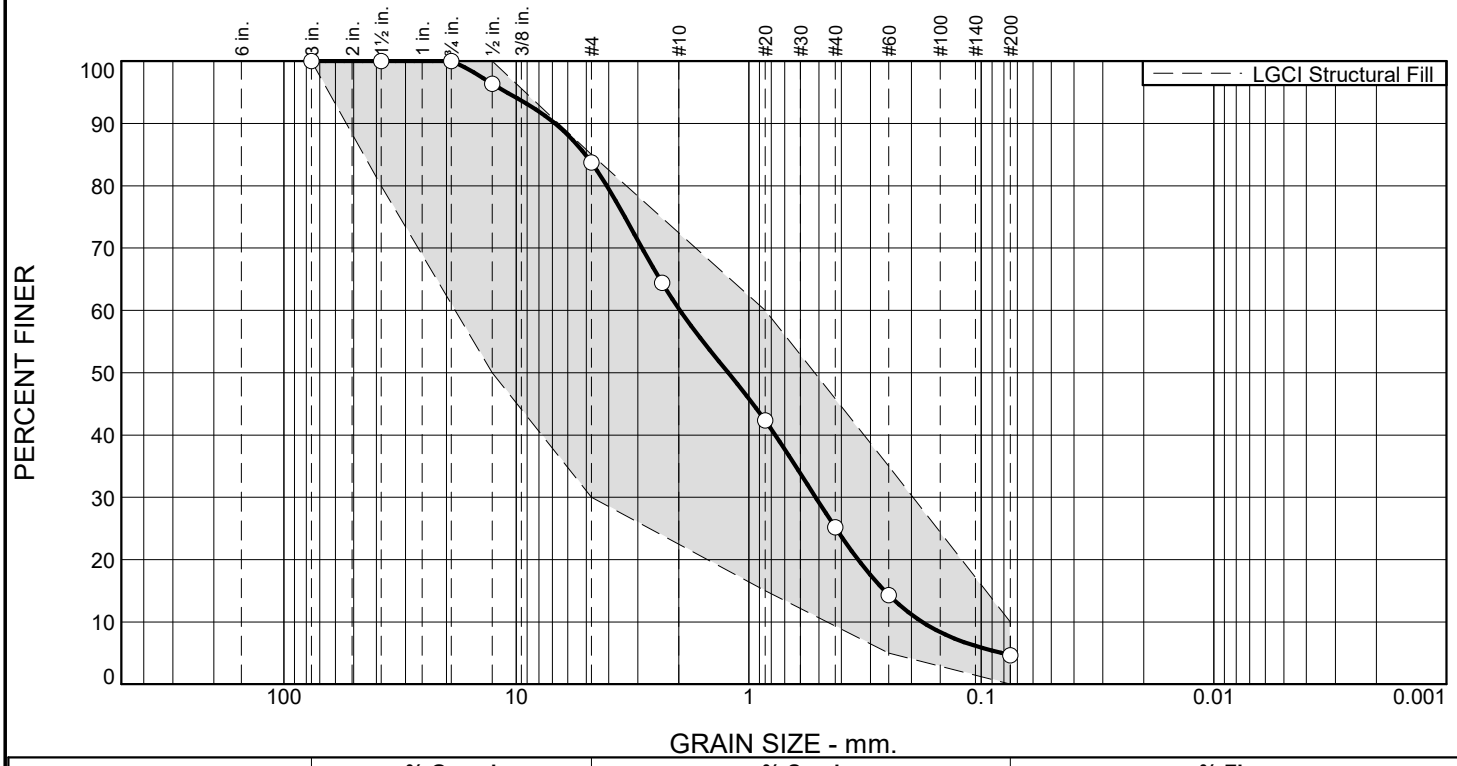
Date Sampled: 12/20/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.3	23.4	35.1	20.5	4.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	96.4	50.0 - 100.0	
#4	83.7	30.0 - 85.0	
#8	64.4		
#20	42.3	15.0 - 60.0	
#40	25.2		
#60	14.3	5.0 - 35.0	
#200	4.7	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Well Graded SAND with Gravel (SW), fine to coarse, 0-5% fines, 15-20% fine subrounded gravel, brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=**

Coefficients

D_{90}= 6.8105 D_{85}= 5.0396 D_{60}= 1.9747
D_{50}= 1.2259 D_{30}= 0.5164 D_{15}= 0.2606
D_{10}= 0.1796 C_u= 11.00 C_c= 0.75

Remarks

Natural sand sample.

Date Received: 12/27/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Boring B-107
Sample Number: S14 **Depth:** 34.0'-36.0'

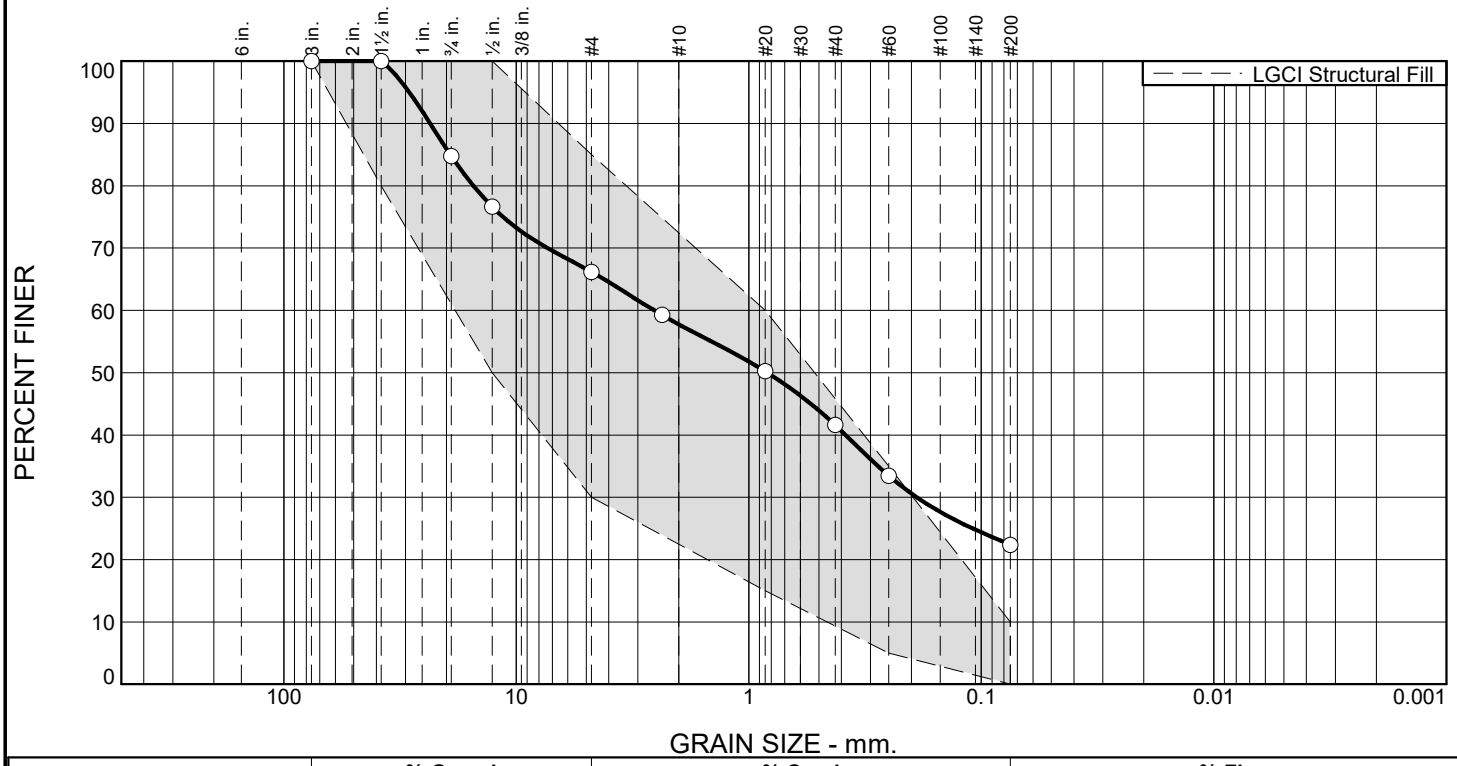
Date Sampled: 12/27/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.2	18.6	8.4	16.2	19.2	22.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	84.8		
0.5"	76.6	50.0 - 100.0	
#4	66.2	30.0 - 85.0	
#8	59.3		
#20	50.2	15.0 - 60.0	
#40	41.6		
#60	33.5	5.0 - 35.0	
#200	22.4	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND with Gravel (SM), fine to coarse, 20-25% fines, 30-35% fine to coarse subangular gravel, trace of trash, trace of organic soil, trace of asphalt, dark brown to gray

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 23.4771 D_{85}= 19.2219 D_{60}= 2.5486
D_{50}= 0.8315 D_{30}= 0.1893 D_{15}=
D_{10}= C_u= C_c=

Remarks

Fill sample.

Date Received: 12/14/22 **Date Tested:** 12/16/22

Tested By: MBH

Checked By: NP

Location: Probe P-1
Sample Number: S2 **Depth:** 2.0'-4.0'

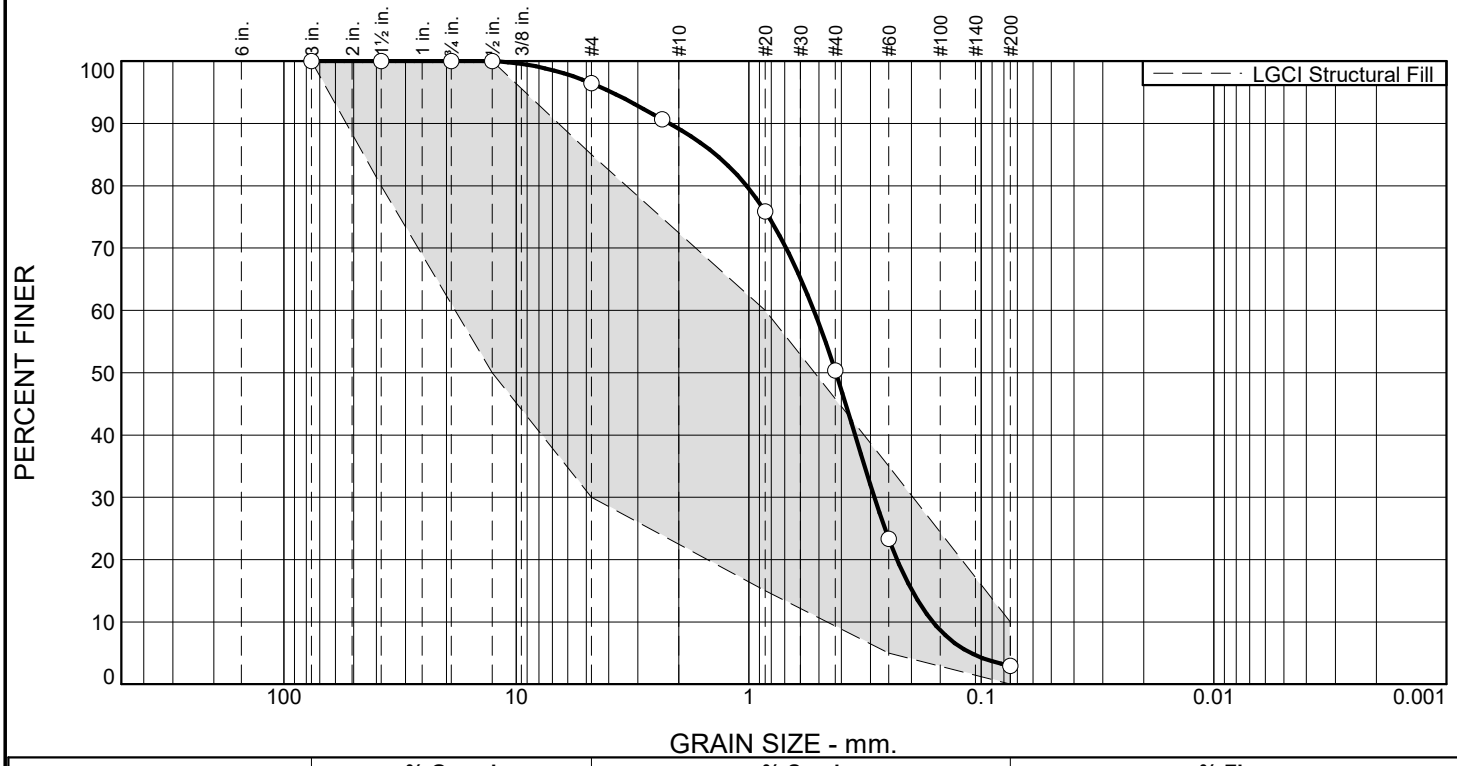
Date Sampled: 12/14/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.5	7.4	38.7	47.5	2.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	100.0	50.0 - 100.0	
#4	96.5	30.0 - 85.0	X
#8	90.7		
#20	75.9	15.0 - 60.0	X
#40	50.4		
#60	23.3	5.0 - 35.0	
#200	2.9	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND (SP), fine to medium, trace coarse, 0-5% fines, 0-5% fine subrounded gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=**

Coefficients

D_{90}= 2.1924 D_{85}= 1.3842 D_{60}= 0.5254
D_{50}= 0.4220 D_{30}= 0.2881 D_{15}= 0.1982
D_{10}= 0.1614 C_u= 3.25 C_c= 0.98

Remarks

Natural sand sample.

Date Received: 12/15/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Probe P-3
Sample Number: S3 **Depth:** 9.0'-11.0'

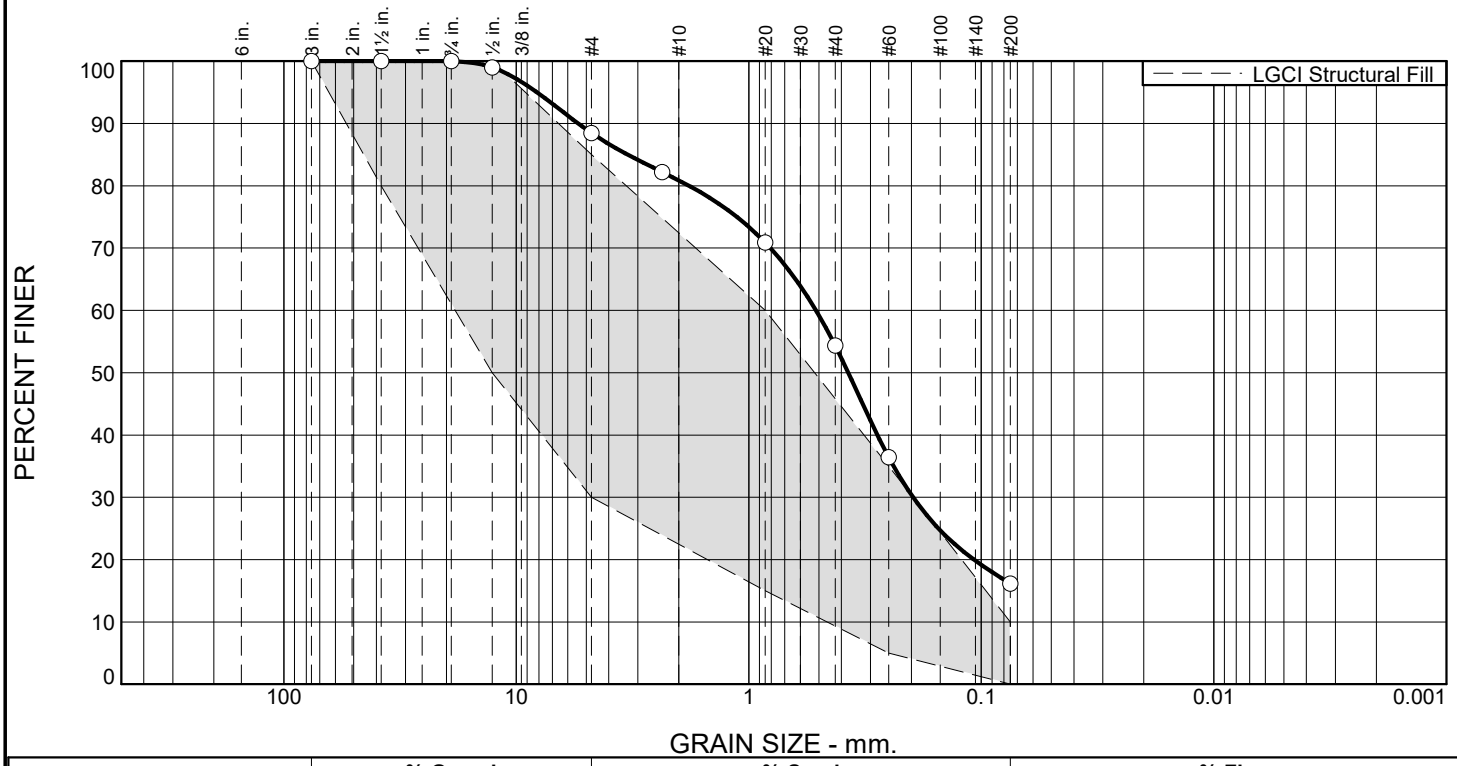
Date Sampled: 12/15/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.5	7.6	26.5	38.3	16.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	100.0		
0.5"	99.0	50.0 - 100.0	
#4	88.5	30.0 - 85.0	X
#8	82.2		
#20	70.9	15.0 - 60.0	X
#40	54.4		
#60	36.4	5.0 - 35.0	X
#200	16.1	0.0 - 10.0	X

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Silty SAND (SM), fine to medium, trace coarse, 15-20% fines, 10-15% fine subrounded gravel, light brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 5.4135 D_{85}= 3.3128 D_{60}= 0.5145
D_{50}= 0.3731 D_{30}= 0.1963 D_{15}=
D_{10}= C_u= C_c=

Remarks

Natural sand sample.

Date Received: 12/15/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Probe P-3
Sample Number: S4 **Depth:** 14.0'-16.0'

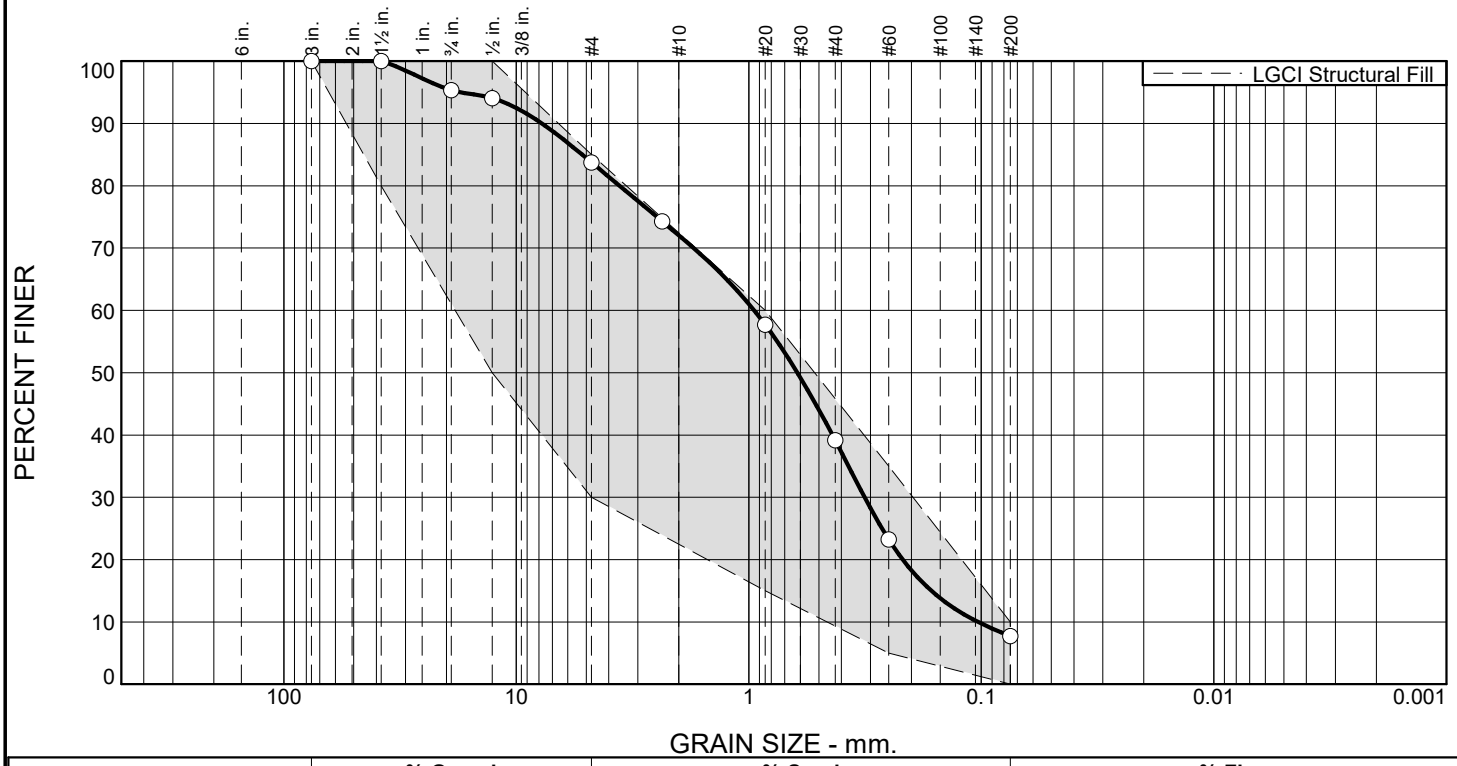
Date Sampled: 12/15/22

LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.6	11.6	11.7	32.9	31.5	7.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0	100.0	
1.5"	100.0	80.0 - 100.0	
0.75"	95.4		
0.5"	94.1	50.0 - 100.0	
#4	83.8	30.0 - 85.0	
#8	74.3		
#20	57.7	15.0 - 60.0	
#40	39.2		
#60	23.2	5.0 - 35.0	
#200	7.7	0.0 - 10.0	

* LGCI Structural Fill

Material Description

ASTM (D 2488) Classification: Poorly Graded SAND with Silt and Gravel (SP-SM), fine to medium, trace coarse, 5-10% fines, 15-20% fine to coarse subrounded gravel, dark brown

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 7.7452 D_{85}= 5.2064 D_{60}= 0.9481
D_{50}= 0.6186 D_{30}= 0.3173 D_{15}= 0.1641
D_{10}= 0.1033 C_u= 9.18 C_c= 1.03

Remarks

Fill sample.

Date Received: 12/20/22 **Date Tested:** 1/4/23

Tested By: NP

Checked By: SL

Location: Probe P-4
Sample Number: S2 **Depth:** 2.0'-4.0'

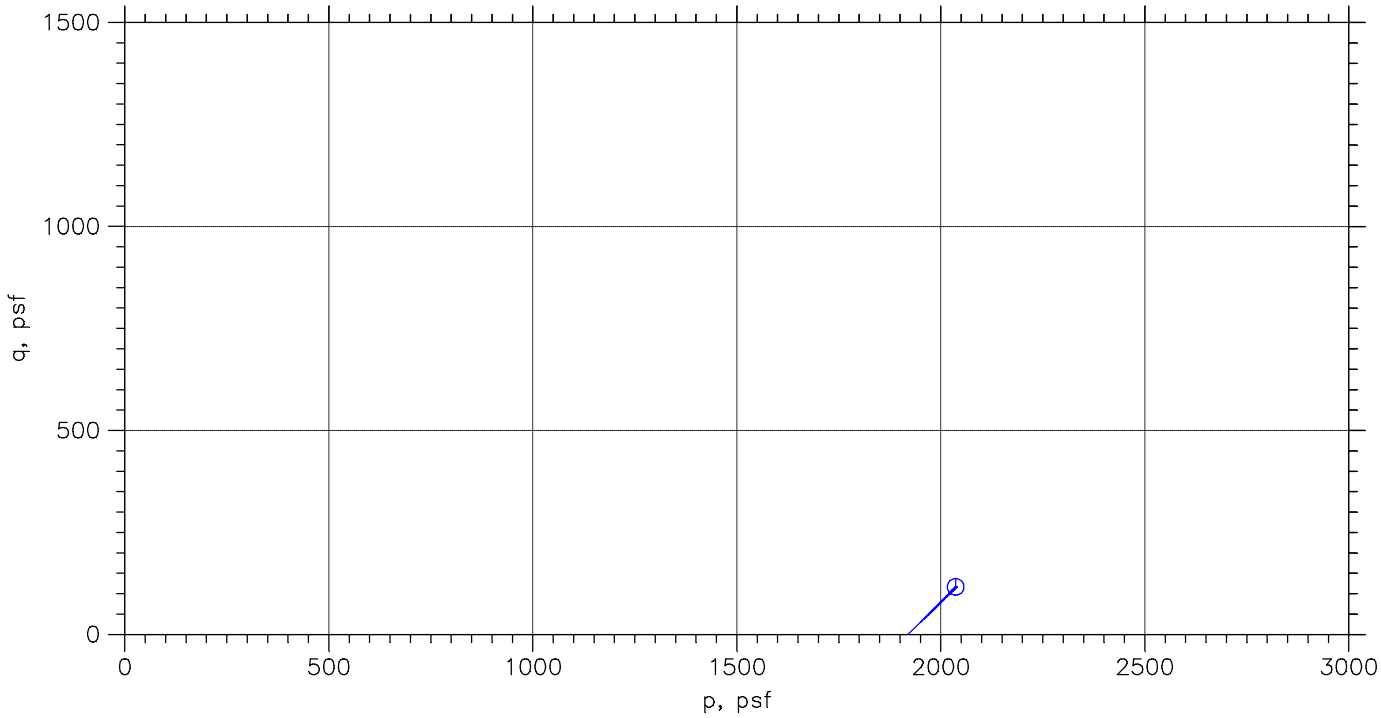
Date Sampled: 12/20/22

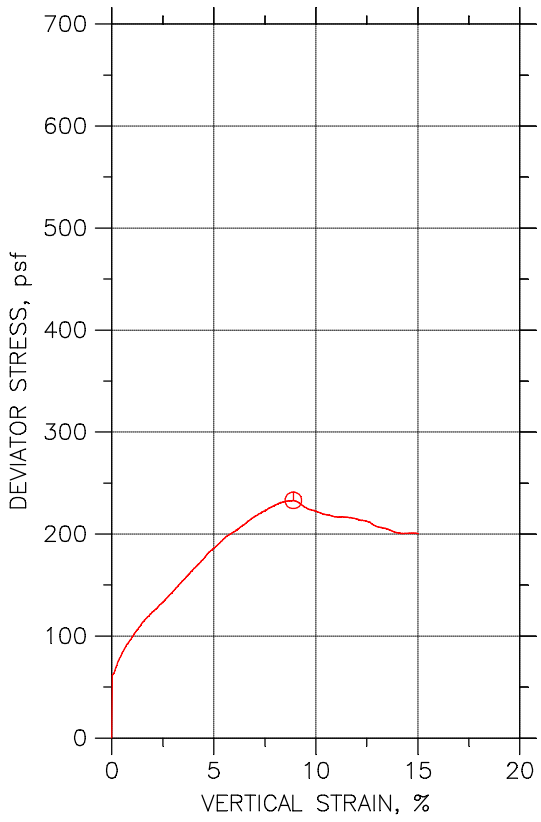
LGCI
Lahlaf Geotechnical Consulting, Inc.

Client: Ai3 Architects, LLC
Project: Proposed Central Falls High School, Central Falls, RI

Project No: 2232 **Figure**

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	⏲			
Sample No.	T1			
Test No.	UU-1			
Depth	28-30'			
Tested by	amp			
Test Date	1/13/23			
Checked by	njh			
Check Date	1/18/23			
Diameter, in	2.8			
Height, in	6.1			
Water Content, %	288.3			
Dry Density, pcf	17.2			
Saturation, %	89.3			
Void Ratio	8.07			
Confining Stress, psf	1920			
Undrained Strength, psf	116.5			
Max. Dev. Stress, psf	232.9			
Strain at Failure, %	8.9			
Strain Rate, %/min	1			
Estimated Specific Gravity	2.5			
Liquid Limit	---			
Plastic Limit	---			
Plasticity Index	---			

GeoTesting EXPRESS

Project: Prop. Central Falls HS

Location: Central Falls, RI

Project No.: GTX-316607

Boring No.: P-4

Sample Type: intact

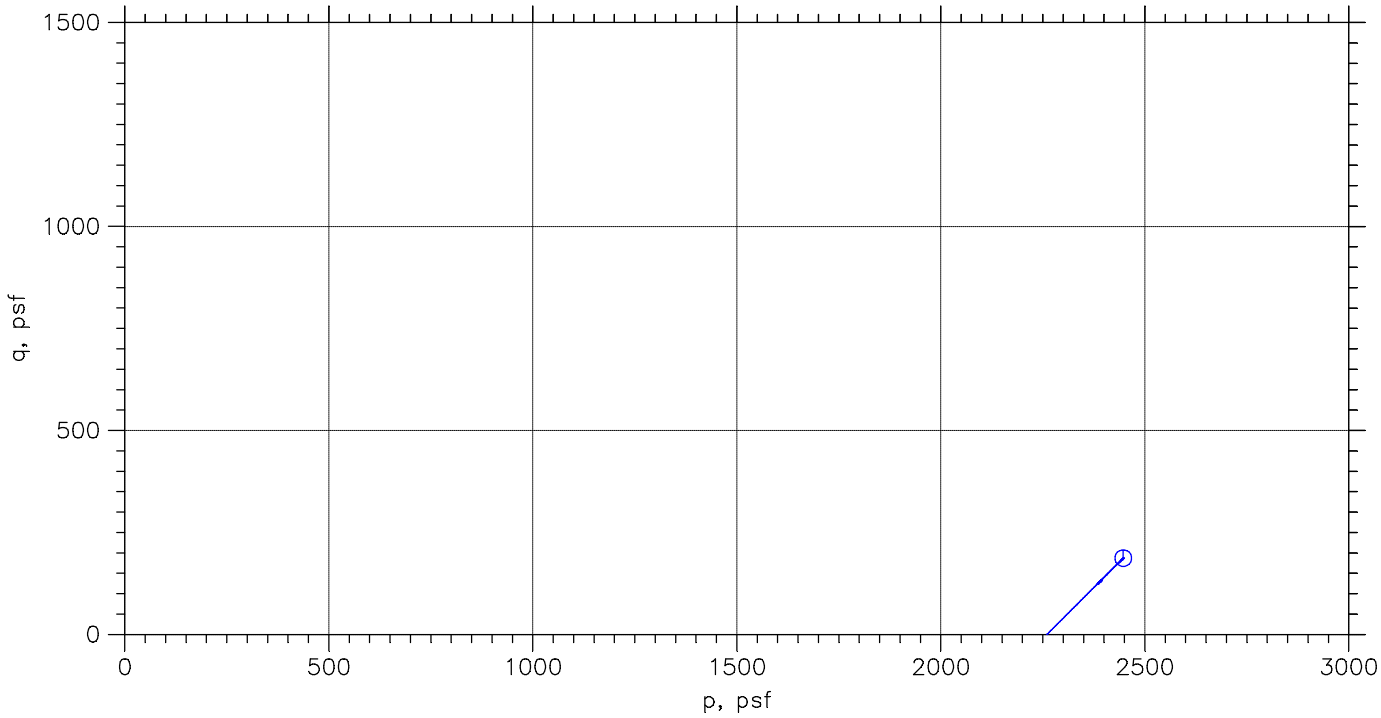
Description: Moist, very dark brown peat

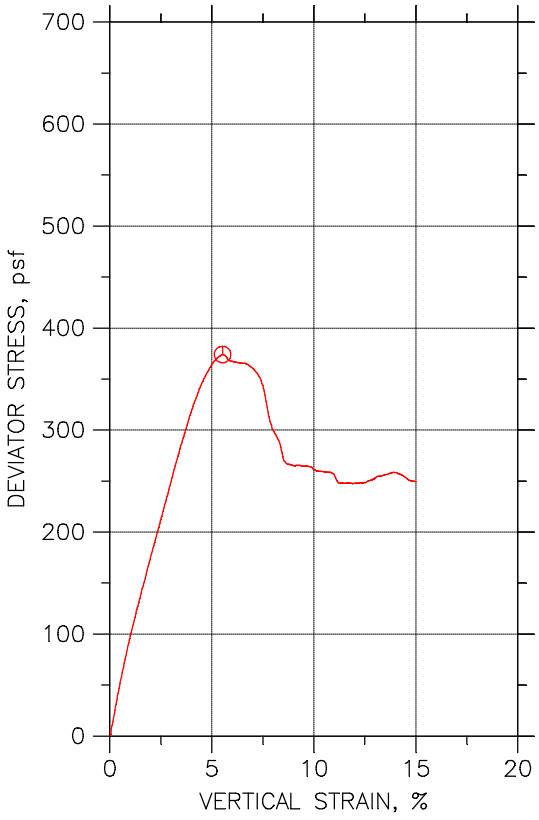
Remarks: TX-010

Phase calculations based on start of test.

Wed, 18-JAN-2023 15:17:42

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	⏲			
Sample No.	T2			
Test No.	UU-2			
Depth	36-38'			
Tested by	amp			
Test Date	1/13/23			
Checked by	njh			
Check Date	**1/18/23**			
Diameter, in	2.8			
Height, in	6.2			
Water Content, %	171.8			
Dry Density, pcf	28.91			
Saturation, %	97.7			
Void Ratio	4.4			
Confining Stress, psf	2260			
Undrained Strength, psf	187			
Max. Dev. Stress, psf	374.1			
Strain at Failure, %	5.53			
Strain Rate, %/min	1			
Estimated Specific Gravity	2.5			
Liquid Limit	---			
Plastic Limit	---			
Plasticity Index	---			

GeoTesting EXPRESS

Project: Prop. Central Falls HS

Location: Central Falls, RI

Project No.: GTX-316607

Boring No.: P-4

Sample Type: intact

Description: Moist, very dark brown organic clay

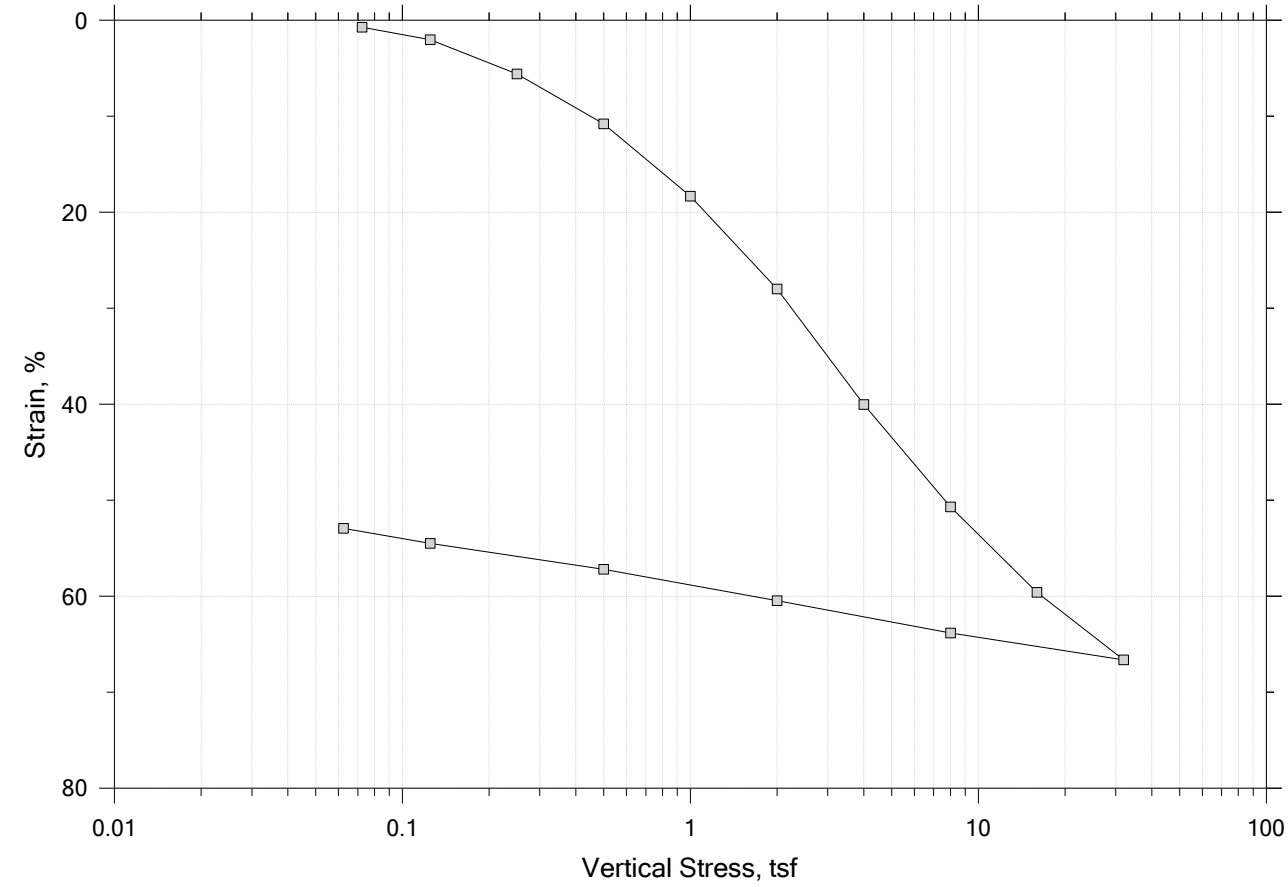
Remarks: System 010

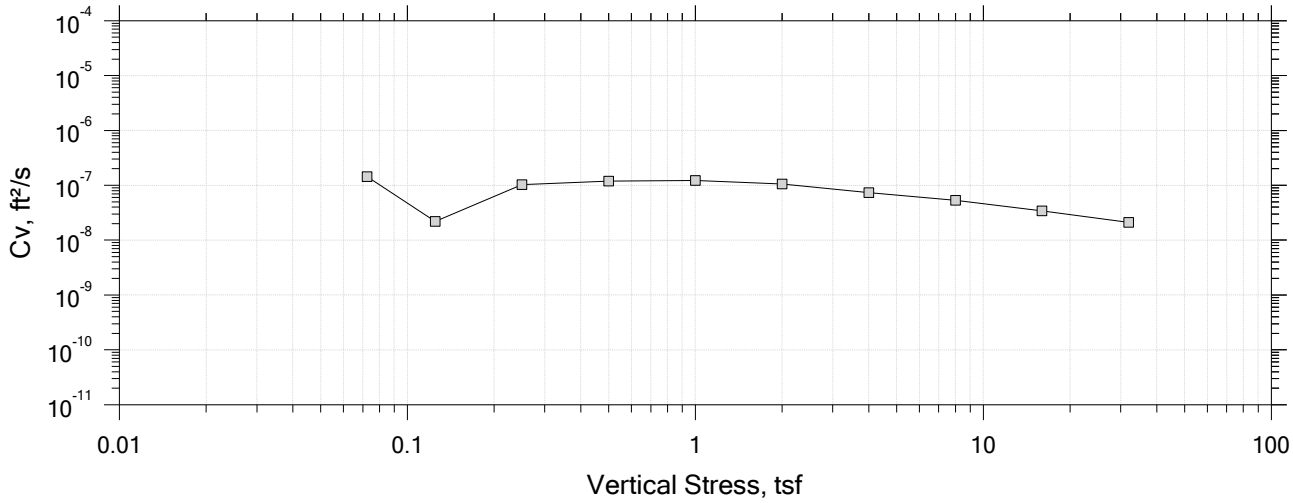
Phase calculations based on start of test.

Wed, 18-JAN-2023 15:28:51

One-Dimensional Consolidation by ASTM D2435 - Method A

Summary Report

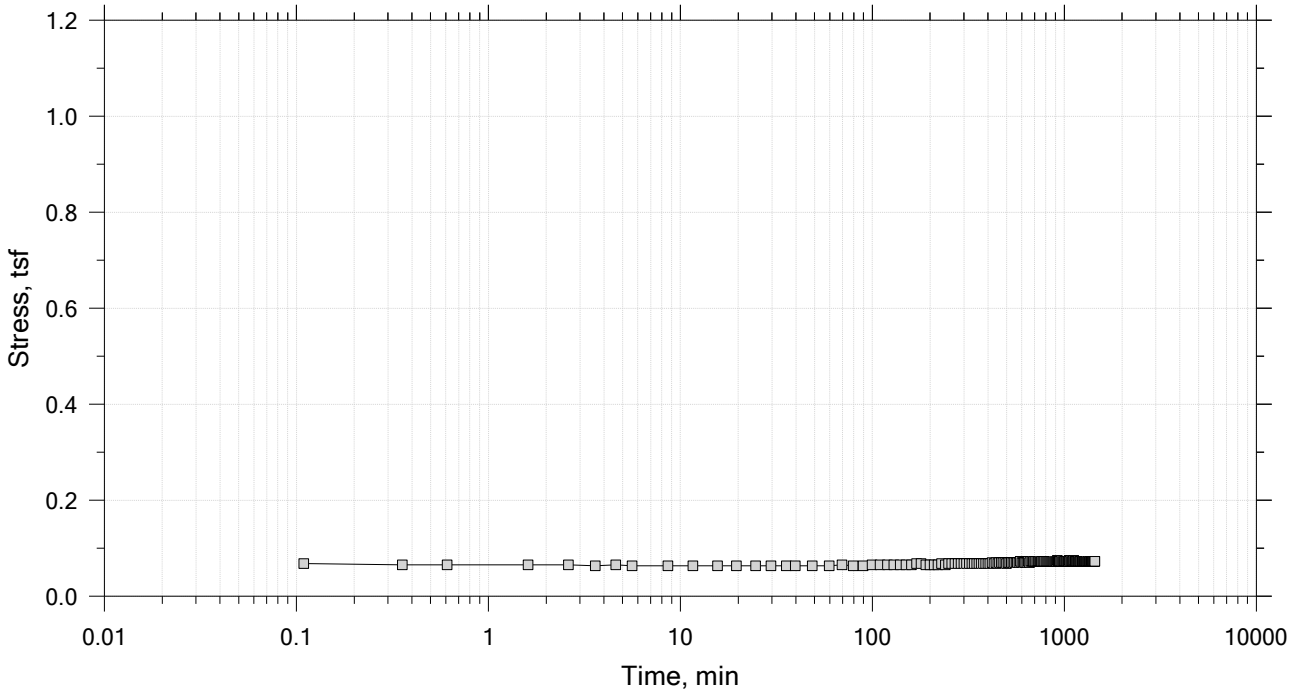


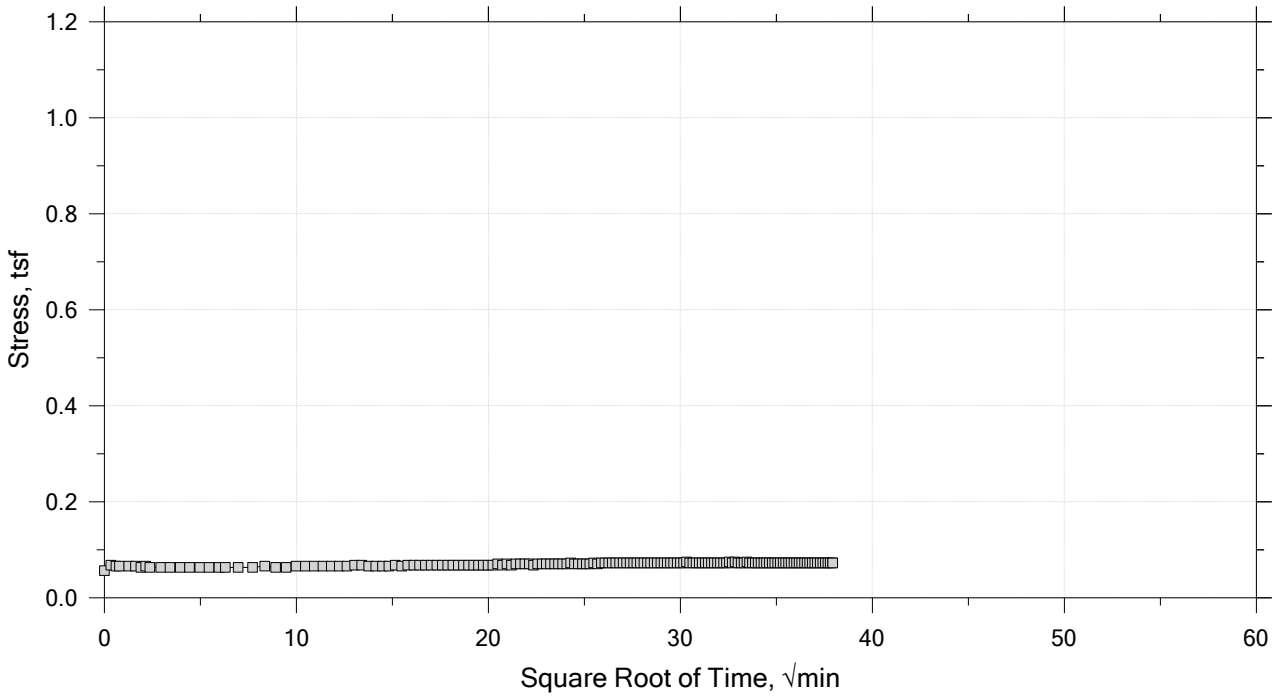


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 1 of 15
Constant Volume Step
Stress: 0.0724 tsf

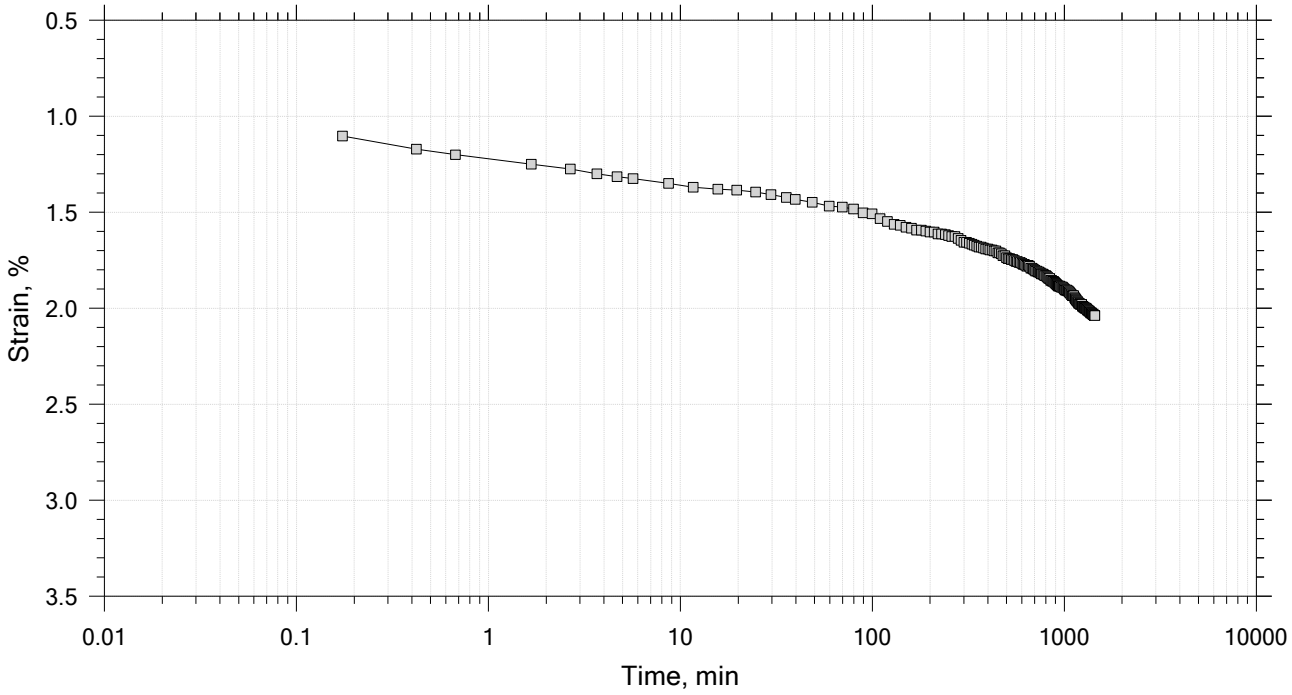


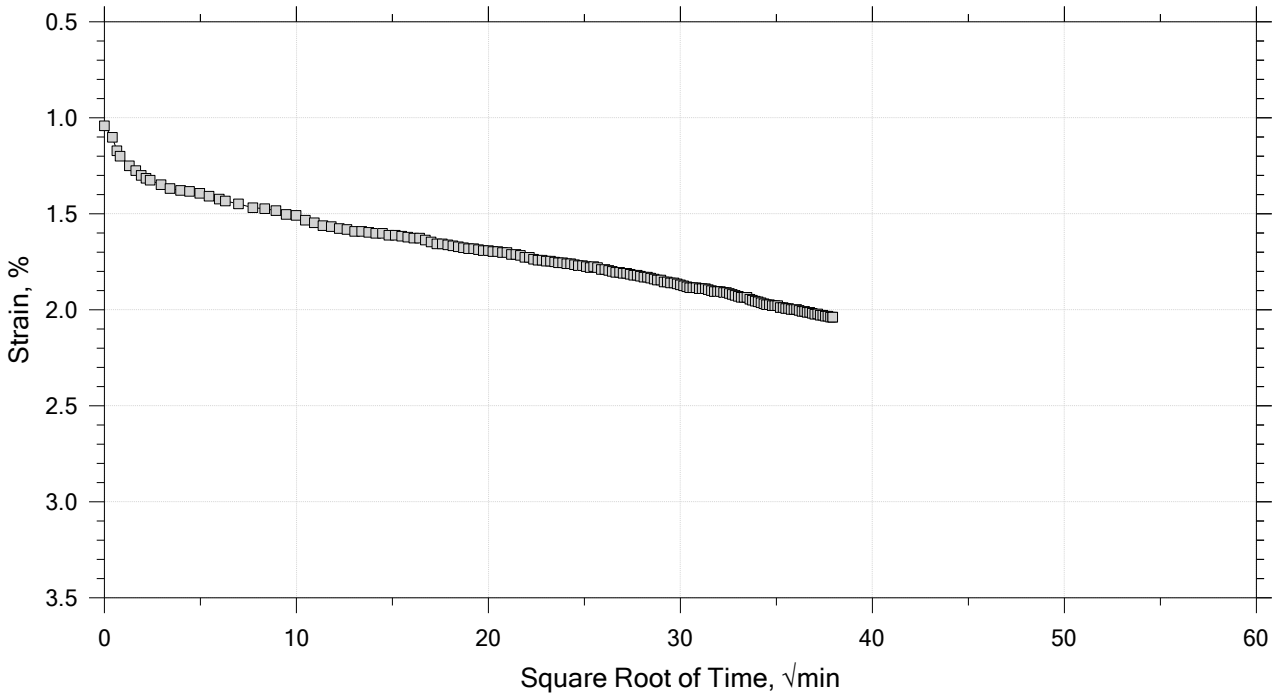


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 2 of 15
Constant Load Step
Stress: 0.125 tsf

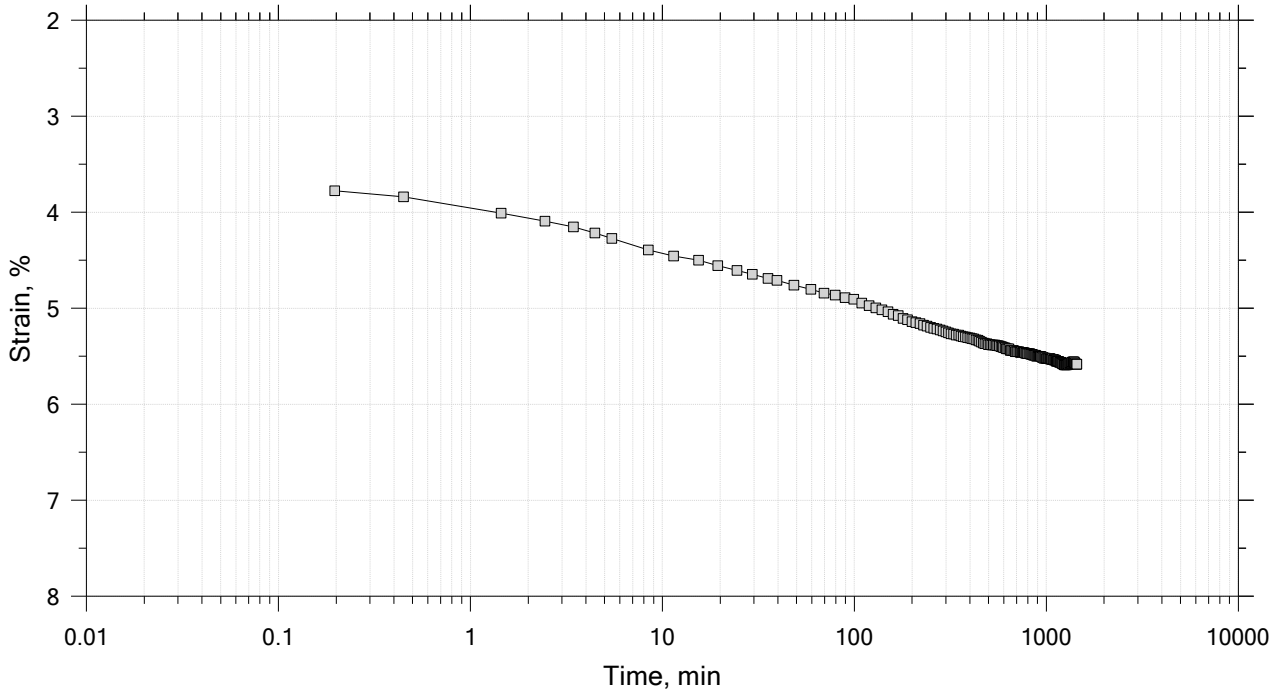


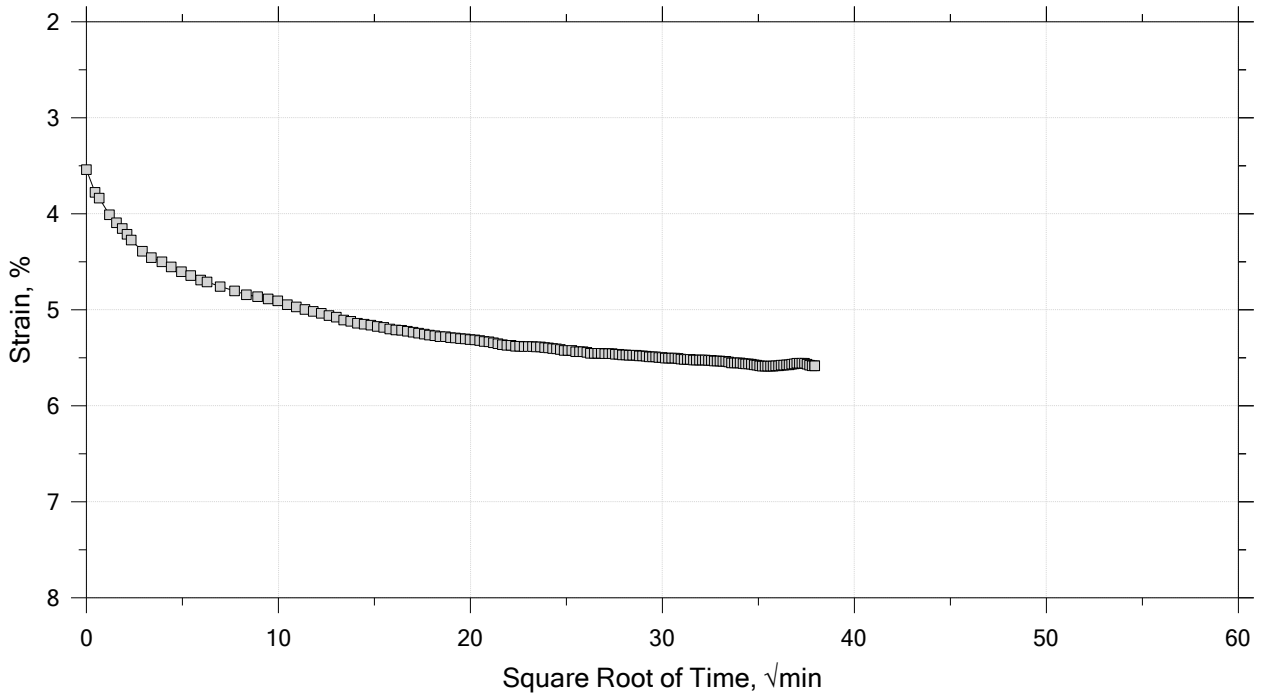


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 3 of 15
Constant Load Step
Stress: 0.25 tsf

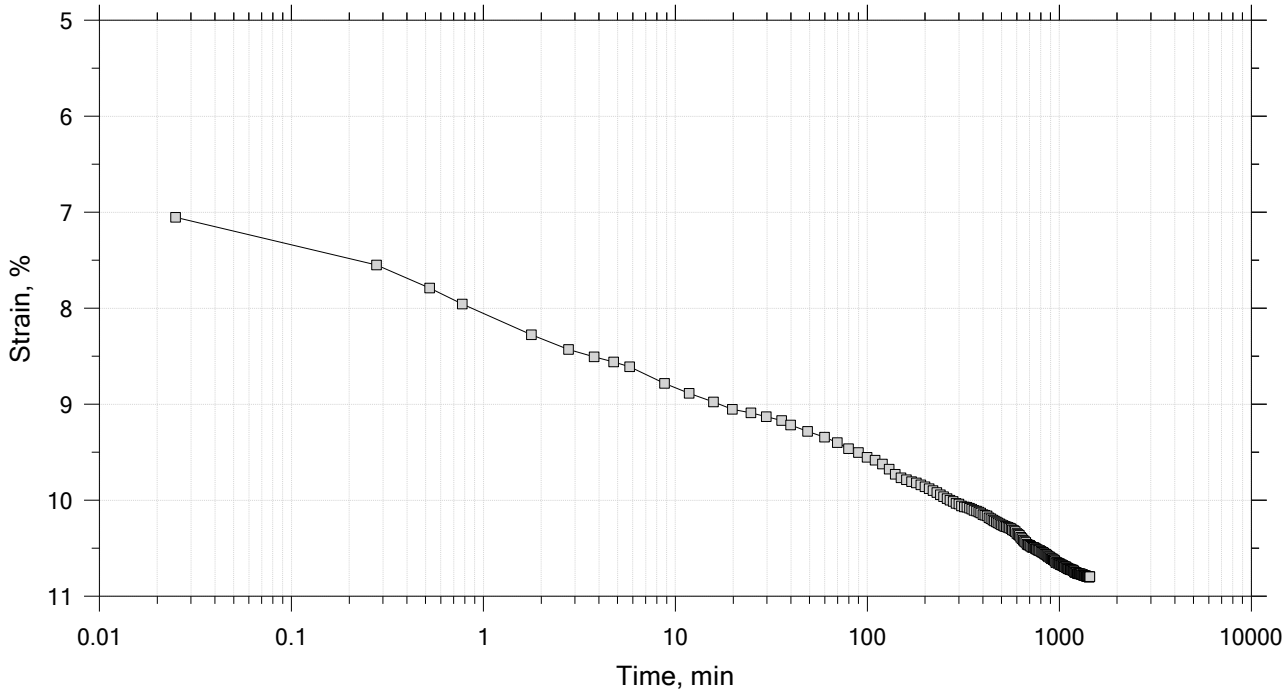


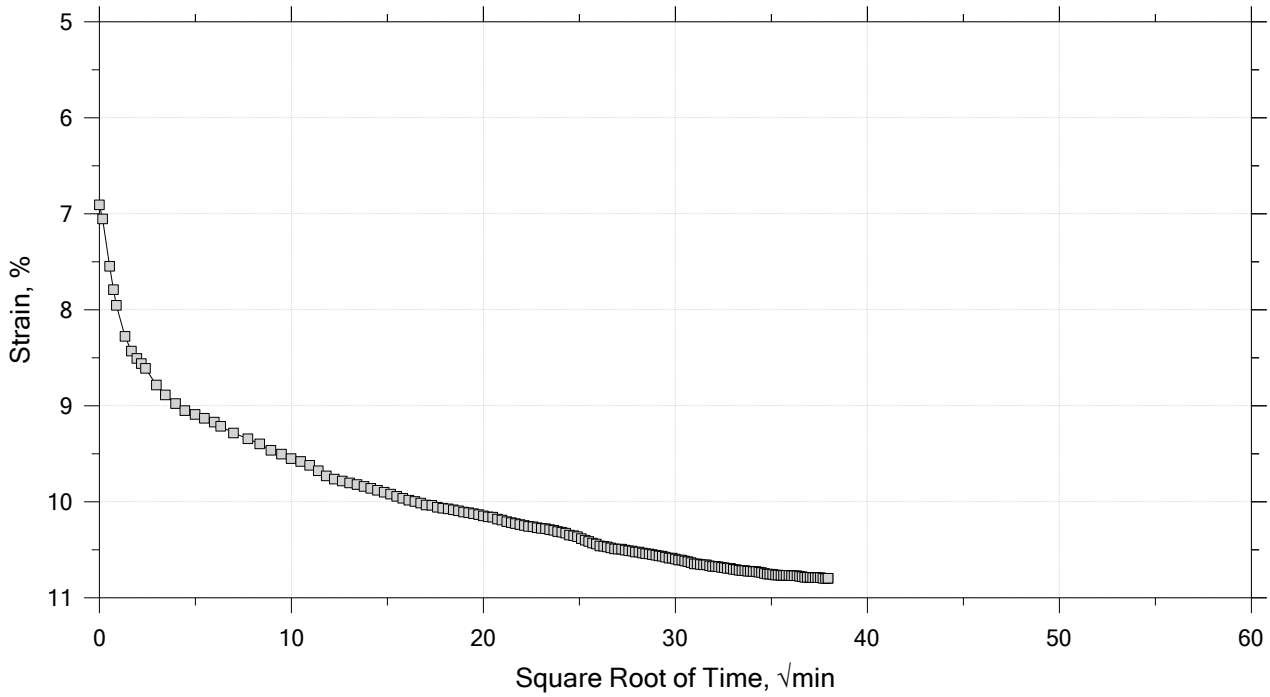


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 4 of 15
Constant Load Step
Stress: 0.5 tsf

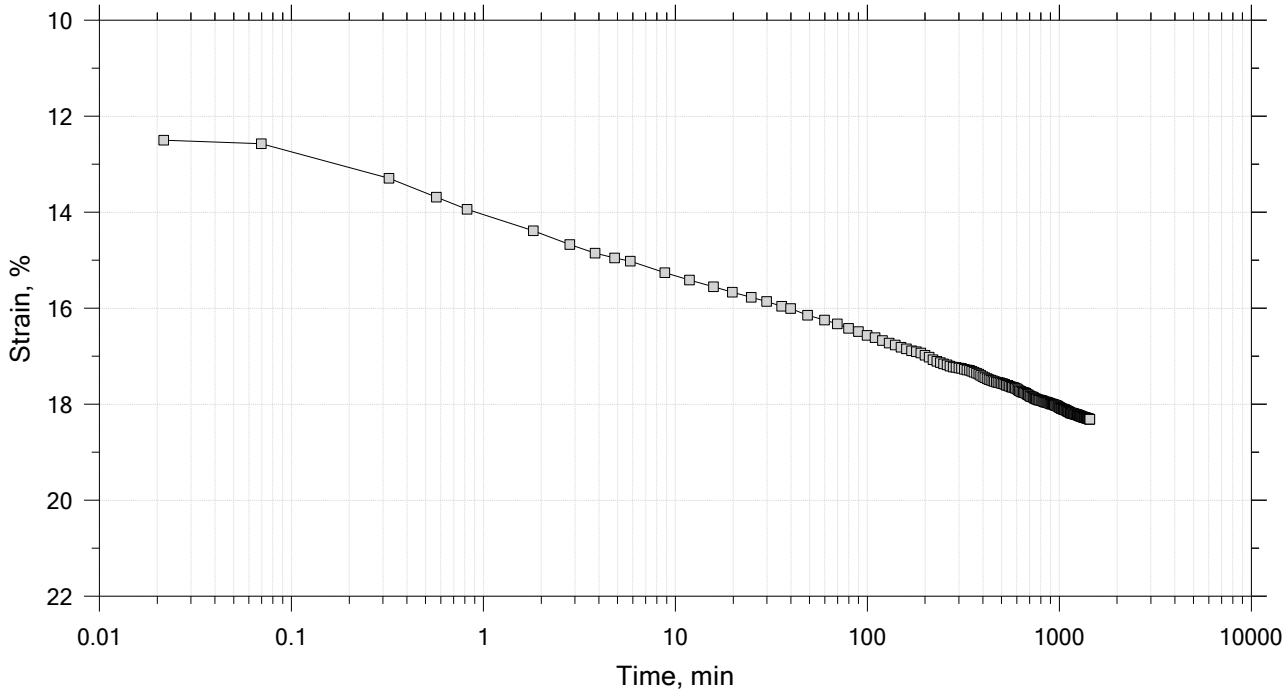


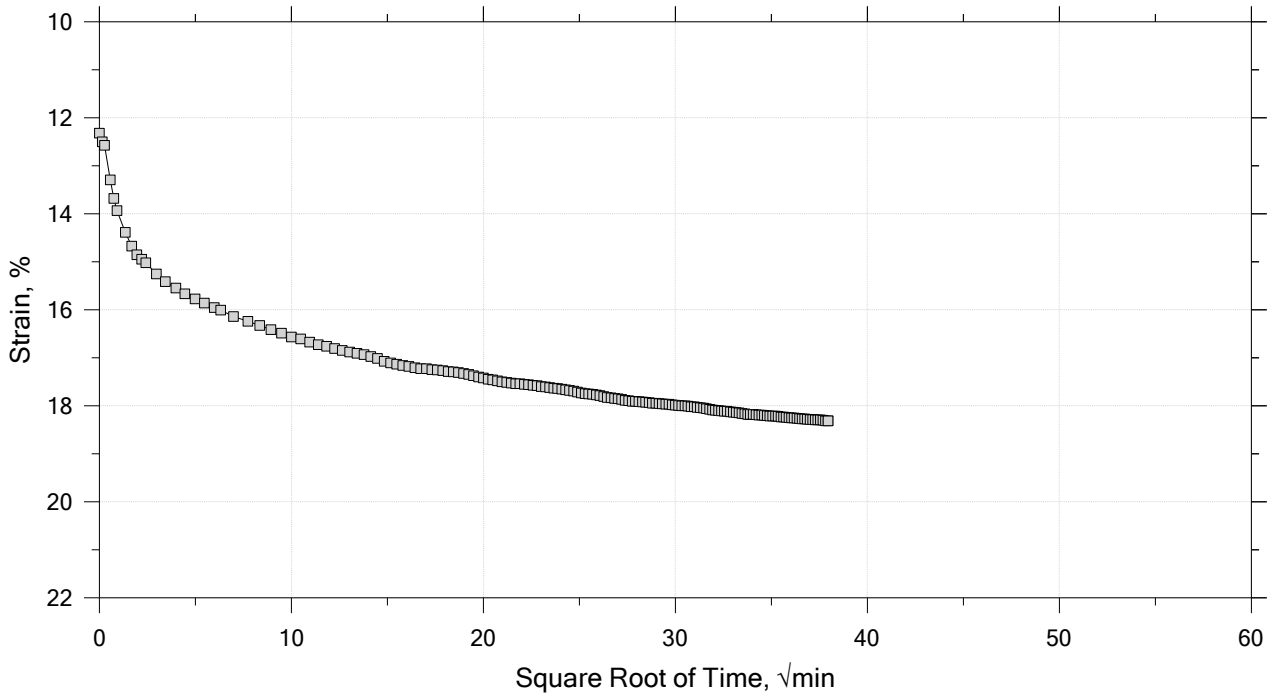


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 5 of 15
Constant Load Step
Stress: 1 tsf

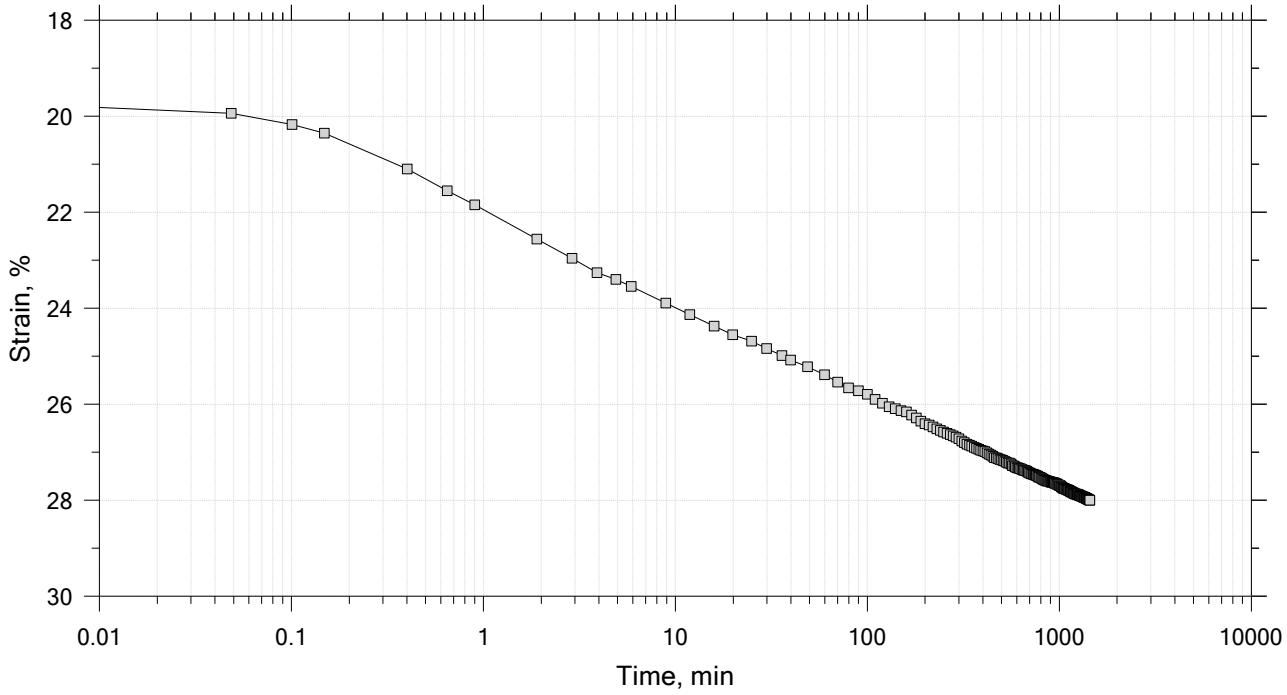


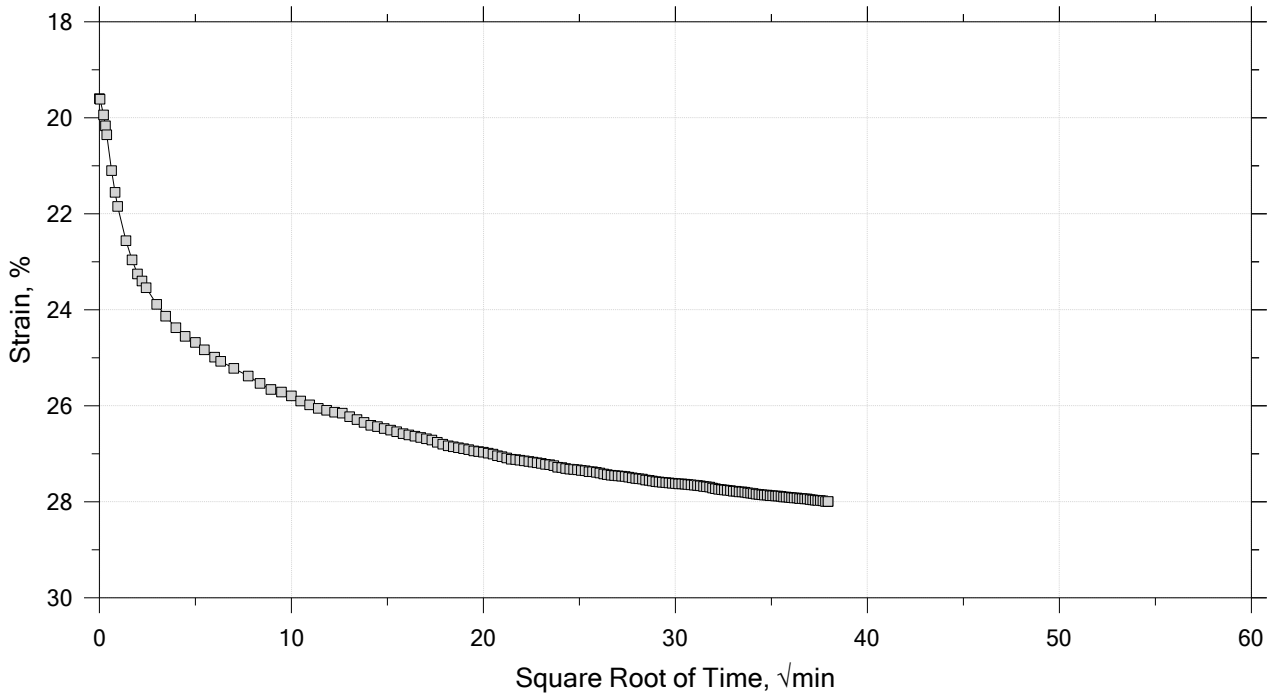


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 6 of 15
Constant Load Step
Stress: 2 tsf

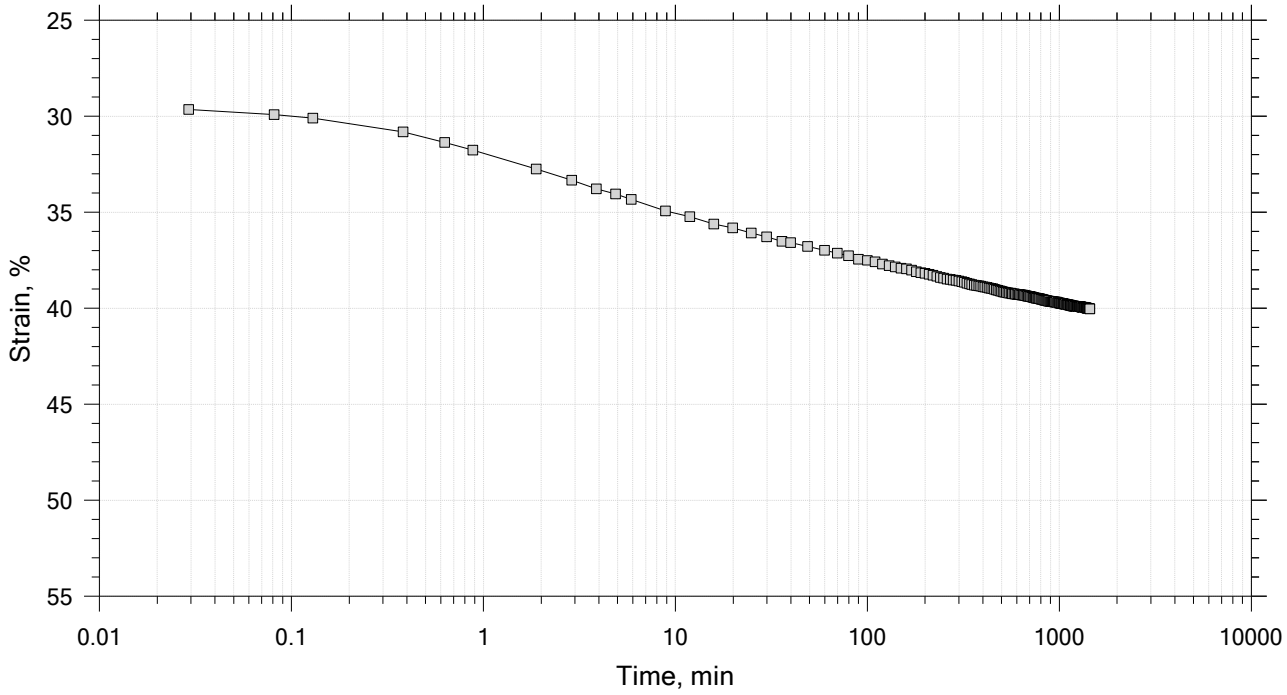


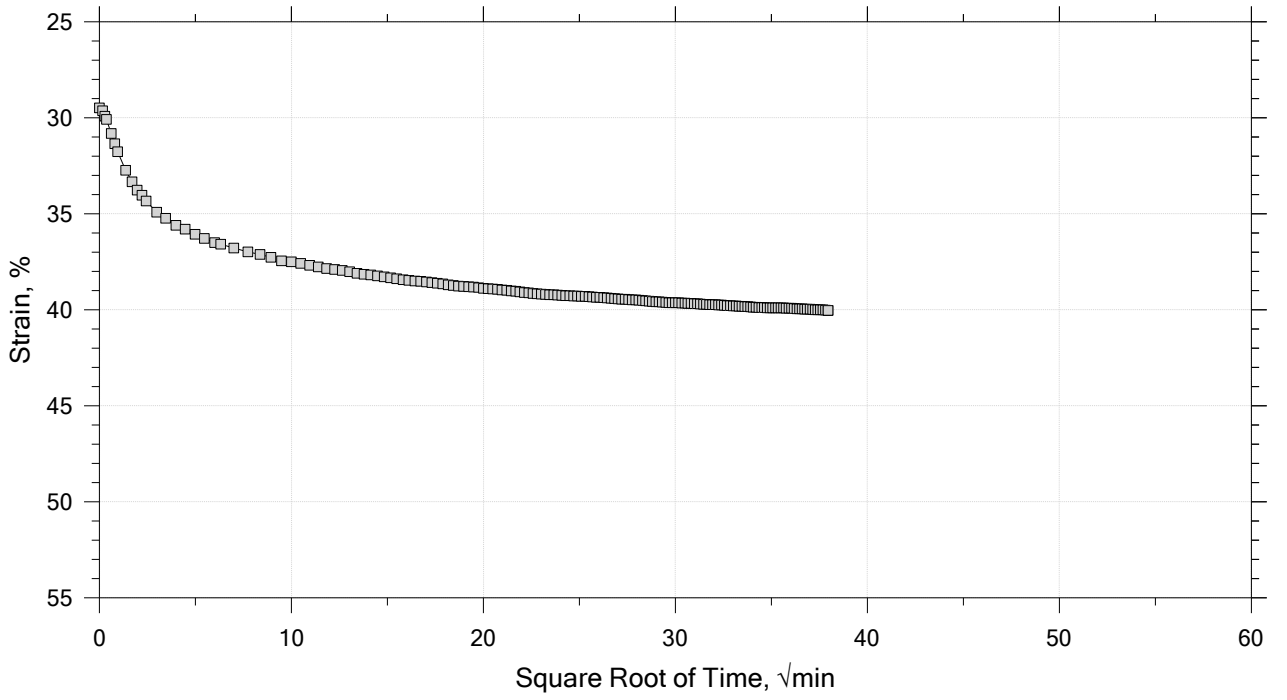


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 7 of 15
Constant Load Step
Stress: 4 tsf

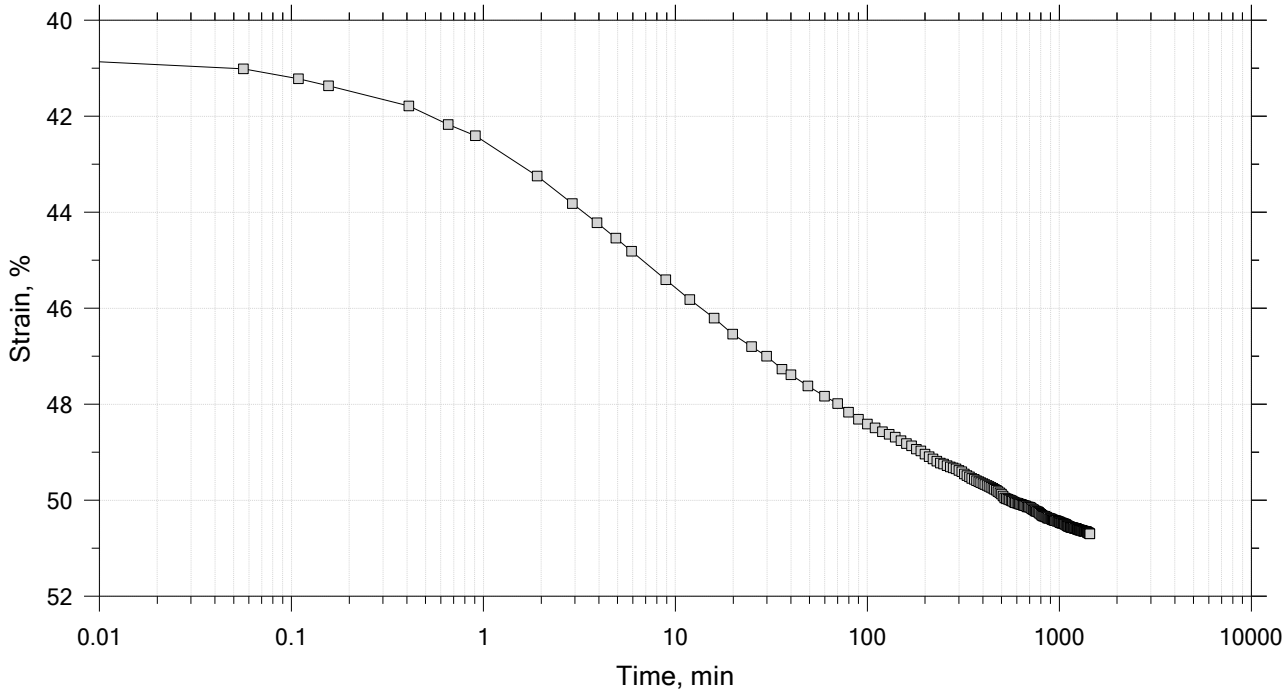


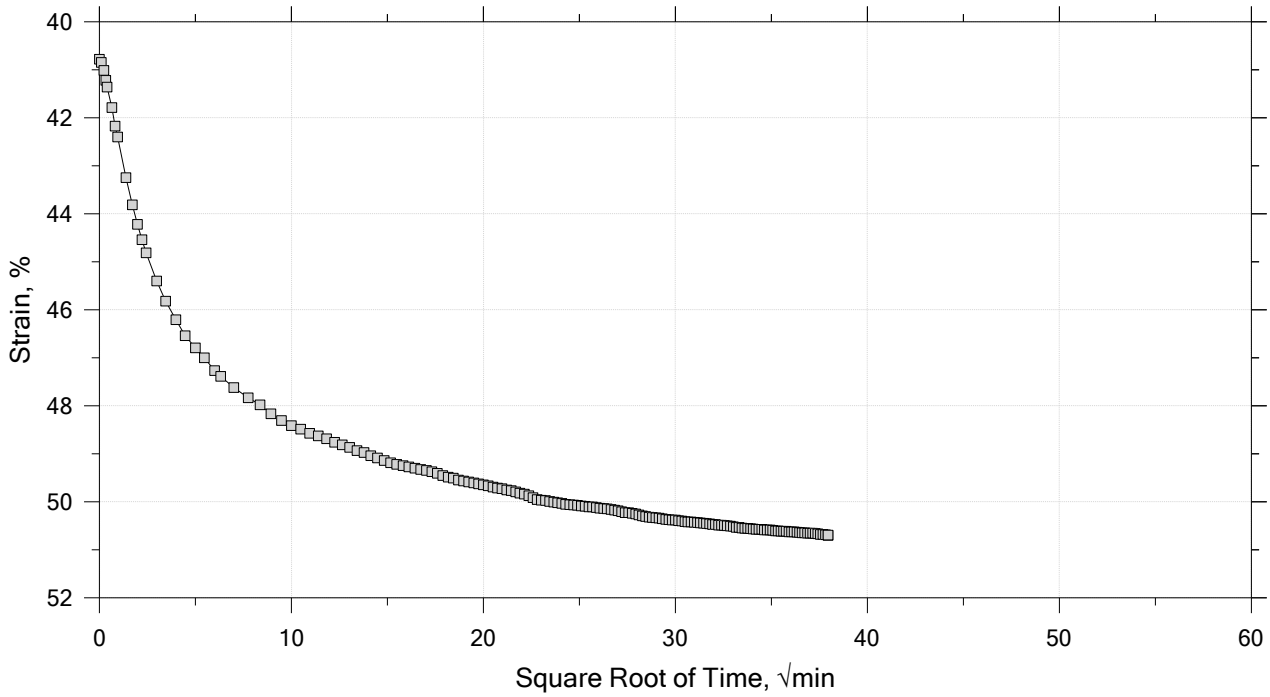


Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
Test No.: IP-1A	Sample Type: intact	Elevation: ---
Description: Moist, very dark brown peat		
Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 8 of 15
Constant Load Step
Stress: 8 tsf

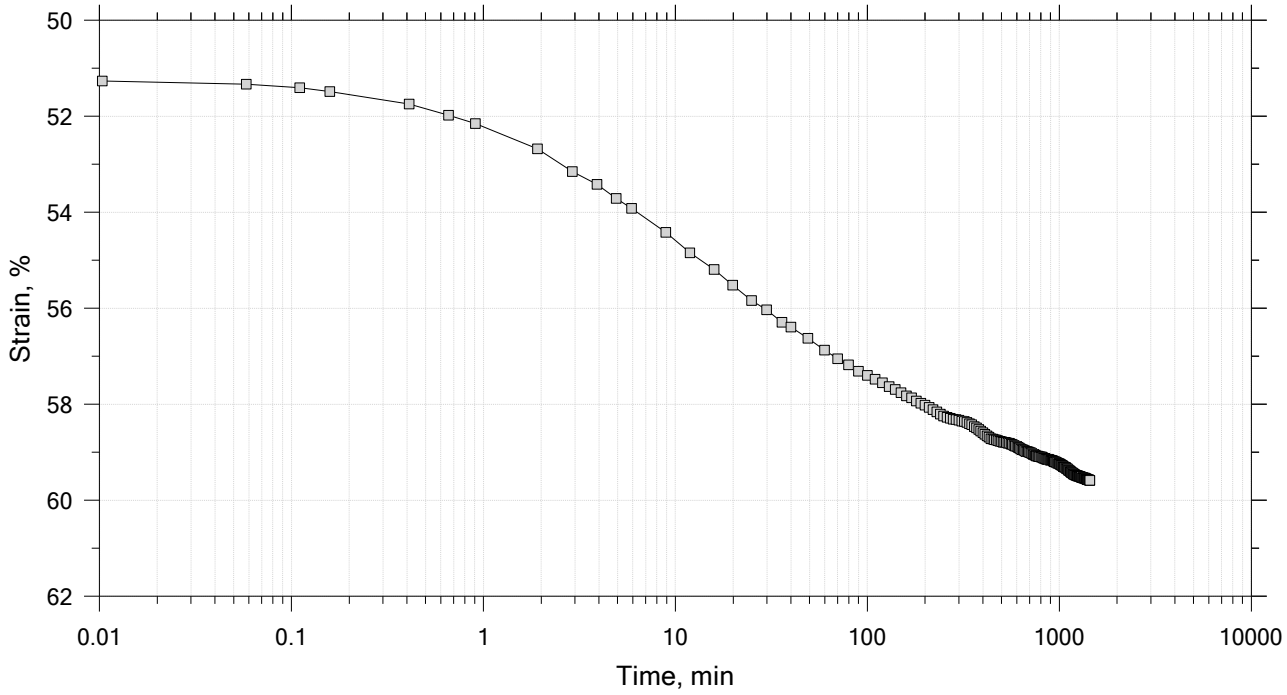


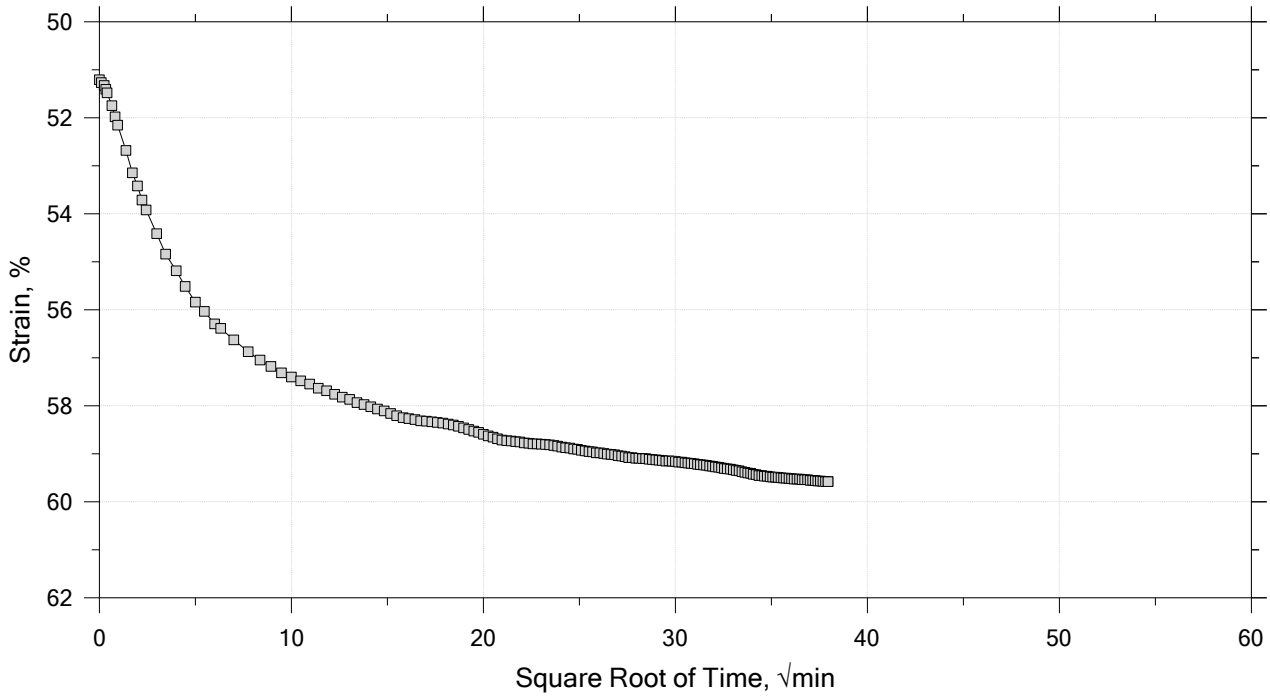


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 9 of 15
Constant Load Step
Stress: 16 tsf

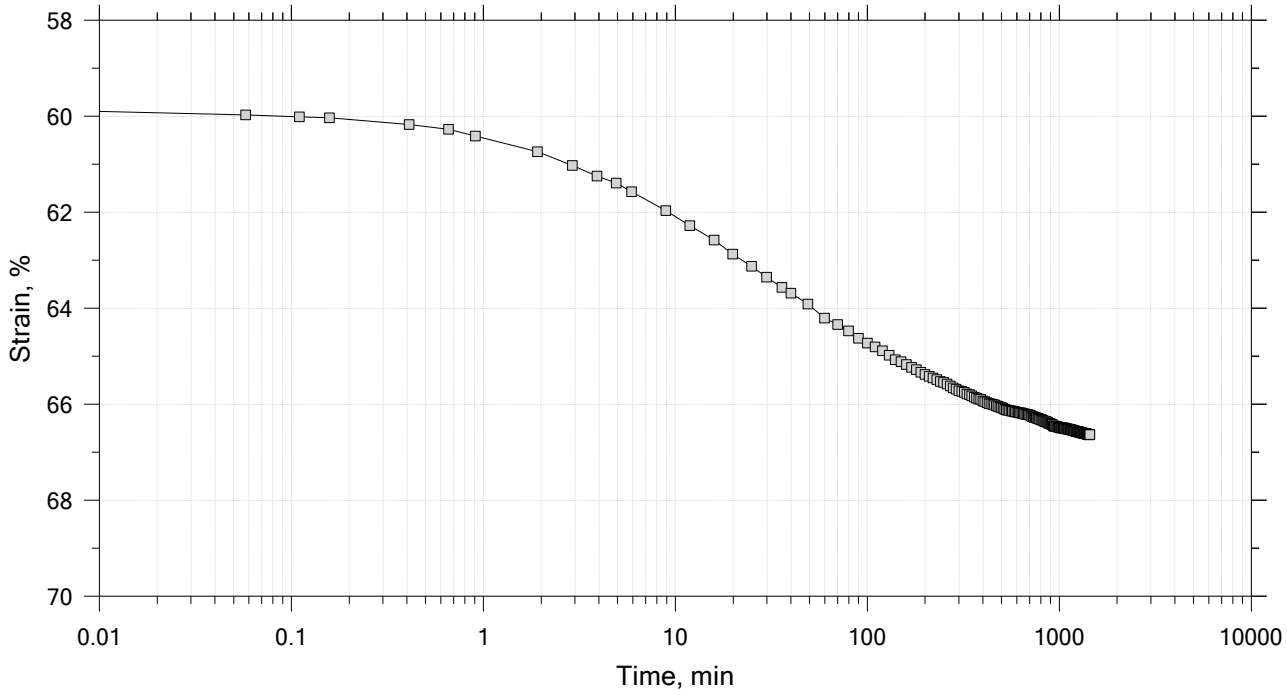


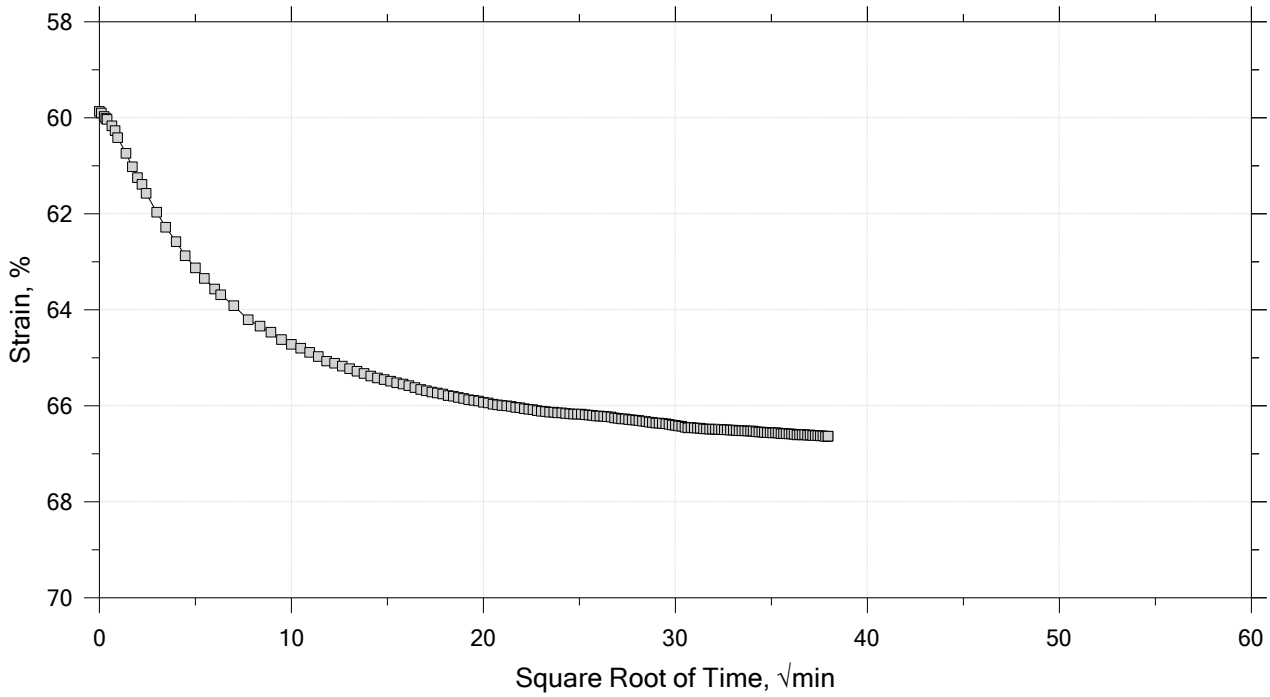


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 10 of 15
Constant Load Step
Stress: 32 tsf

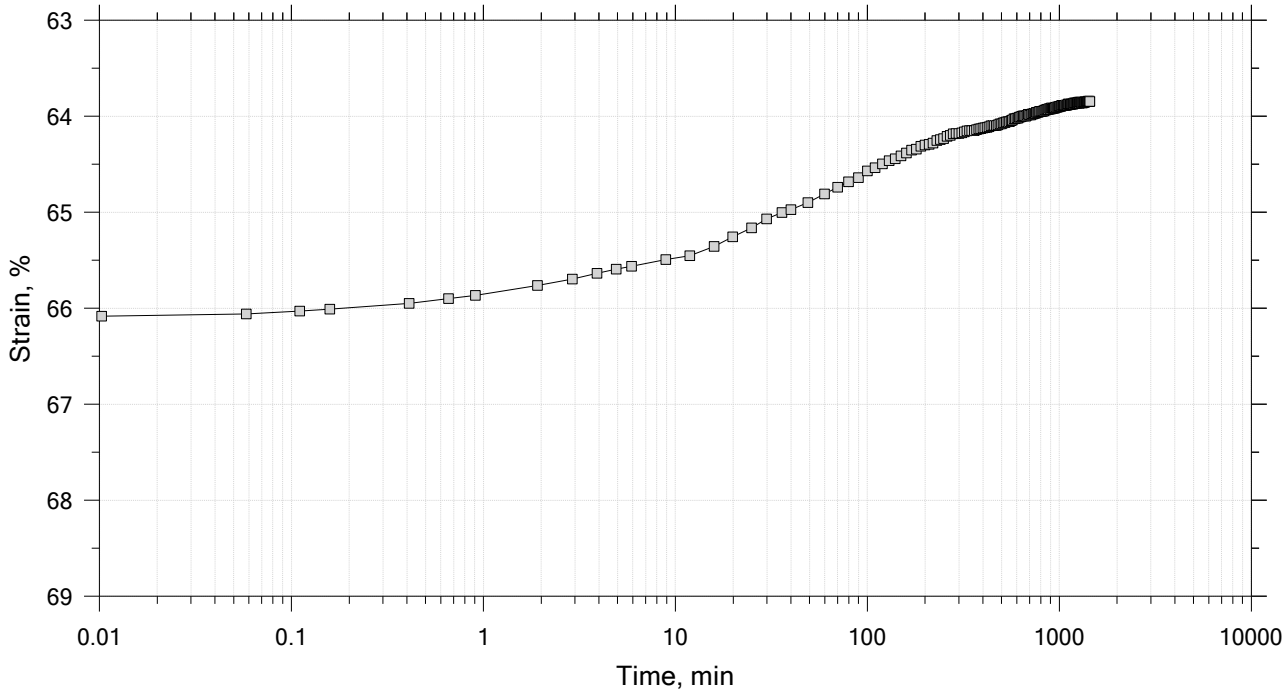


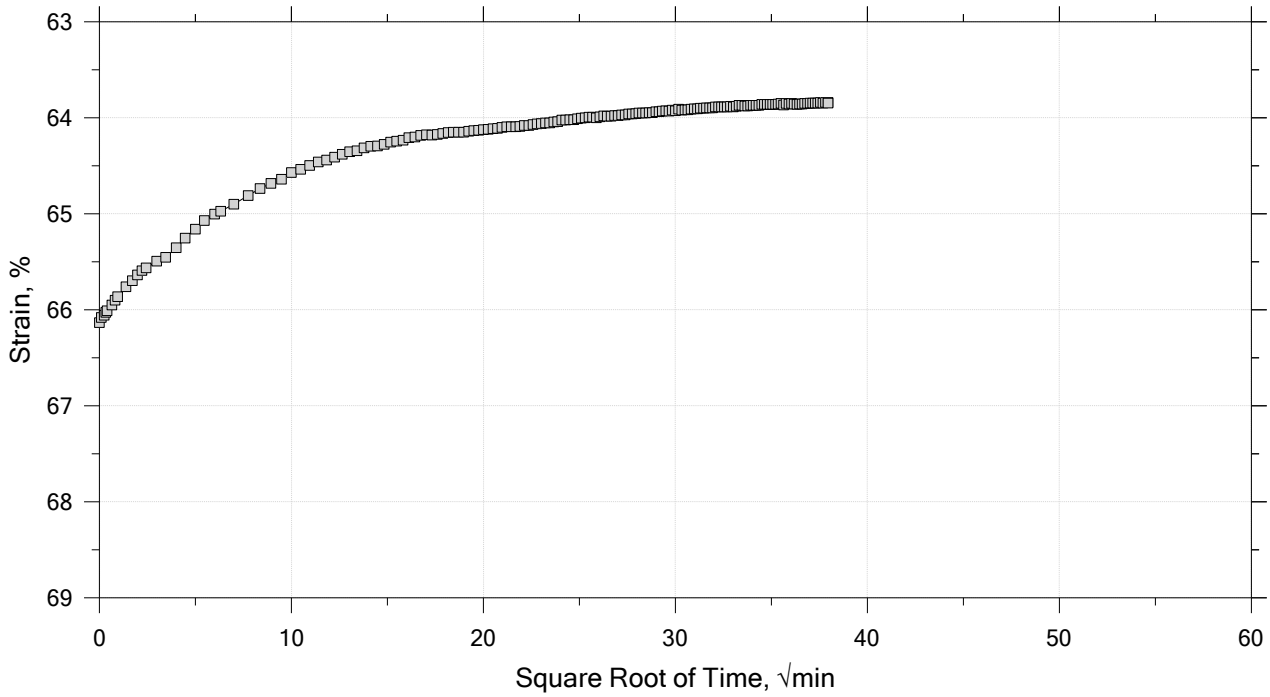


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 11 of 15
Constant Load Step
Stress: 8 tsf

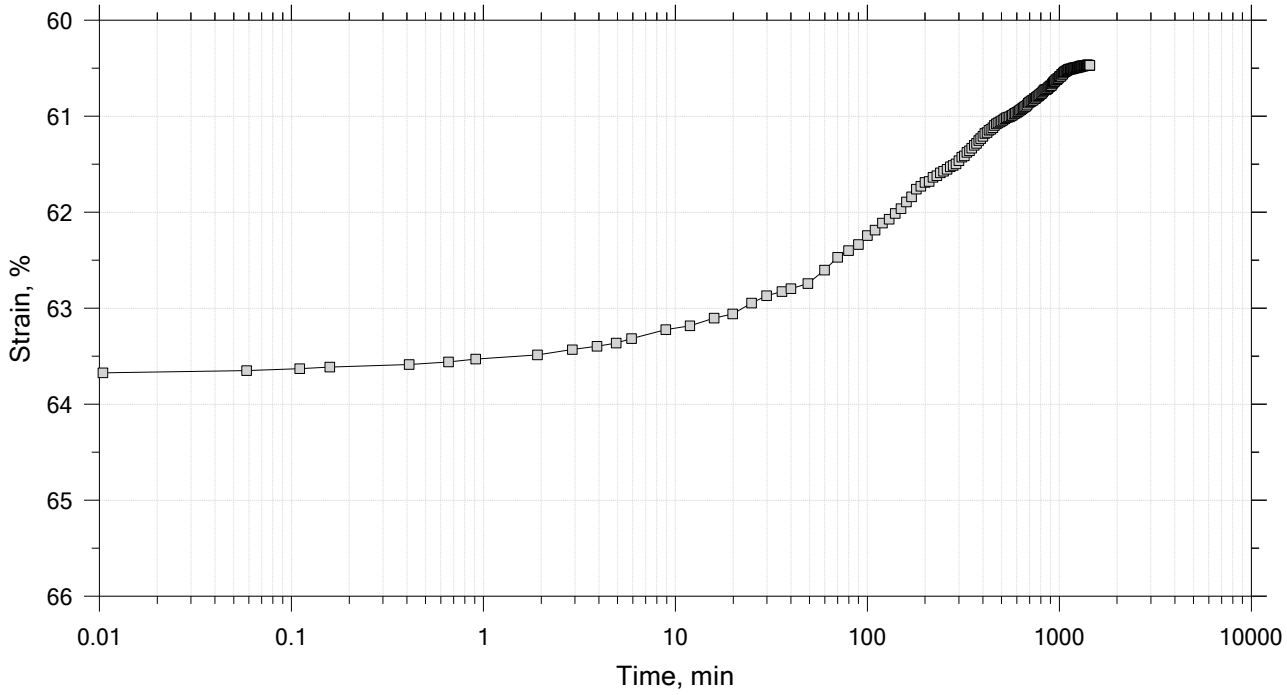


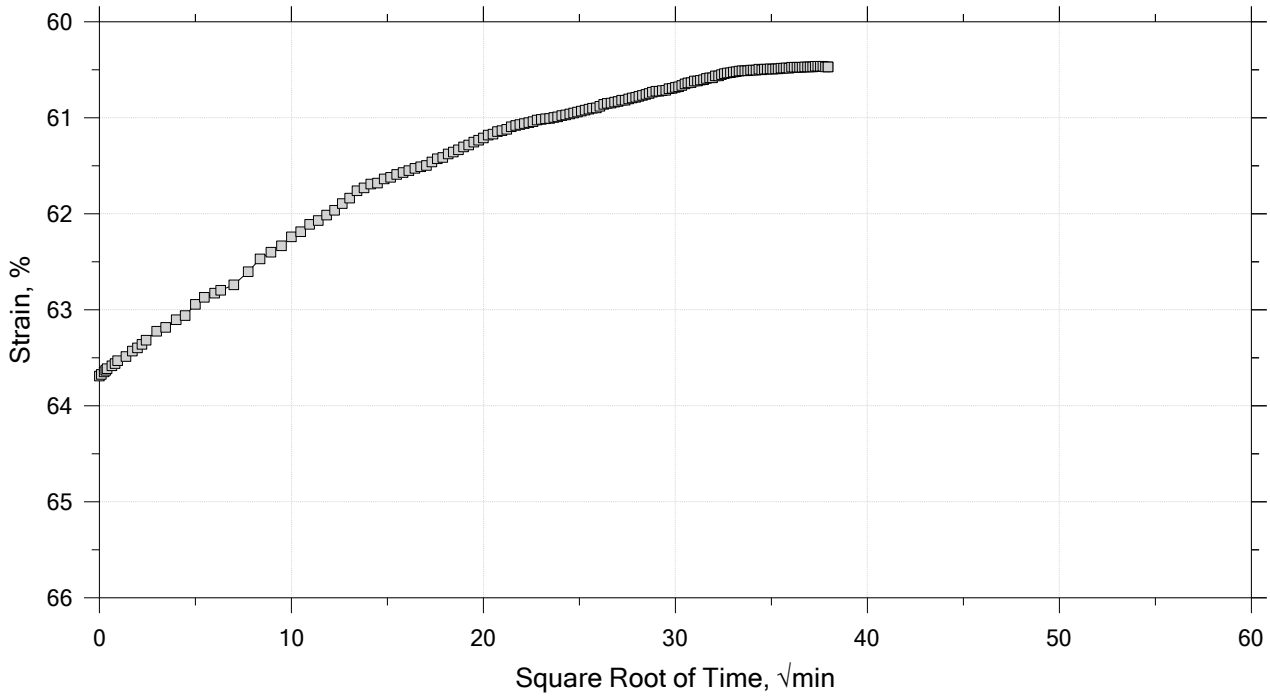


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 12 of 15
Constant Load Step
Stress: 2 tsf

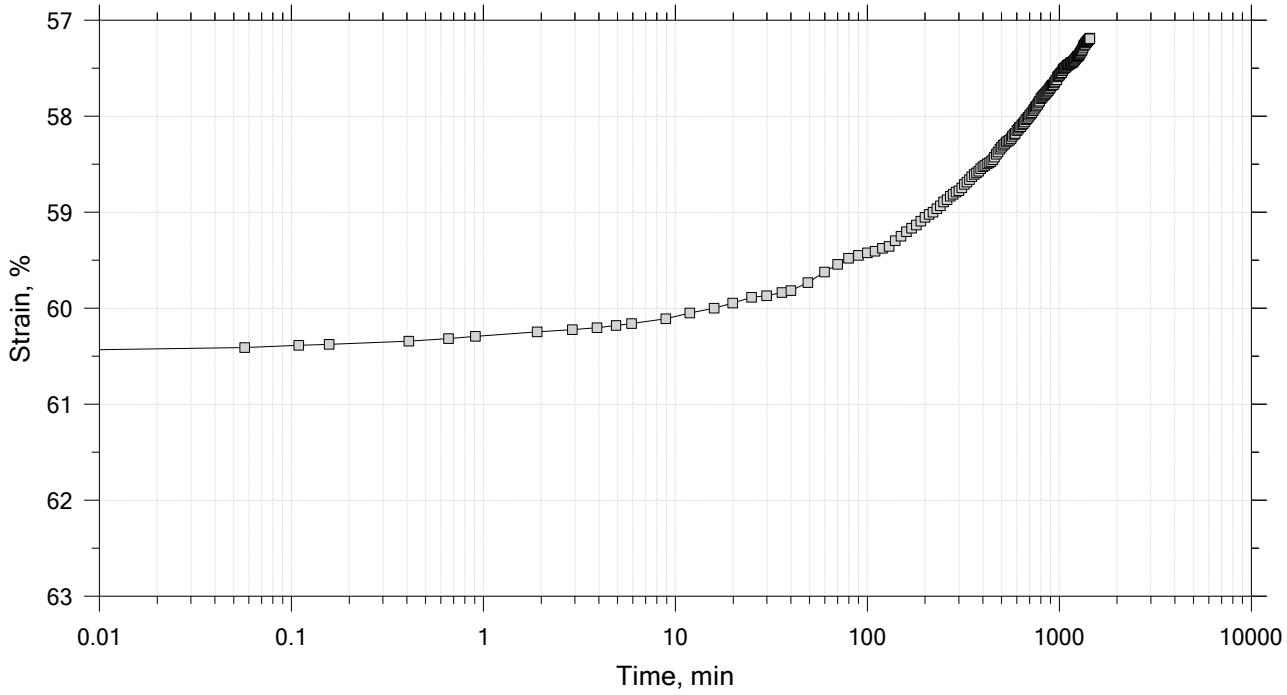


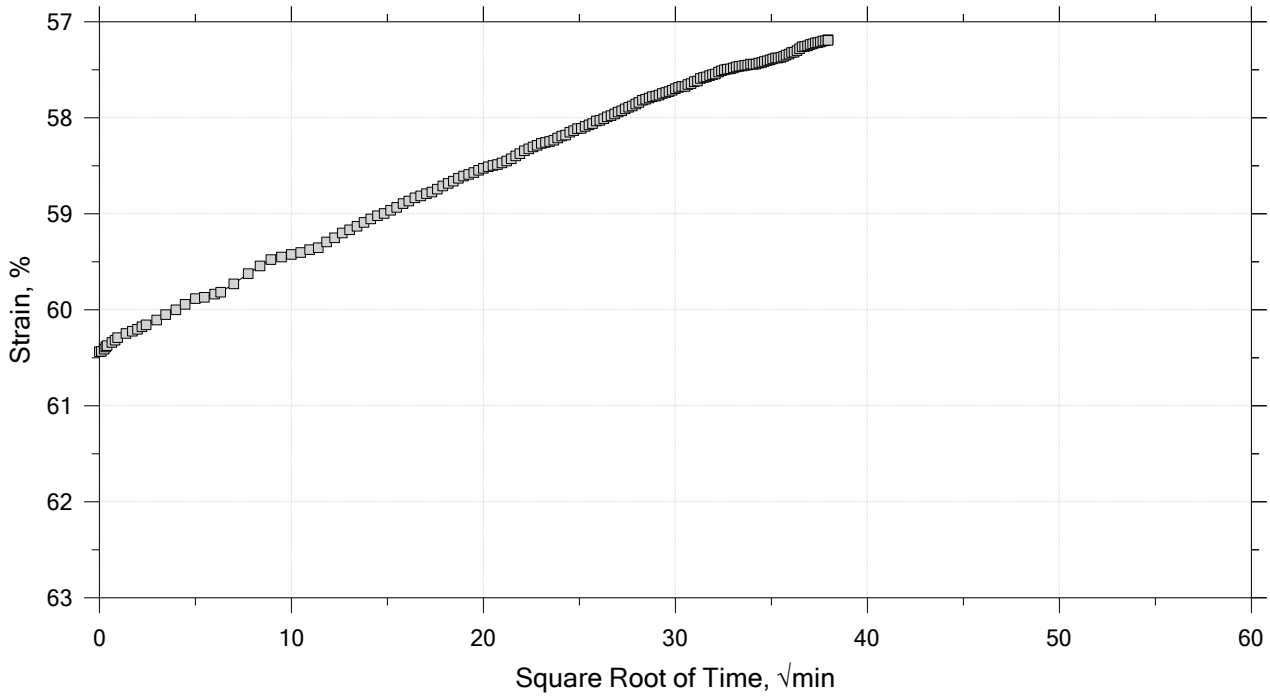


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 13 of 15
Constant Load Step
Stress: 0.5 tsf

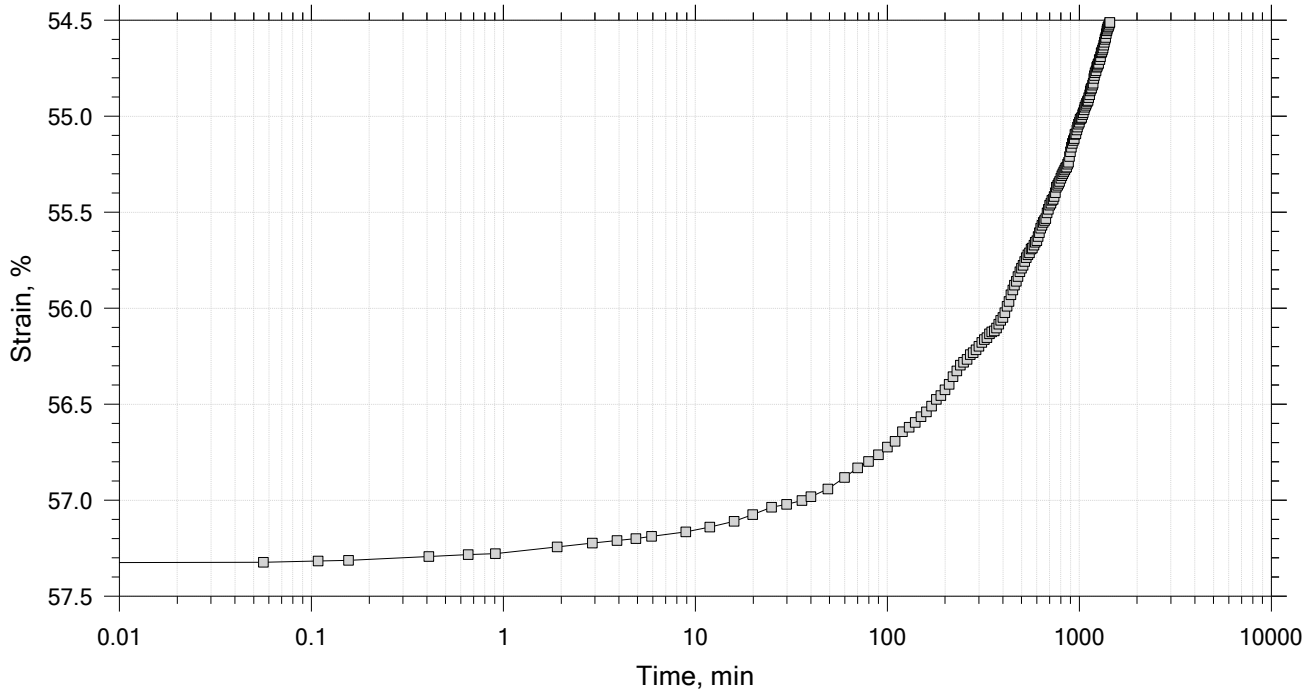


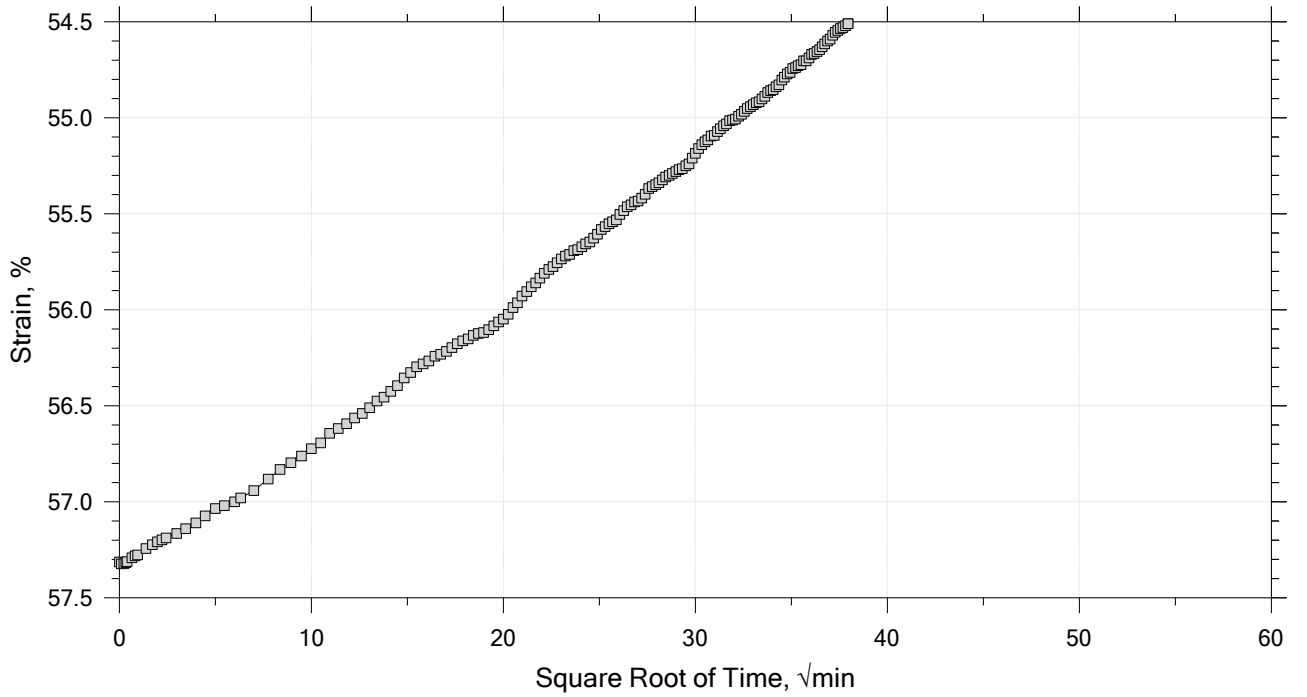


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 14 of 15
Constant Load Step
Stress: 0.125 tsf

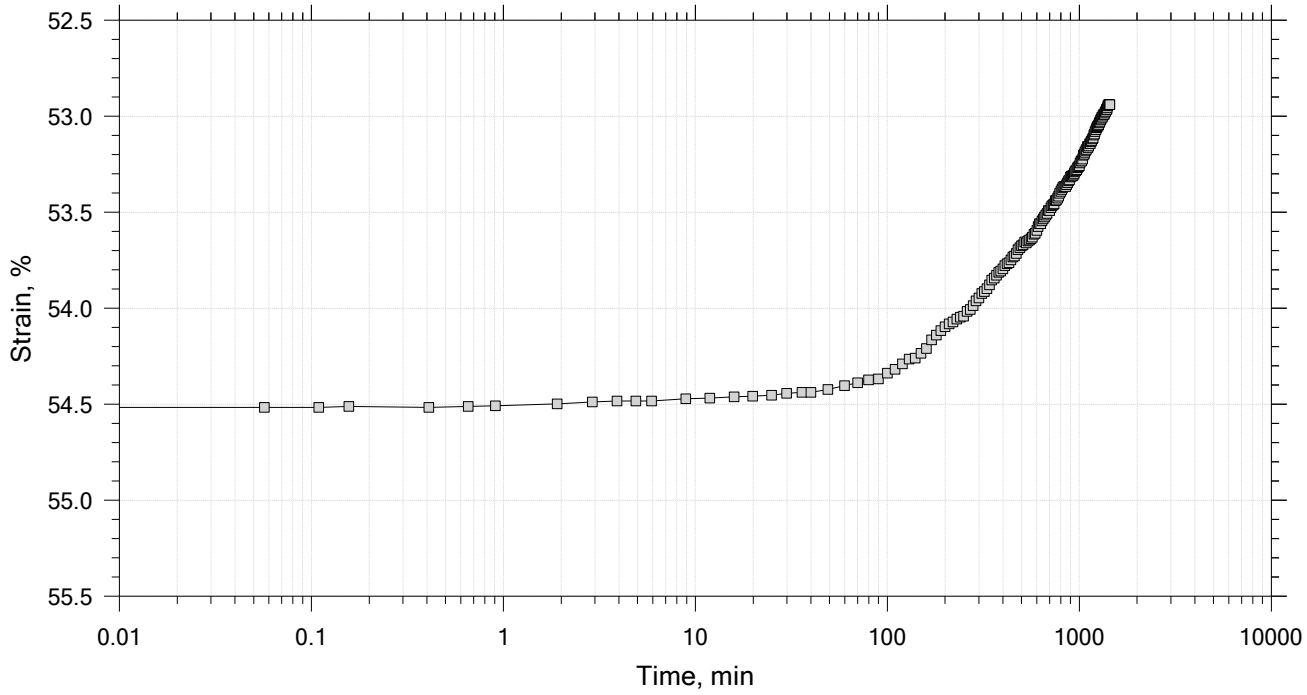


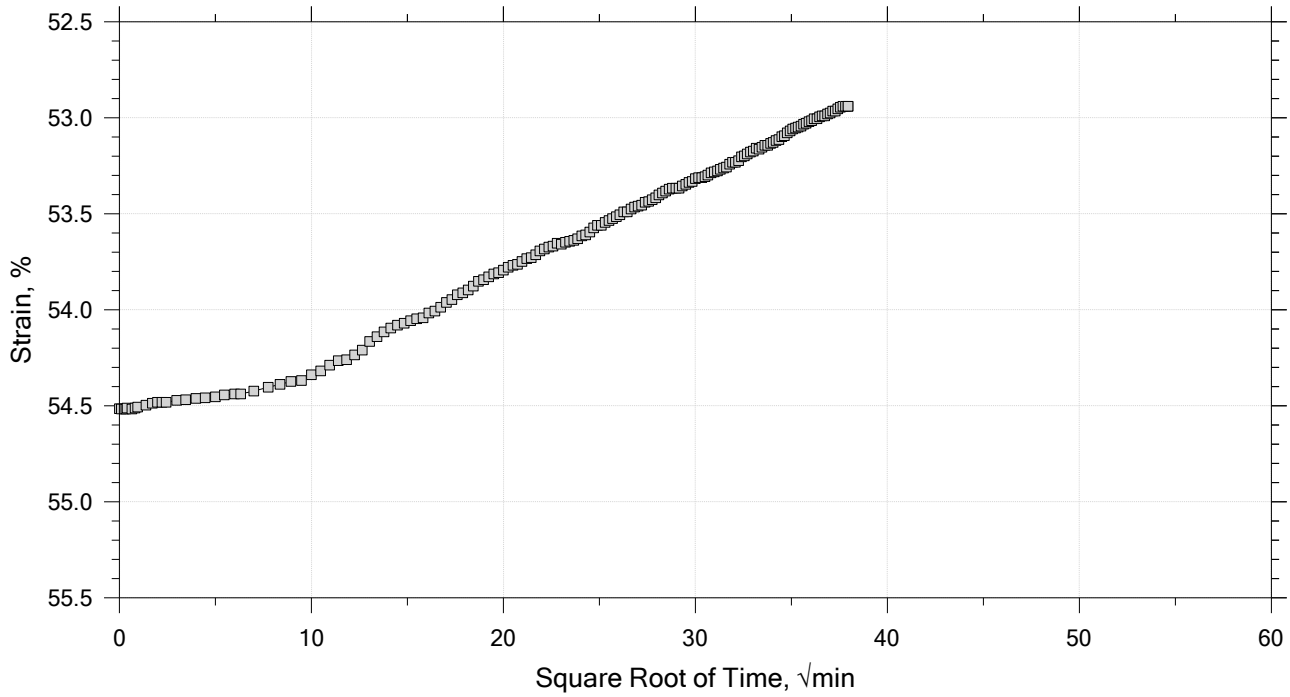


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 15 of 15
Constant Load Step
Stress: 0.0625 tsf





GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 1.50	Liquid Limit: ---
Initial Height: 1.00 in	Initial Void Ratio: 5.66	Plastic Limit: ---
Final Height: 0.46 in	Final Void Ratio: 2.07	Plasticity Index: ---

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	A1829	RING		E3894
Mass Container, gm	8.27	107.73	107.73	8.31
Mass Container + Wet Soil, gm	90.88	186.21	150.82	51.17
Mass Container + Dry Soil, gm	26.99	125.89	125.89	26.37
Mass Dry Soil, gm	18.72	18.157	18.157	18.06
Water Content, %	341.29	332.23	137.32	137.32
Void Ratio	---	5.66	2.07	---
Degree of Saturation, %	---	88.23	100.00	---
Dry Unit Weight, pcf	---	14.091	30.633	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
	Test No.: IP-1A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown peat		
	Remarks: TX-012, Swell Pressure = 0.0724 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Square Root of Time Coefficients

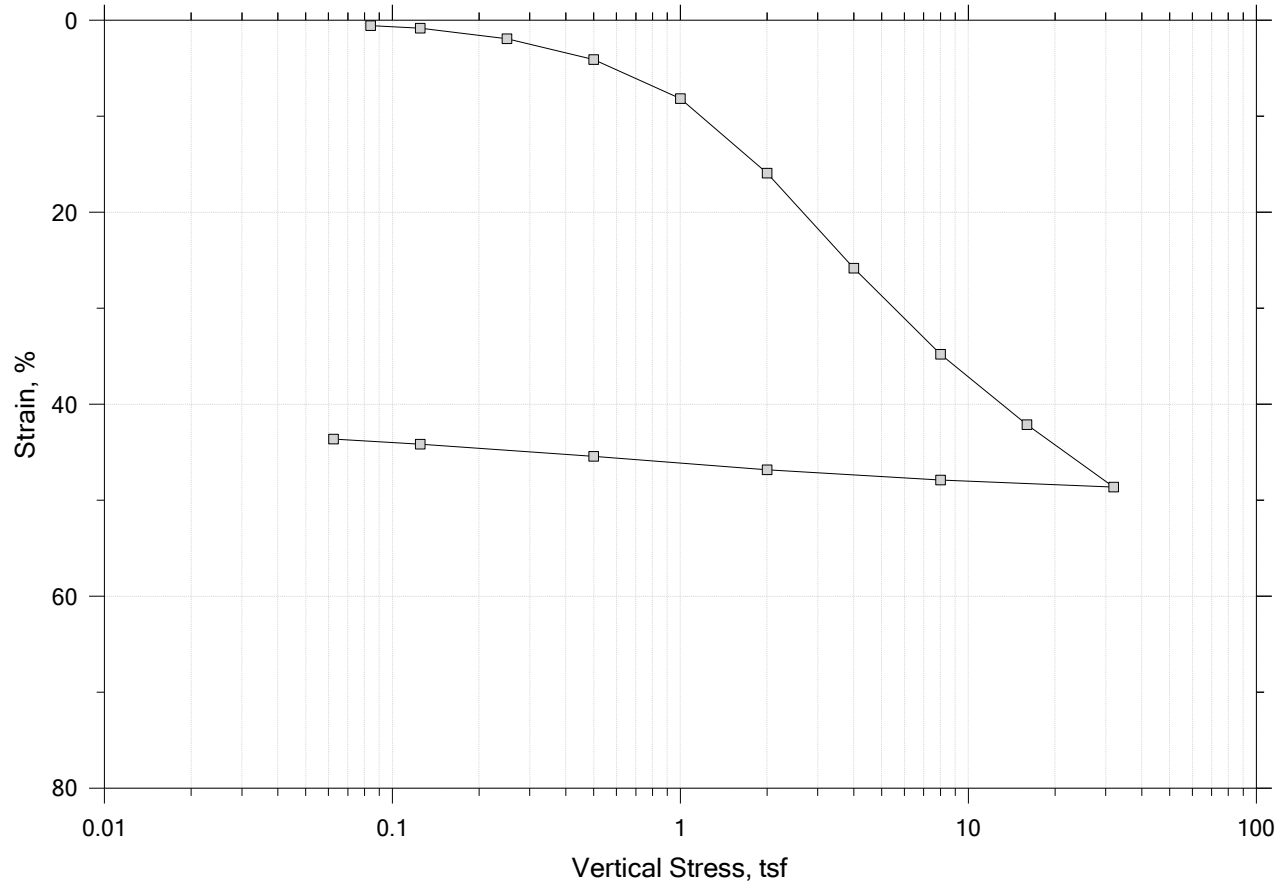
Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft²/s	Mv 1/tsf	k ft/day
1	0.0724	0.007306	5.62	0.731	168.338	1.45e-07	1.01e-01	3.94e-05
2	0.125	0.02038	5.53	2.04	1089.299	2.19e-08	2.49e-01	1.47e-05
3	0.250	0.05583	5.29	5.58	222.070	1.02e-07	2.84e-01	7.82e-05
4	0.500	0.1080	4.95	10.8	173.420	1.19e-07	2.09e-01	6.71e-05
5	1.00	0.1831	4.44	18.3	146.738	1.22e-07	1.50e-01	4.95e-05
6	2.00	0.2800	3.80	28.0	137.758	1.05e-07	9.69e-02	2.75e-05
7	4.00	0.4003	3.00	40.0	145.962	7.32e-08	6.02e-02	1.19e-05
8	8.00	0.5070	2.29	50.7	136.749	5.36e-08	2.67e-02	3.85e-06
9	16.0	0.5958	1.69	59.6	143.525	3.44e-08	1.11e-02	1.03e-06
10	32.0	0.6663	1.22	66.6	159.166	2.10e-08	4.41e-03	2.49e-07
11	8.00	0.6385	1.41	63.8	189.953	1.56e-08	1.16e-03	4.89e-08
12	2.00	0.6047	1.63	60.5	414.697	8.47e-09	5.63e-03	1.29e-07
13	0.500	0.5719	1.85	57.2	1369.329	3.04e-09	2.19e-02	1.79e-07
14	0.125	0.5451	2.03	54.5	---	---	---	---
15	0.0625	0.5294	2.14	52.9	---	---	---	---

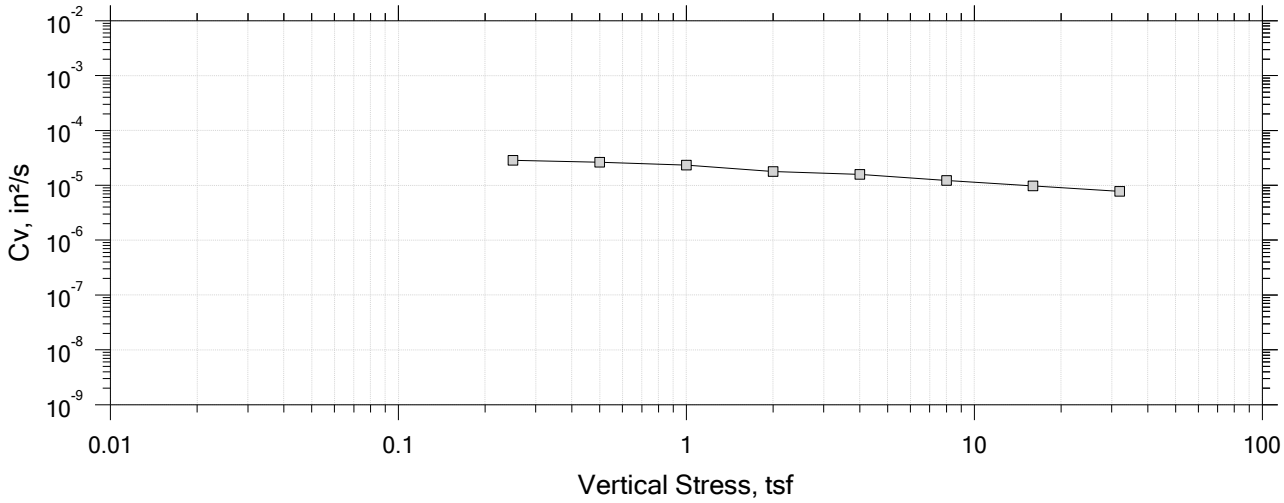
GeoTesting EXPRESS

Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
Boring No.: ~~P-4~~ B-104	Tested By: trm	Checked By: njh
Sample No.: T1	Test Date: 1/11/23	Depth: 28-30'
Test No.: IP-1A	Sample Type: intact	Elevation: ---
Description: Moist, very dark brown peat		
Remarks: TX-012, Swell Pressure = 0.0724 tsf		
Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method A

Summary Report

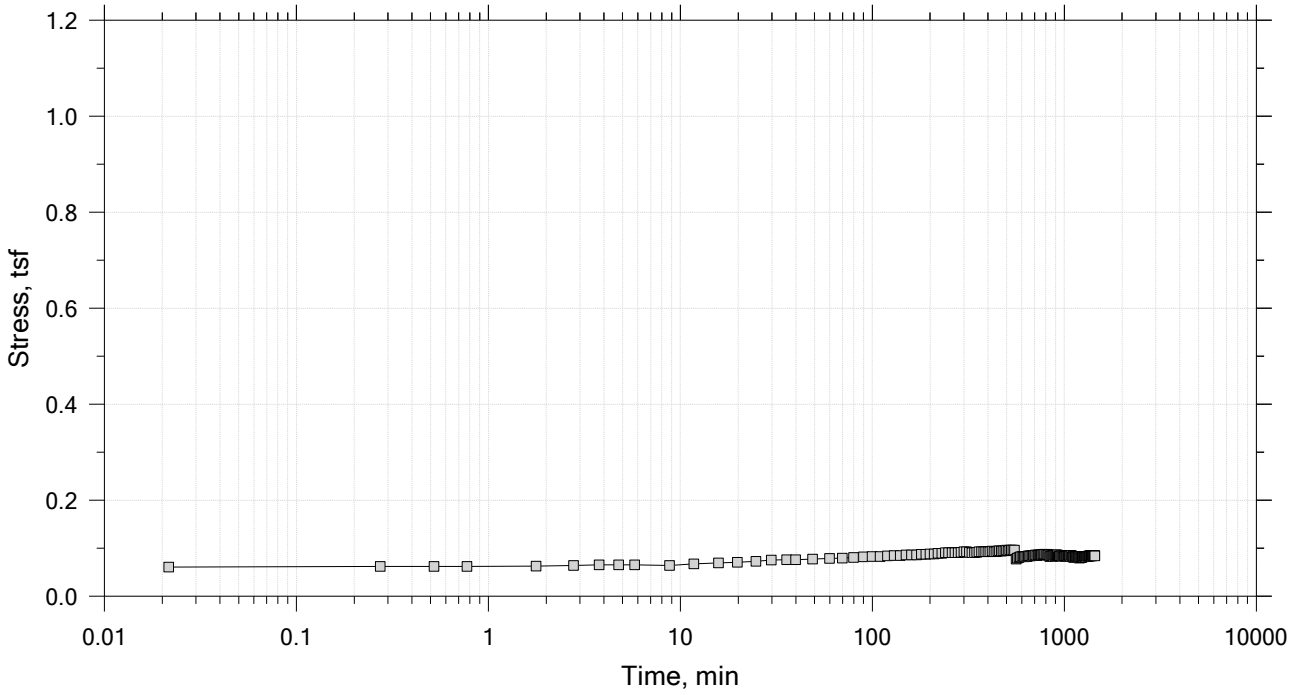


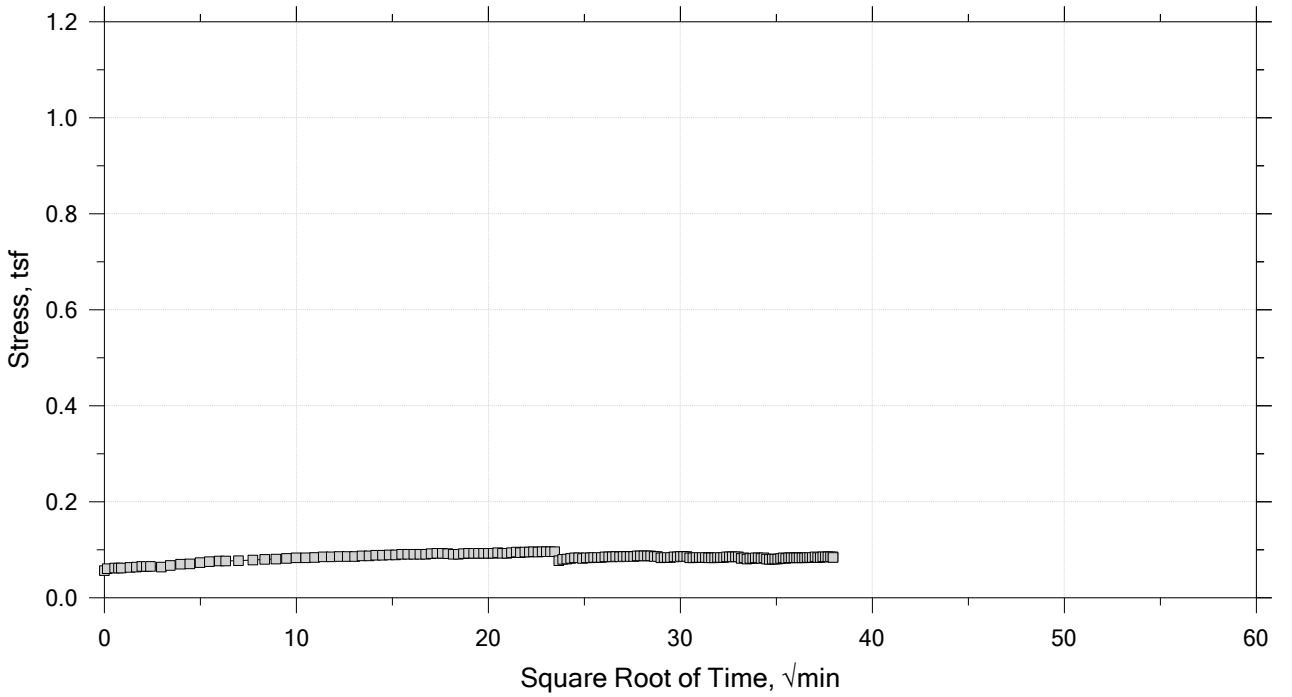


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 1 of 15
Constant Volume Step
Stress: 0.0839 tsf

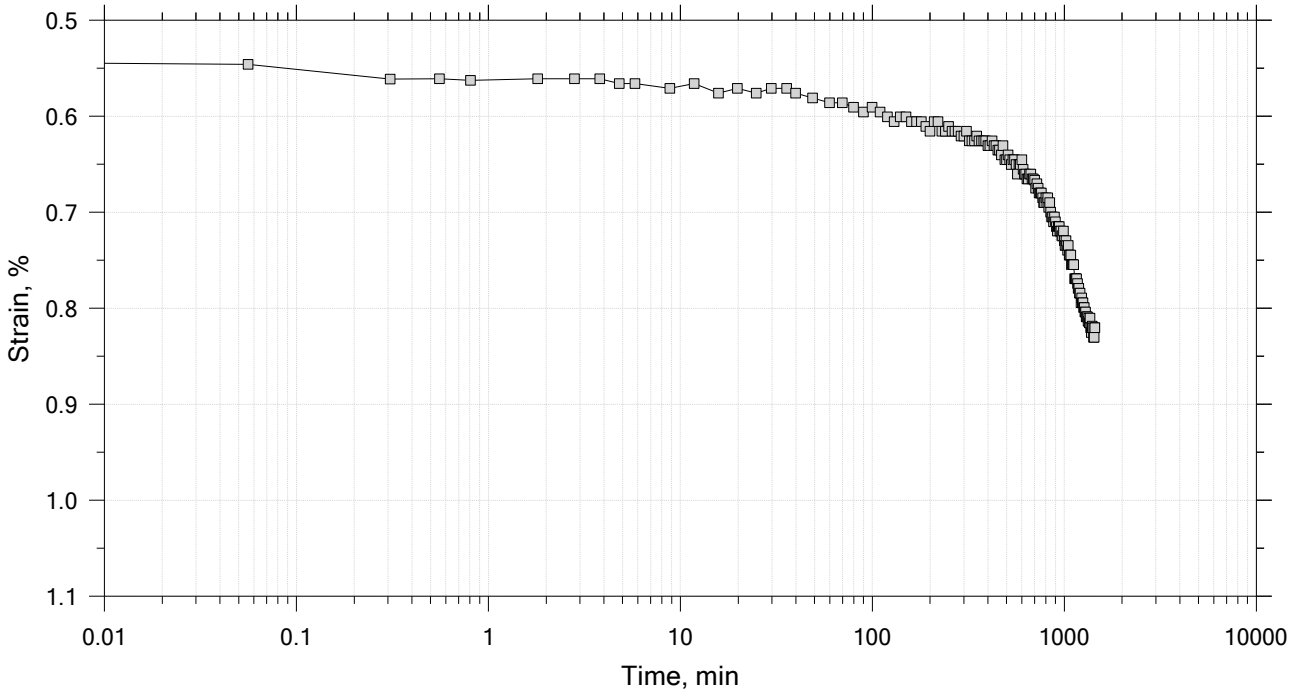


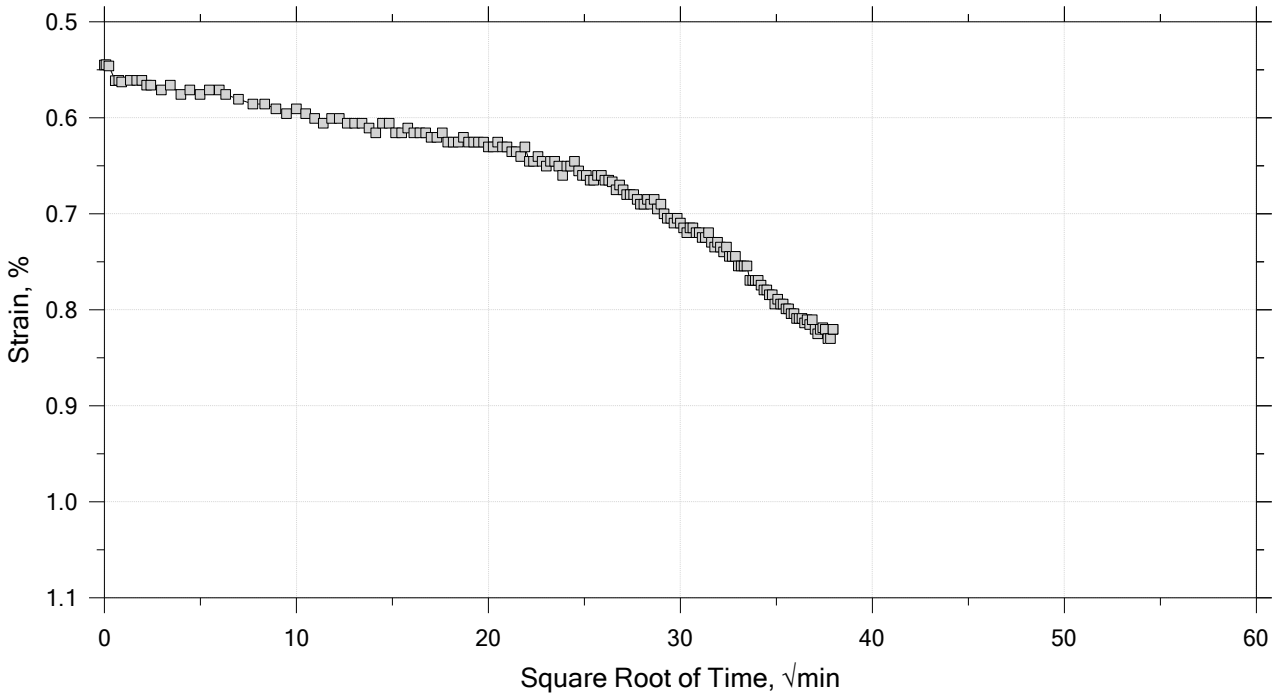


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 2 of 15
Constant Load Step
Stress: 0.125 tsf

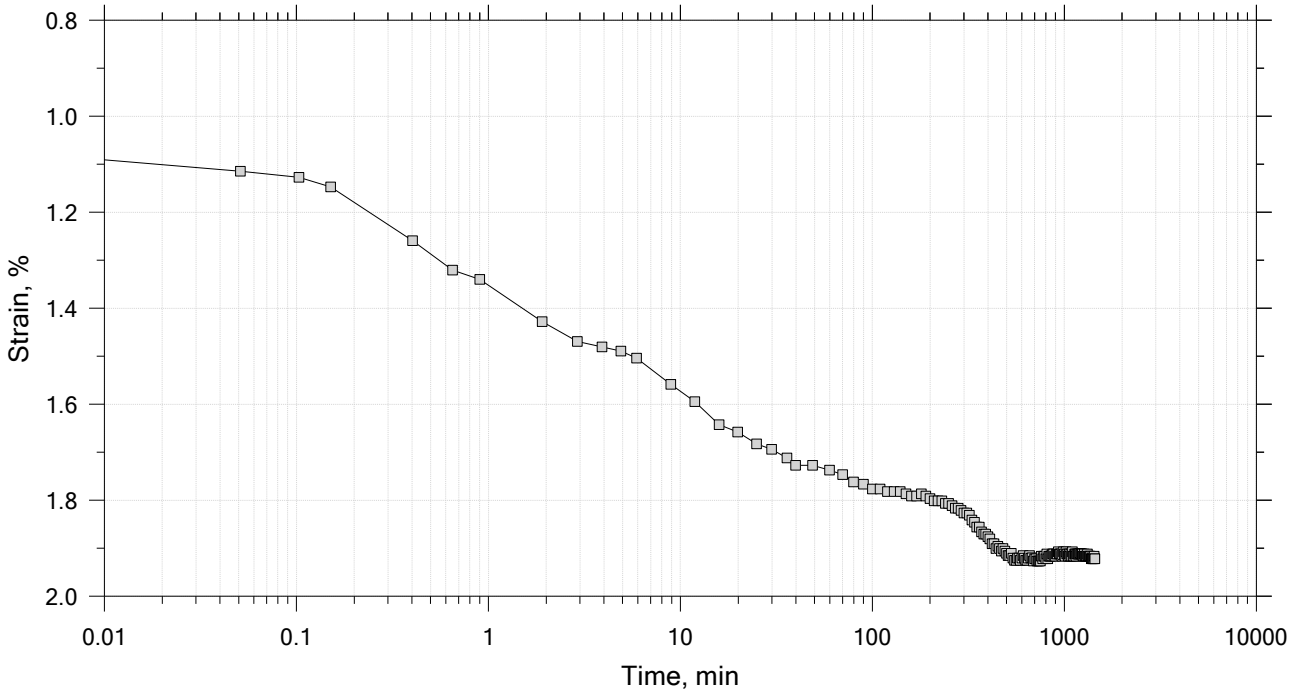


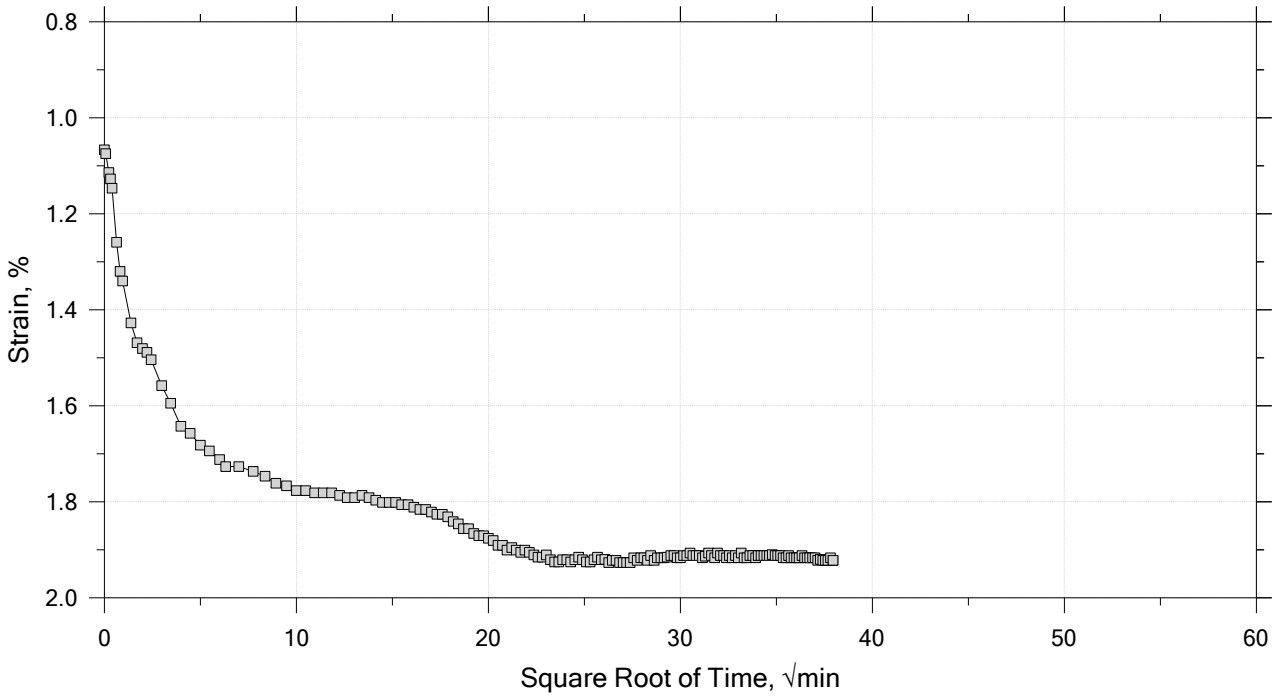


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 3 of 15
Constant Load Step
Stress: 0.25 tsf

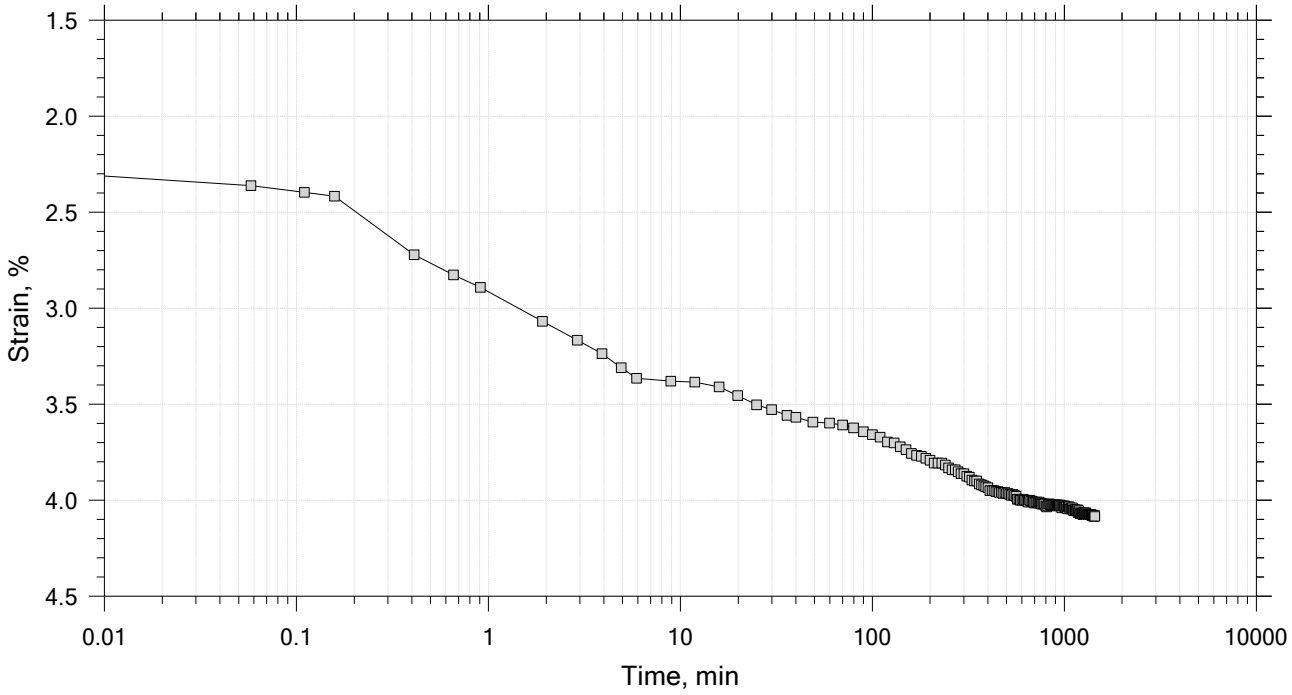


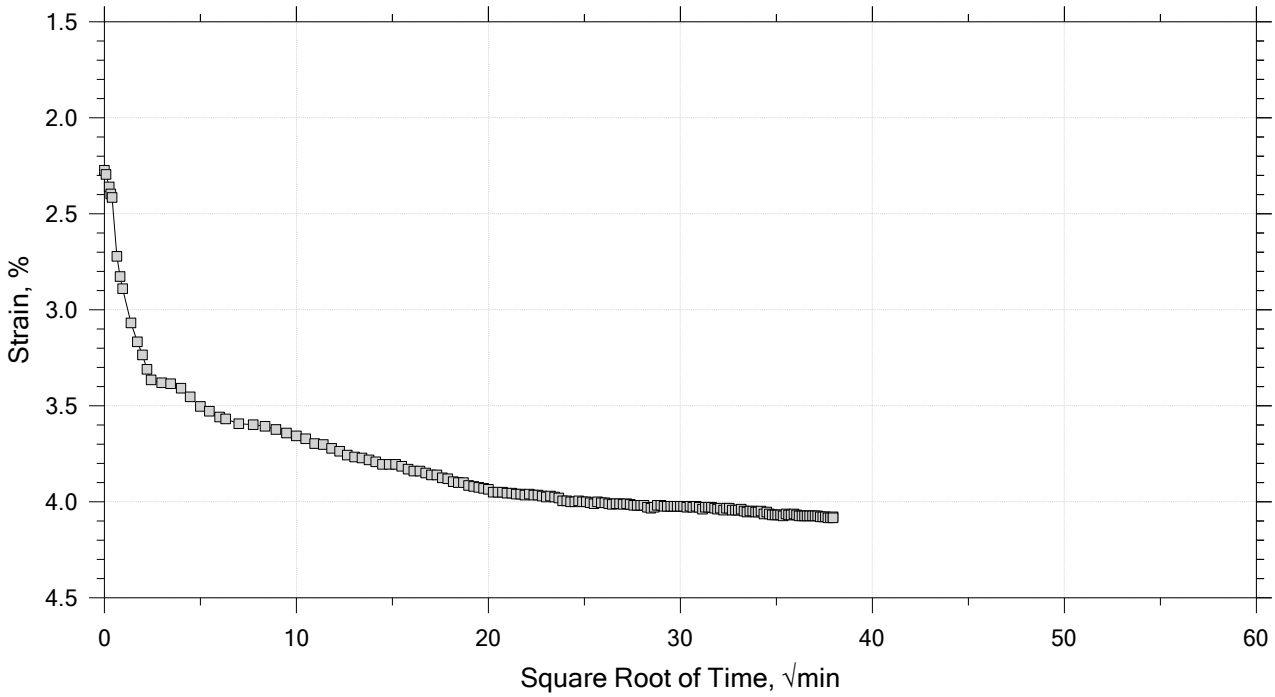


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 4 of 15
Constant Load Step
Stress: 0.5 tsf

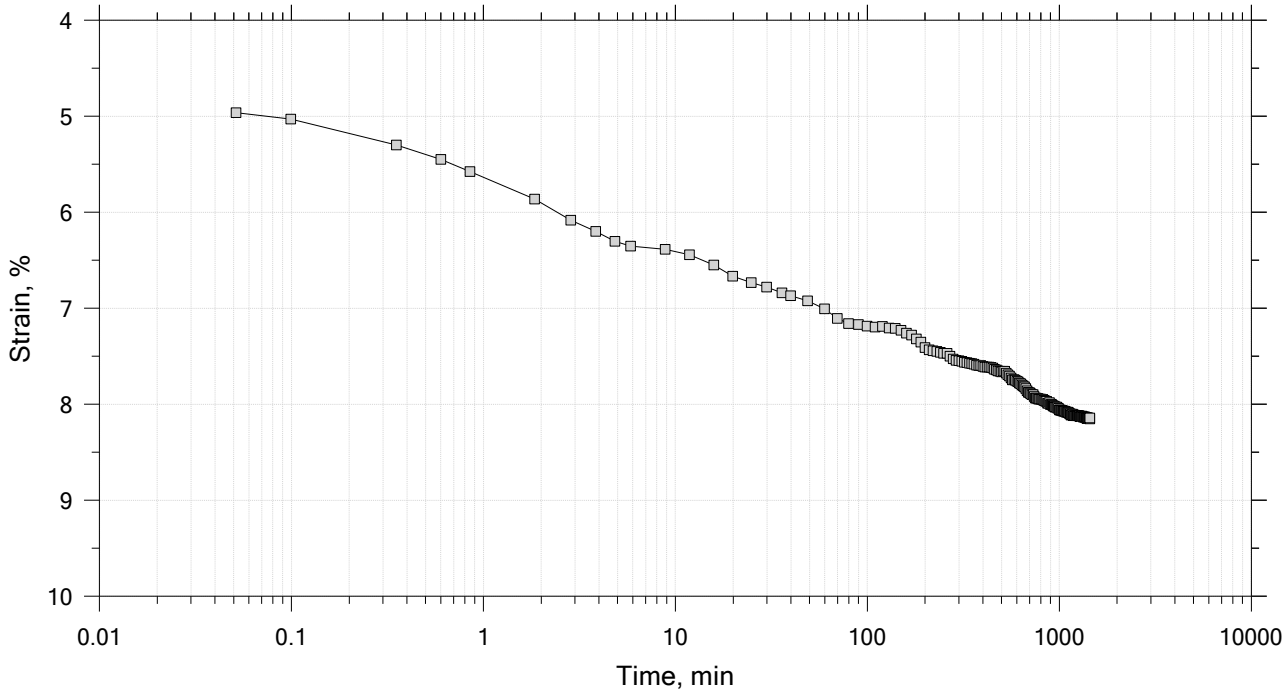


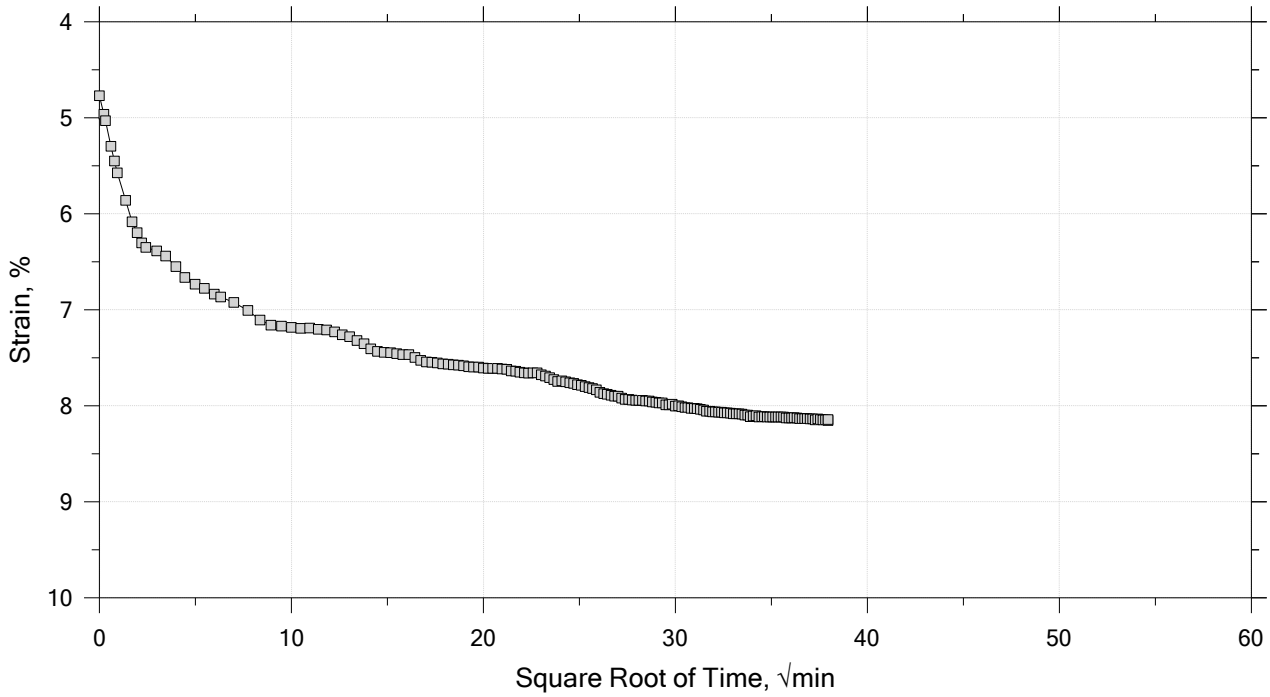


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 5 of 15
Constant Load Step
Stress: 1 tsf

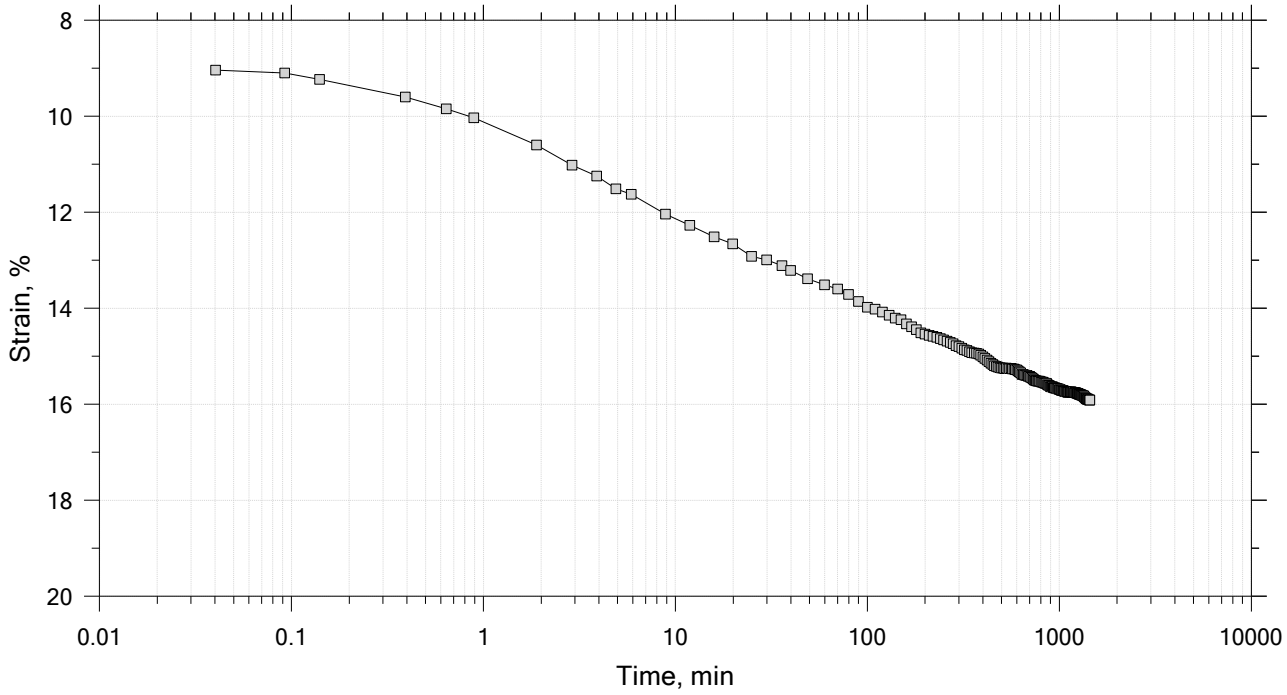


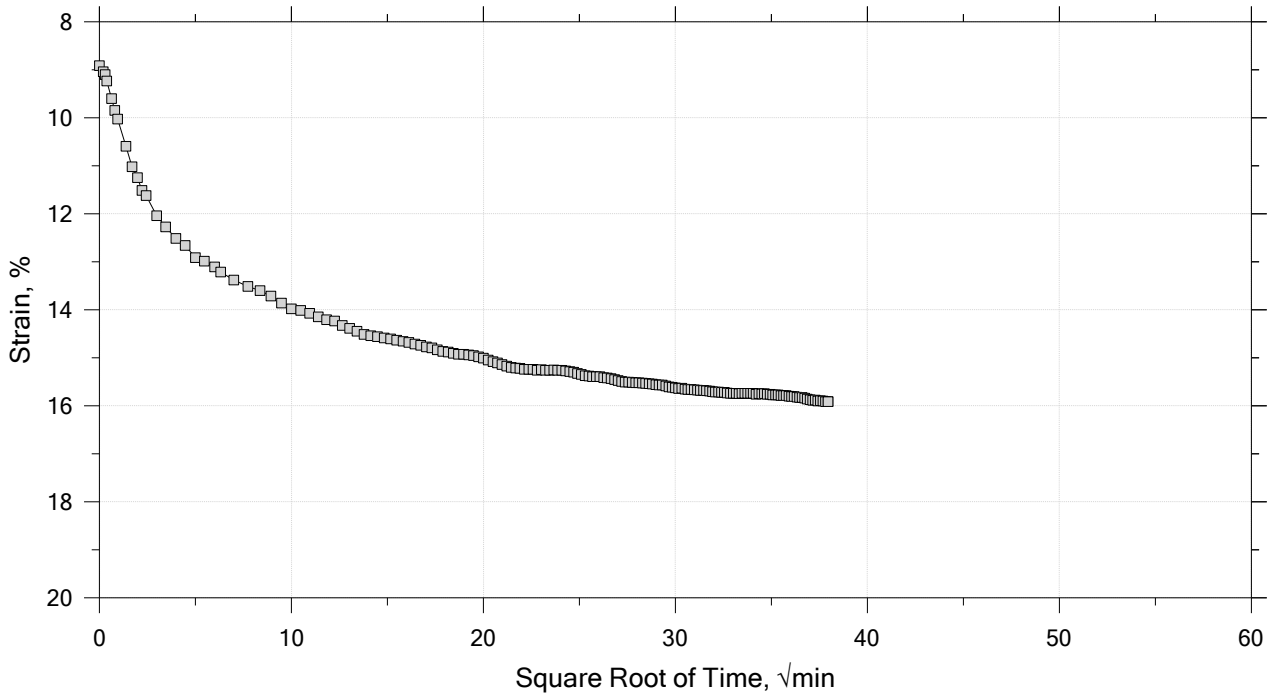


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 6 of 15
Constant Load Step
Stress: 2 tsf

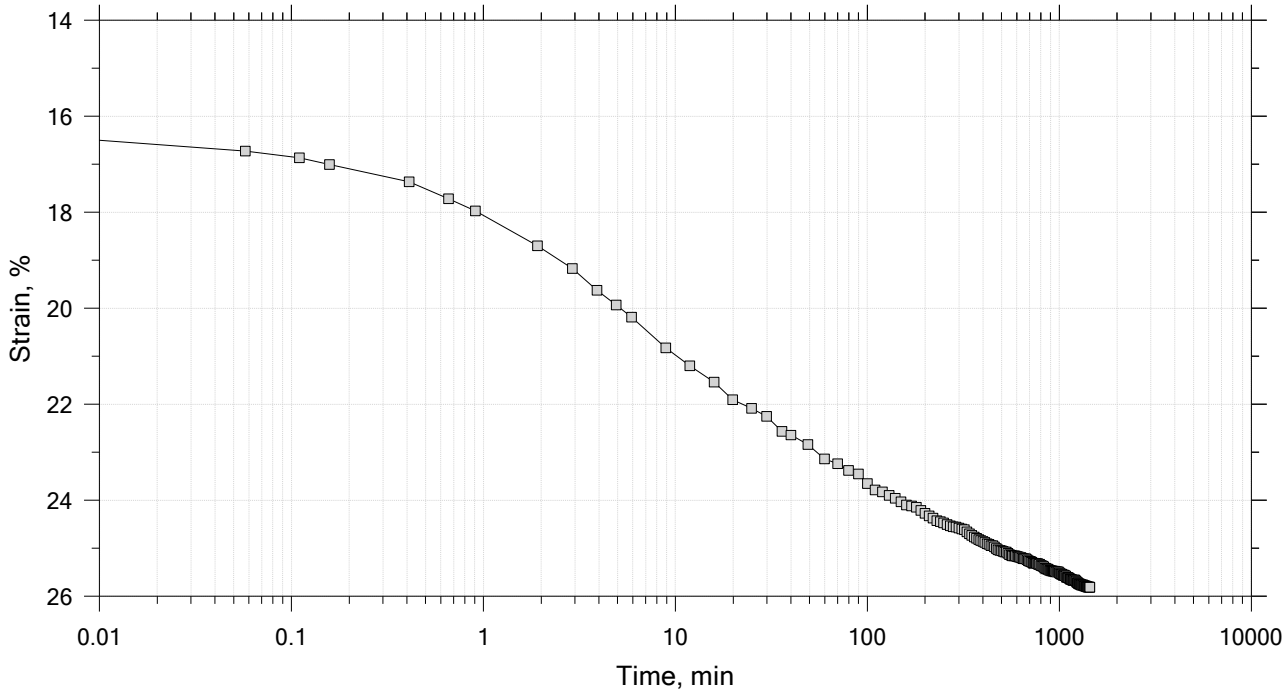


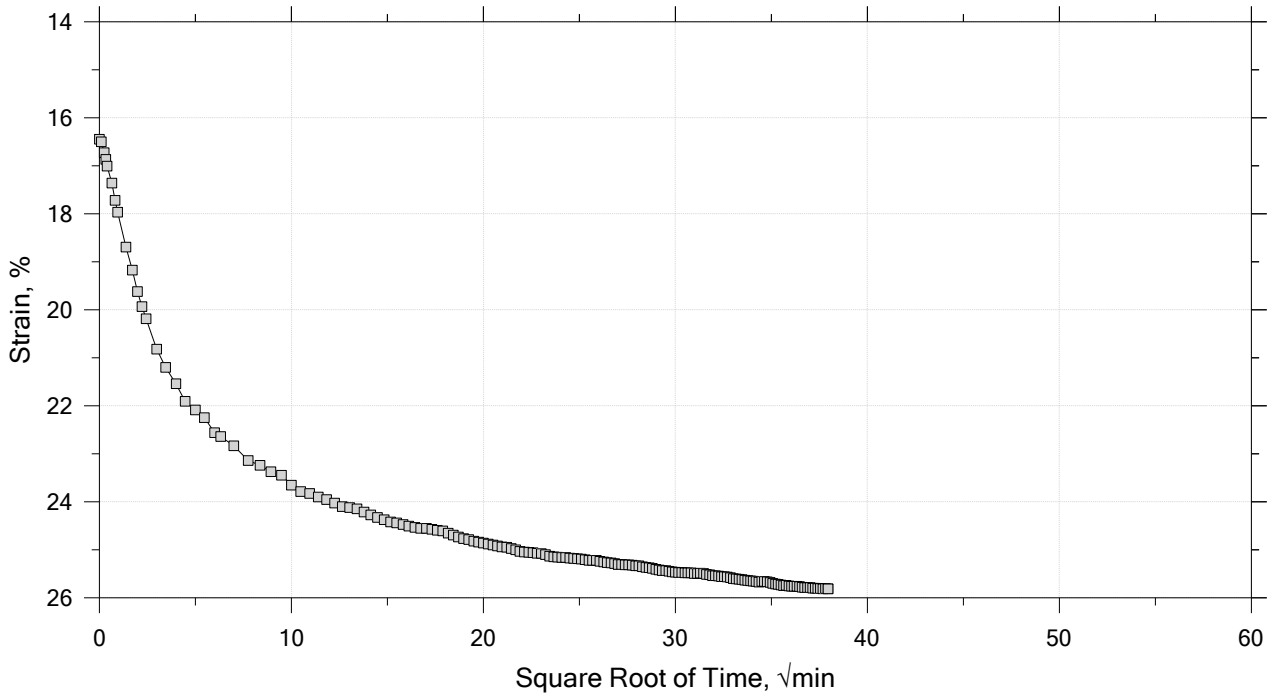


GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 7 of 15
Constant Load Step
Stress: 4 tsf





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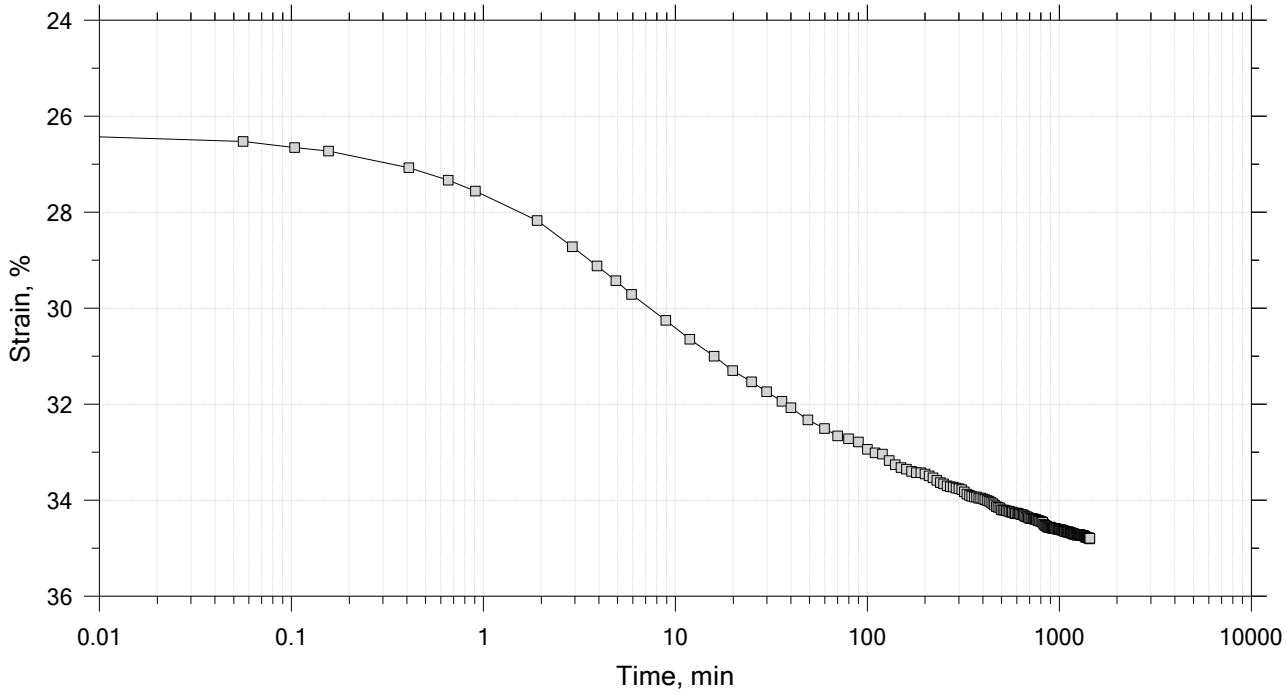
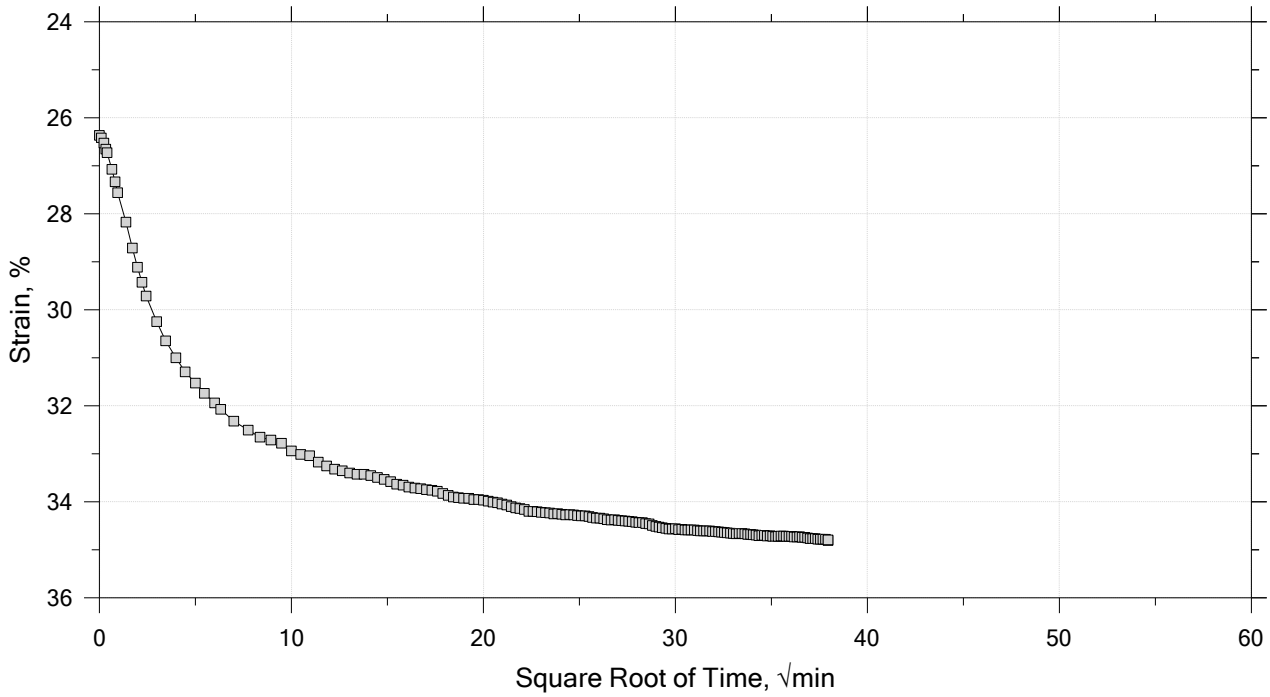
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 8 of 15
Constant Load Step
Stress: 8 tsf





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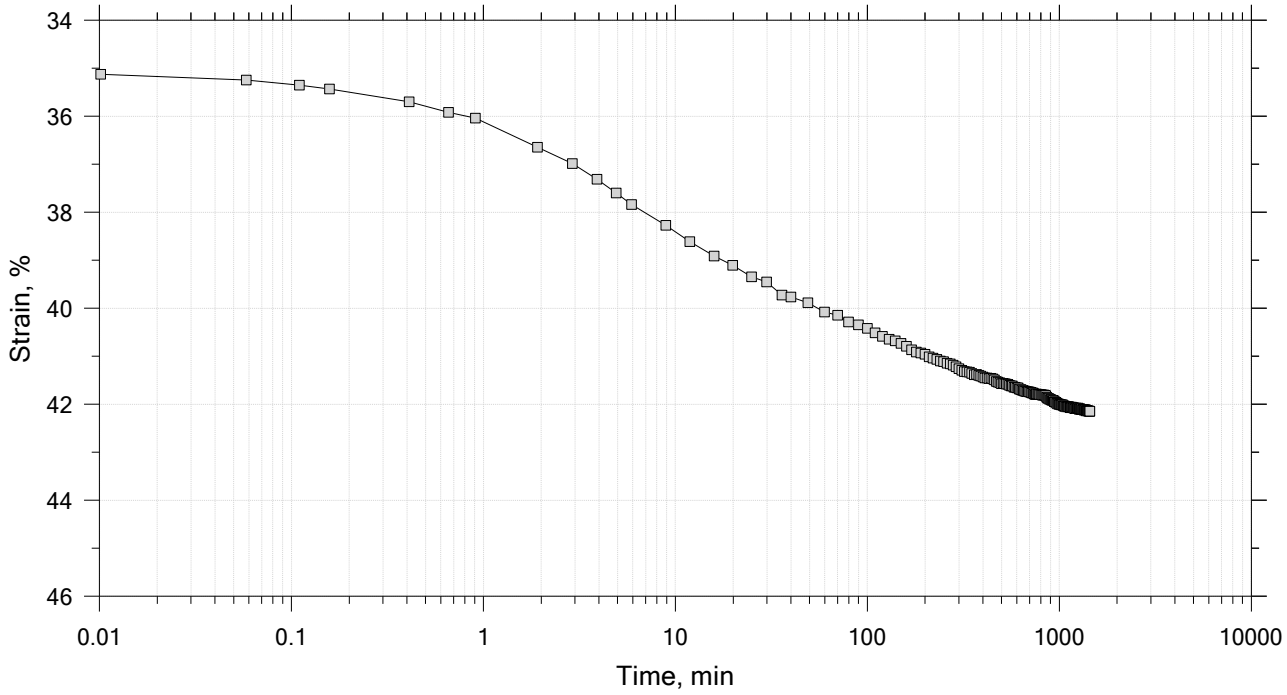
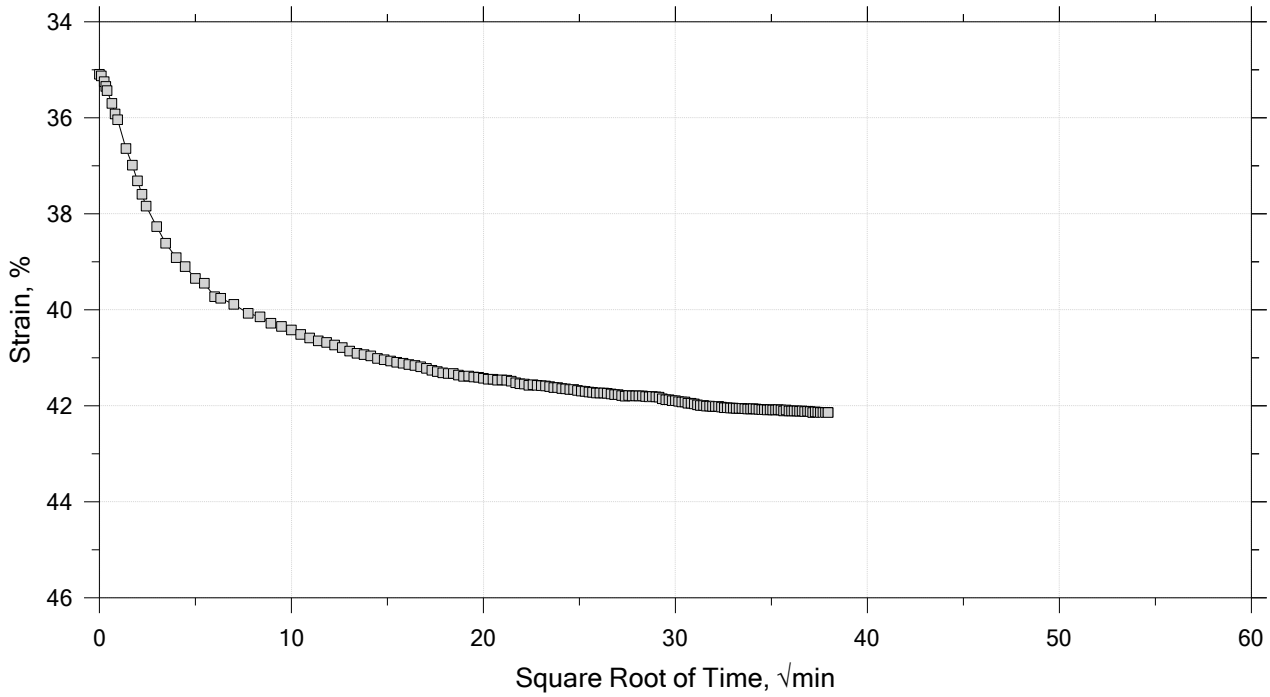
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 9 of 15
Constant Load Step
Stress: 16 tsf





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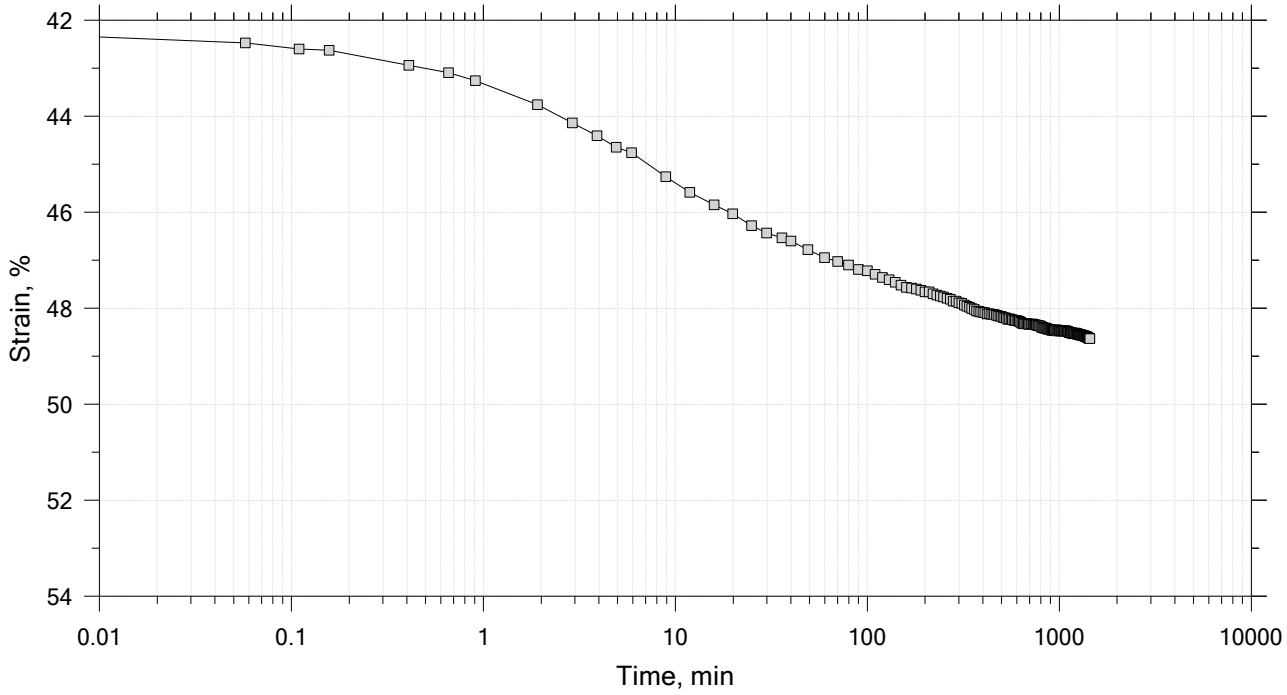
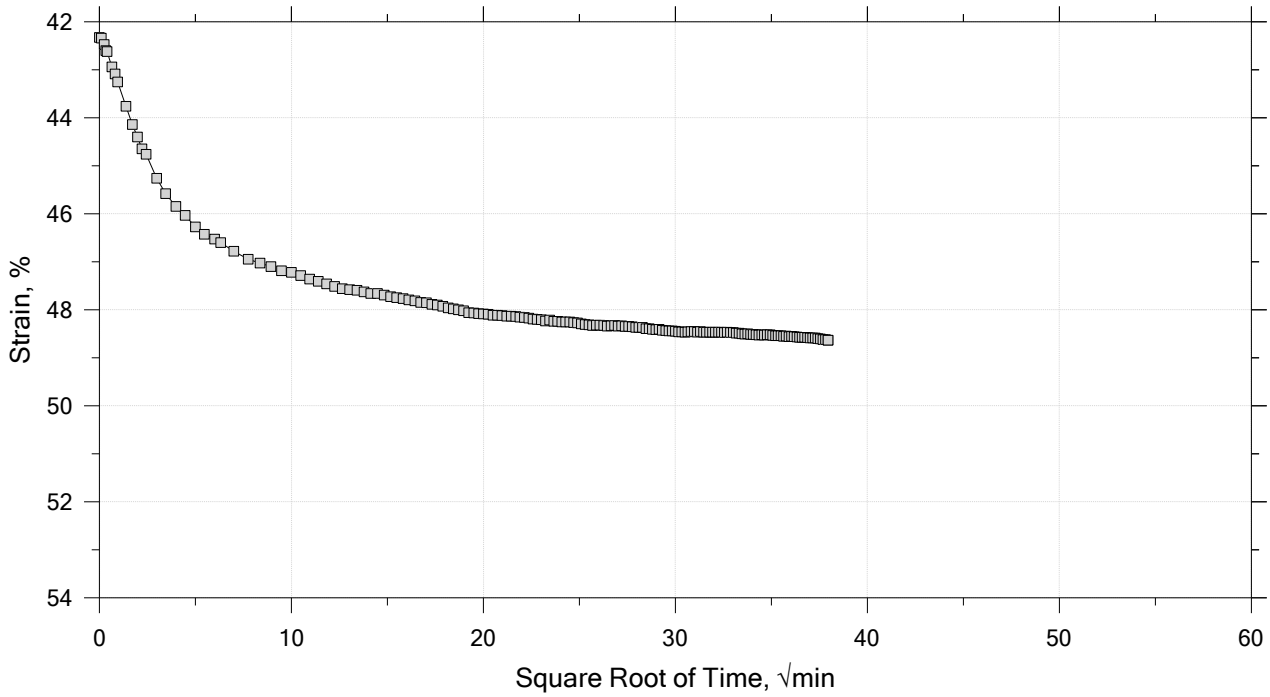
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 10 of 15
Constant Load Step
Stress: 32 tsf





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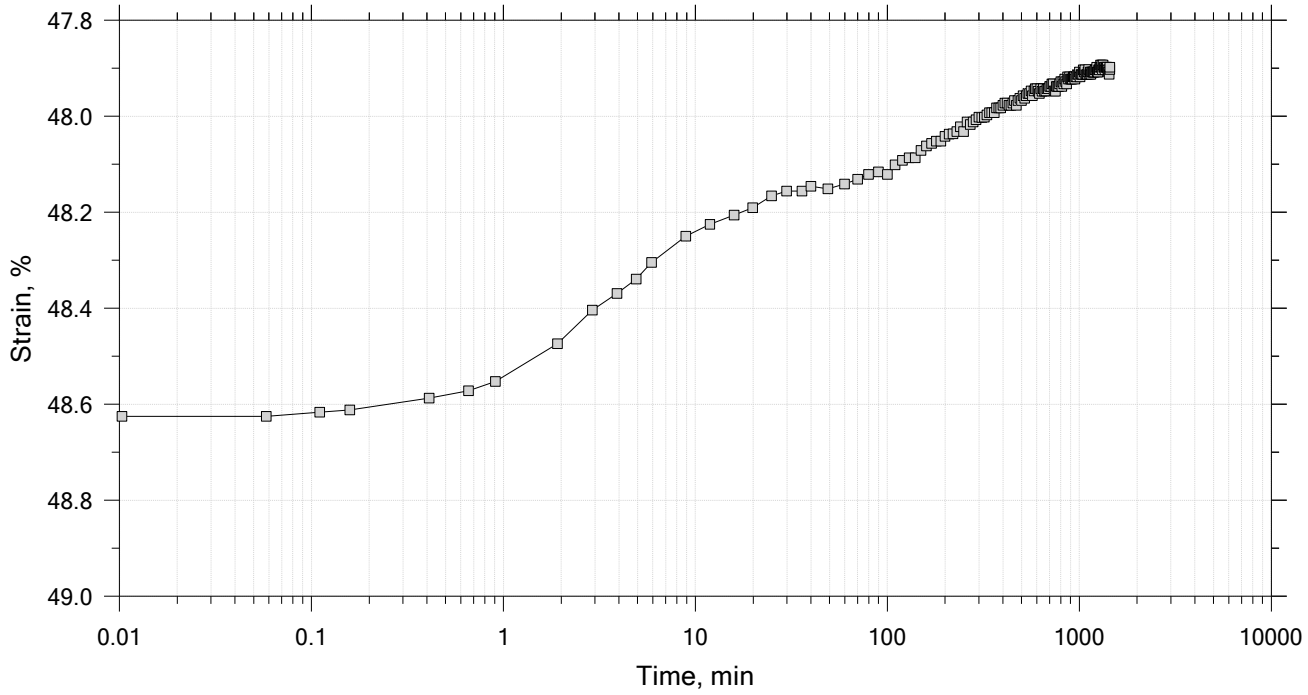
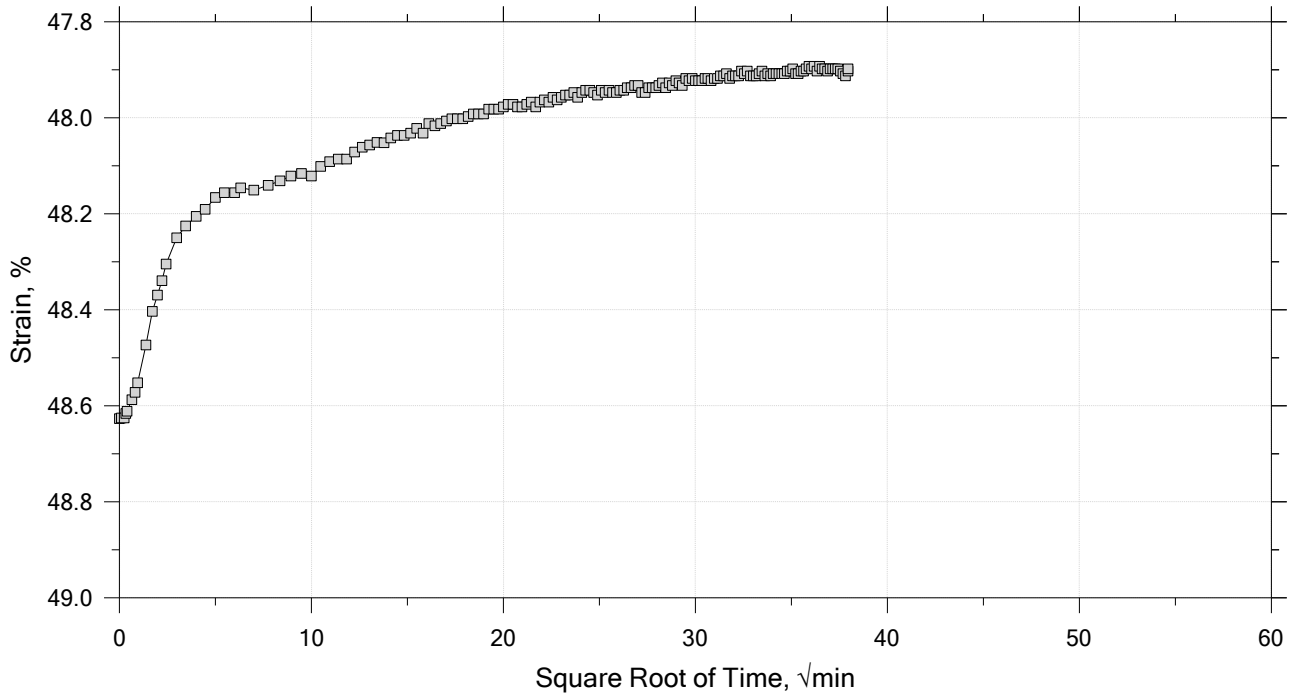
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 11 of 15
Constant Load Step
Stress: 8 tsf





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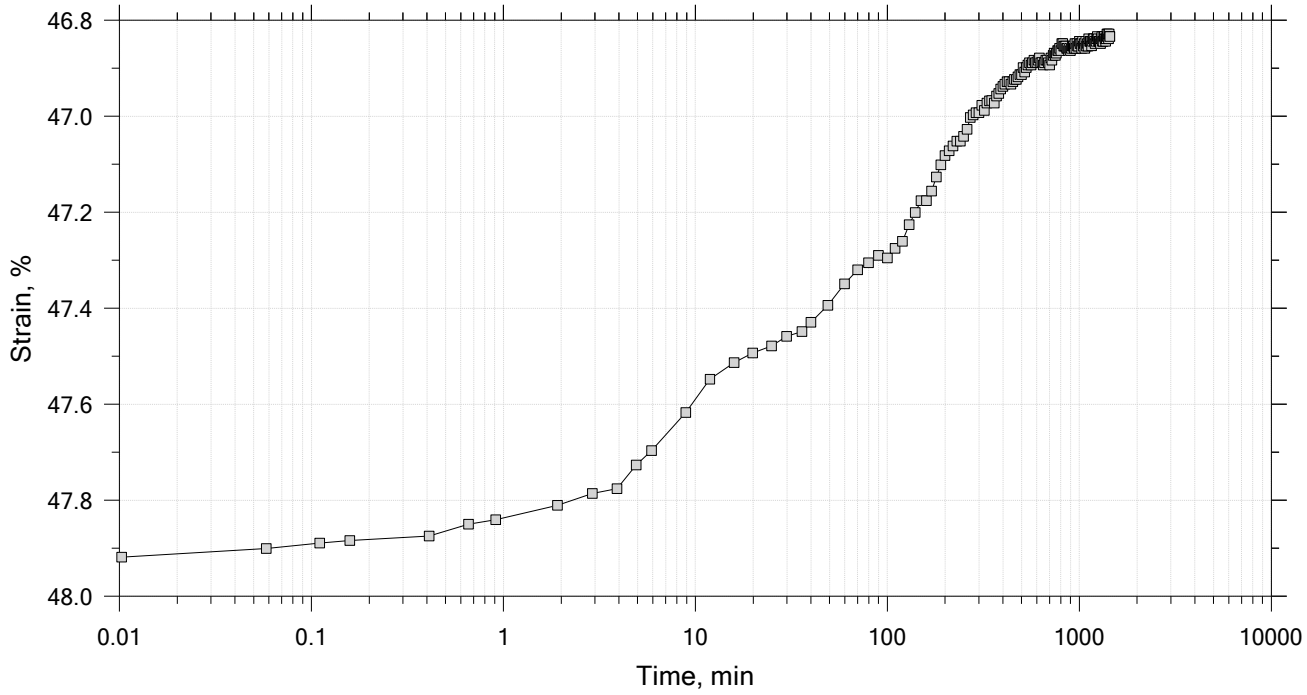
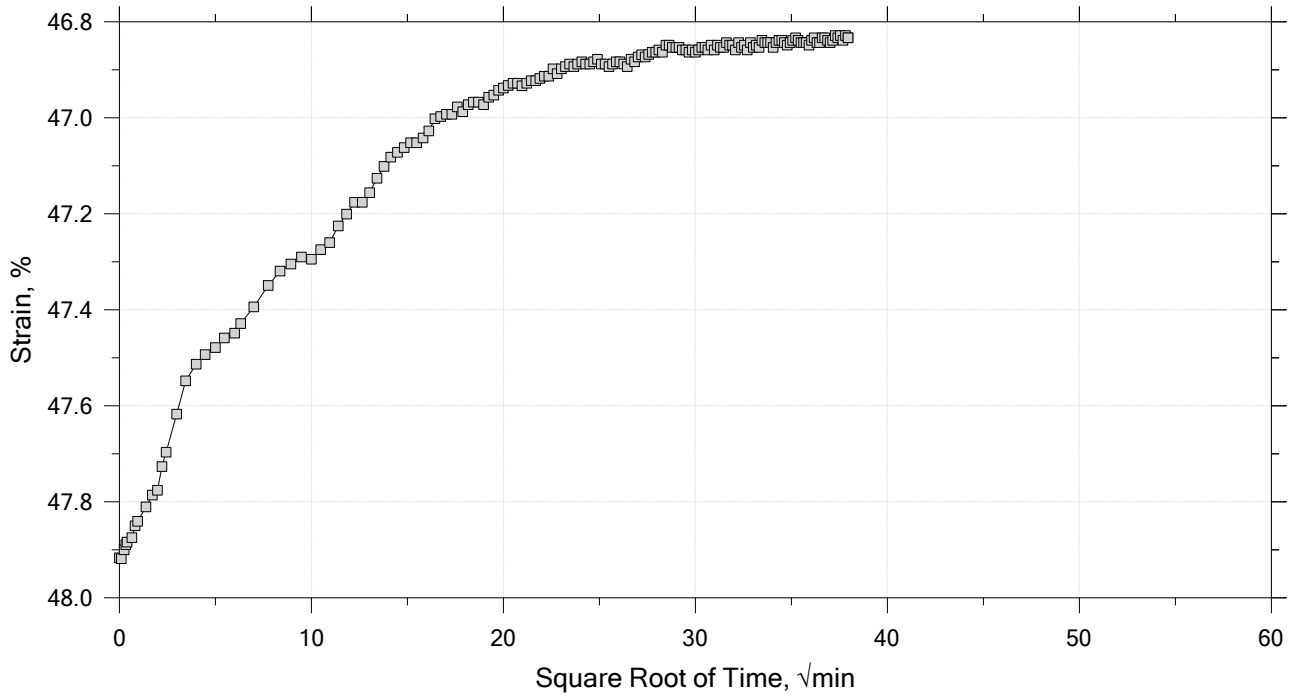
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 12 of 15
Constant Load Step
Stress: 2 tsf





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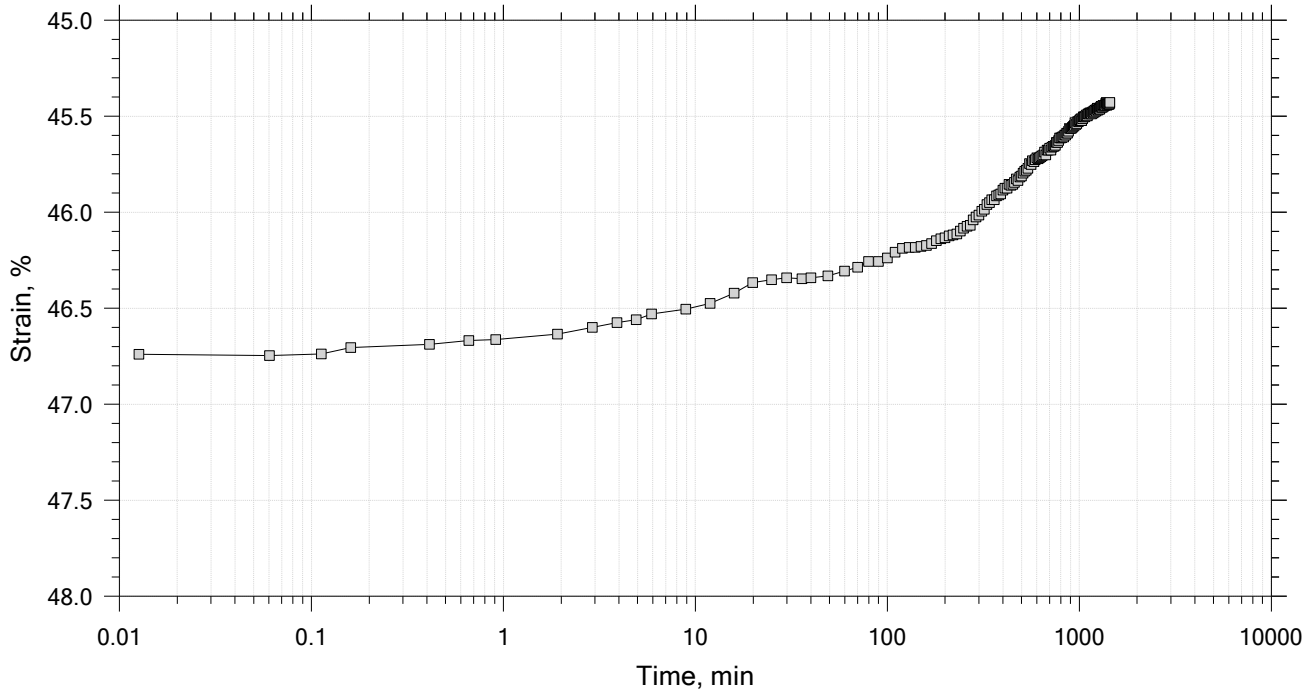
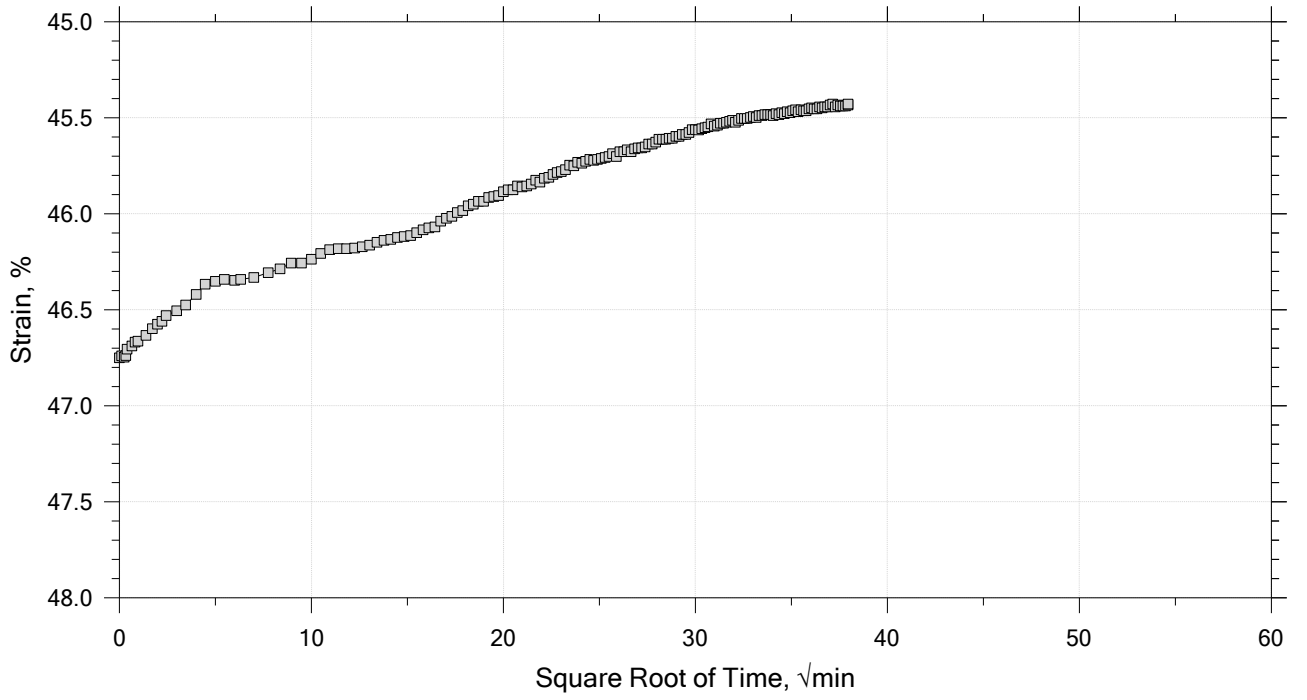
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 13 of 15
Constant Load Step
Stress: 0.5 tsf





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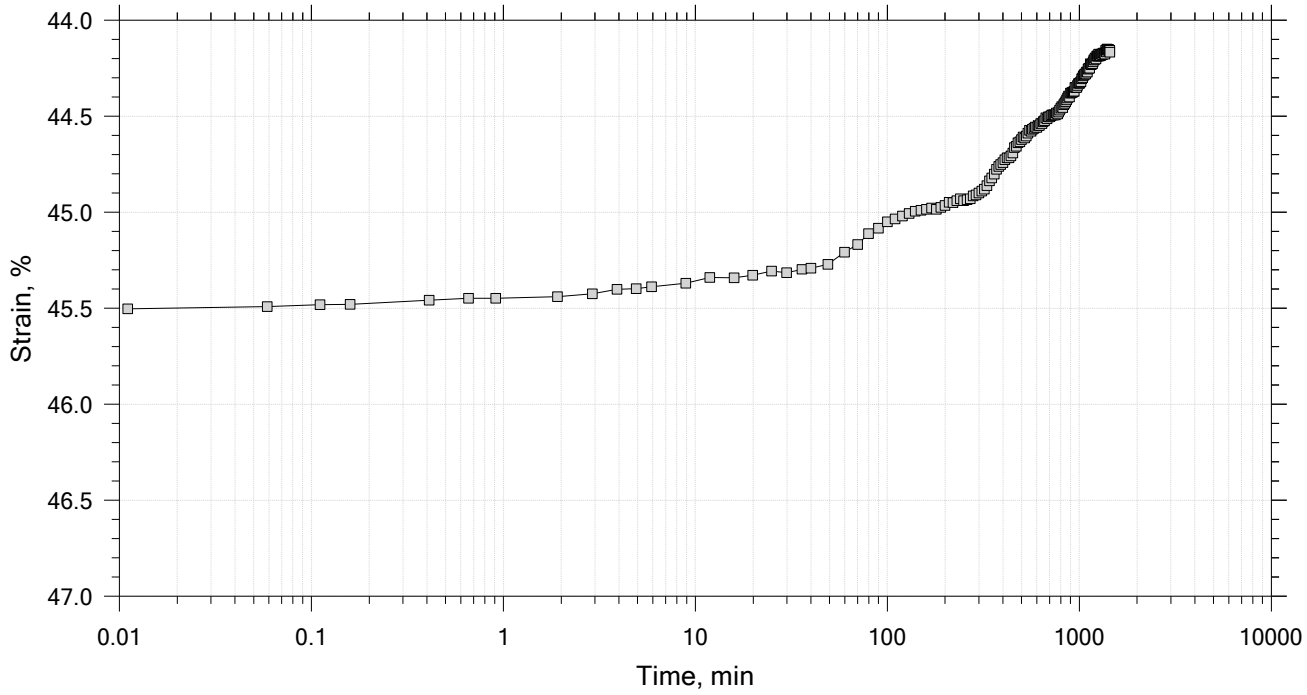
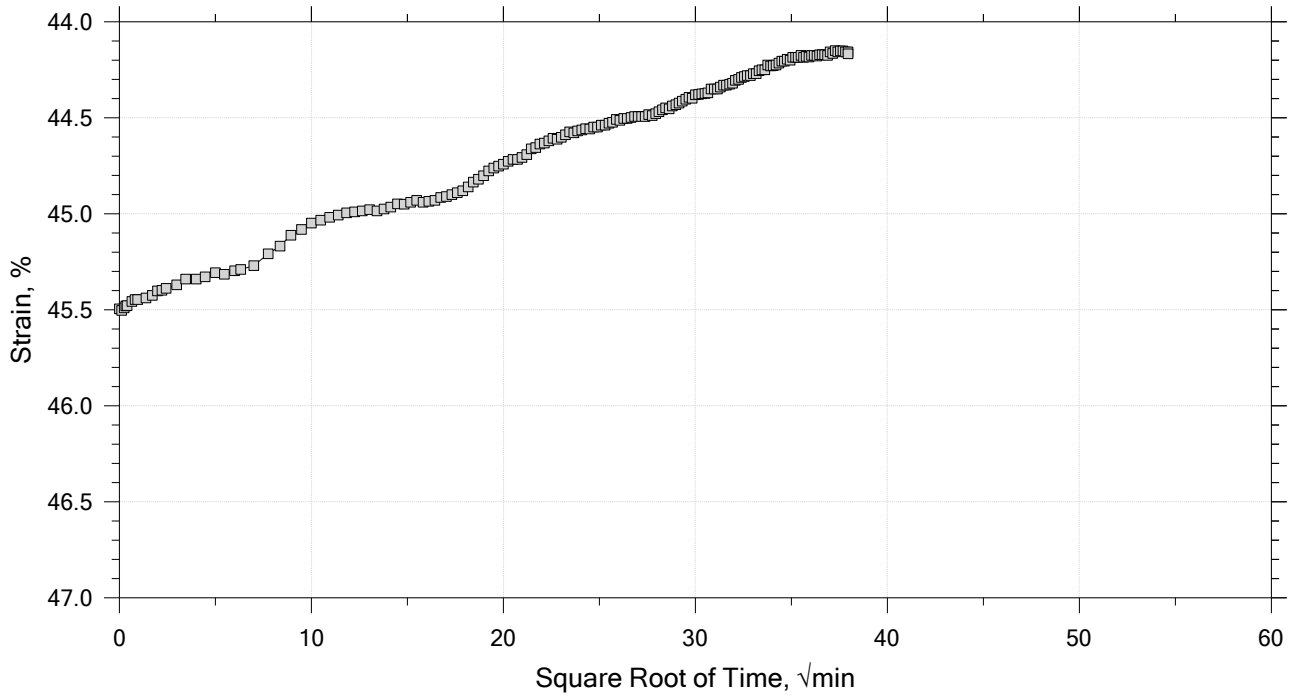
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 14 of 15
Constant Load Step
Stress: 0.125 tsf





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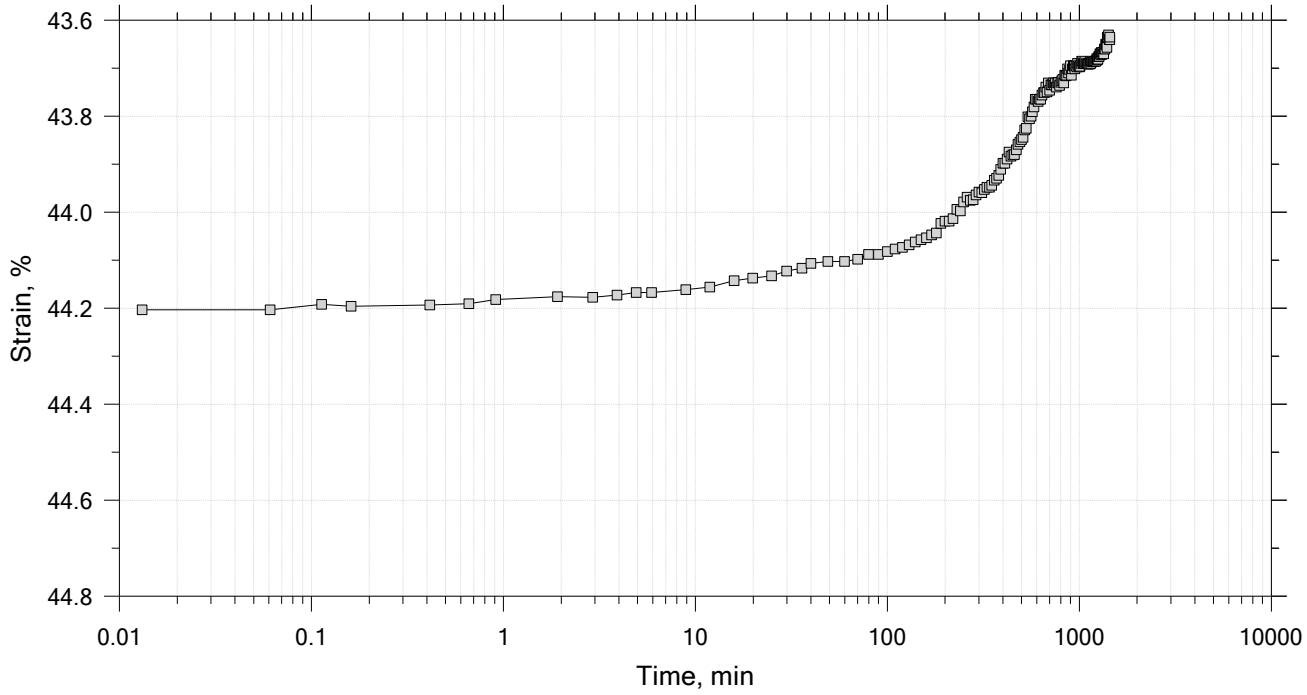
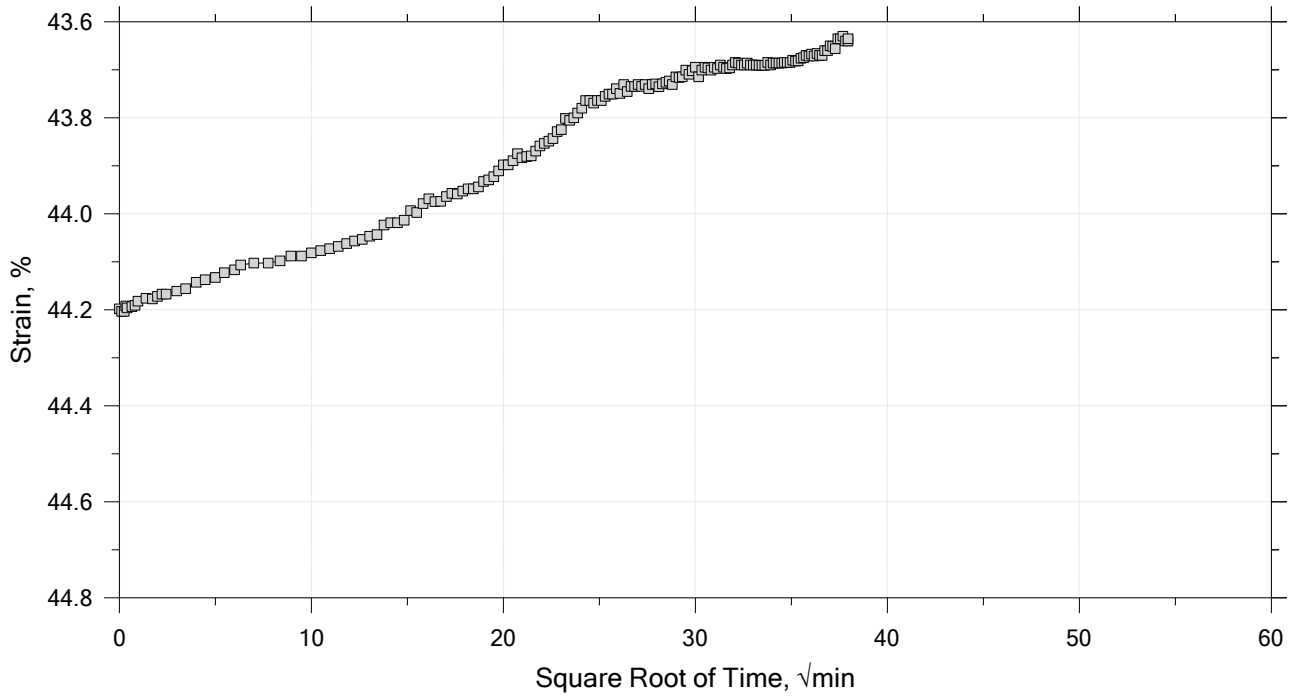
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Time Curve 15 of 15
Constant Load Step
Stress: 0.0625 tsf





GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Specimen Diameter: 2.50 in	Estimated Specific Gravity: 2.68	Liquid Limit: ---
Initial Height: 1.00 in	Initial Void Ratio: 3.54	Plastic Limit: ---
Final Height: 0.56 in	Final Void Ratio: 1.56	Plasticity Index: ---

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	E6324	RING		E5327
Mass Container, gm	8.26	107.97	107.97	8.08
Mass Container + Wet Soil, gm	74.39	211.42	183.13	81.86
Mass Container + Dry Soil, gm	39.49	155.5	155.5	54.74
Mass Dry Soil, gm	31.23	47.533	47.533	46.66
Water Content, %	111.75	117.64	58.12	58.12
Void Ratio	---	3.54	1.56	---
Degree of Saturation, %	---	89.14	100.00	---
Dry Unit Weight, pcf	---	36.889	65.447	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		

One-Dimensional Consolidation by ASTM D2435 - Method A

Square Root of Time Coefficients

Step	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv in²/s	Mv 1/tsf	k ft/day
1	0.0839	0.005651	3.52	0.565	---	---	----	---
2	0.125	0.008202	3.50	0.820	---	---	---	---
3	0.250	0.01922	3.45	1.92	119.902	2.87e-05	8.81e-02	4.73e-05
4	0.500	0.04084	3.36	4.08	125.445	2.65e-05	8.65e-02	4.29e-05
5	1.00	0.08143	3.17	8.14	133.313	2.34e-05	8.12e-02	3.55e-05
6	2.00	0.1591	2.82	15.9	153.100	1.79e-05	7.77e-02	2.60e-05
7	4.00	0.2581	2.37	25.8	139.063	1.59e-05	4.95e-02	1.48e-05
8	8.00	0.3479	1.96	34.8	139.786	1.23e-05	2.25e-02	5.16e-06
9	16.0	0.4214	1.63	42.1	137.934	9.70e-06	9.19e-03	1.67e-06
10	32.0	0.4863	1.33	48.6	136.545	7.72e-06	4.06e-03	5.86e-07
11	8.00	0.4790	1.37	47.9	129.233	7.32e-06	3.07e-04	4.20e-08
12	2.00	0.4683	1.41	46.8	276.307	3.54e-06	1.77e-03	1.18e-07
13	0.500	0.4543	1.48	45.4	1209.587	8.48e-07	9.37e-03	1.49e-07
14	0.125	0.4417	1.54	44.2	1088.550	9.89e-07	3.37e-02	6.24e-07
15	0.0625	0.4364	1.56	43.6	1399.293	7.95e-07	8.49e-02	1.26e-06

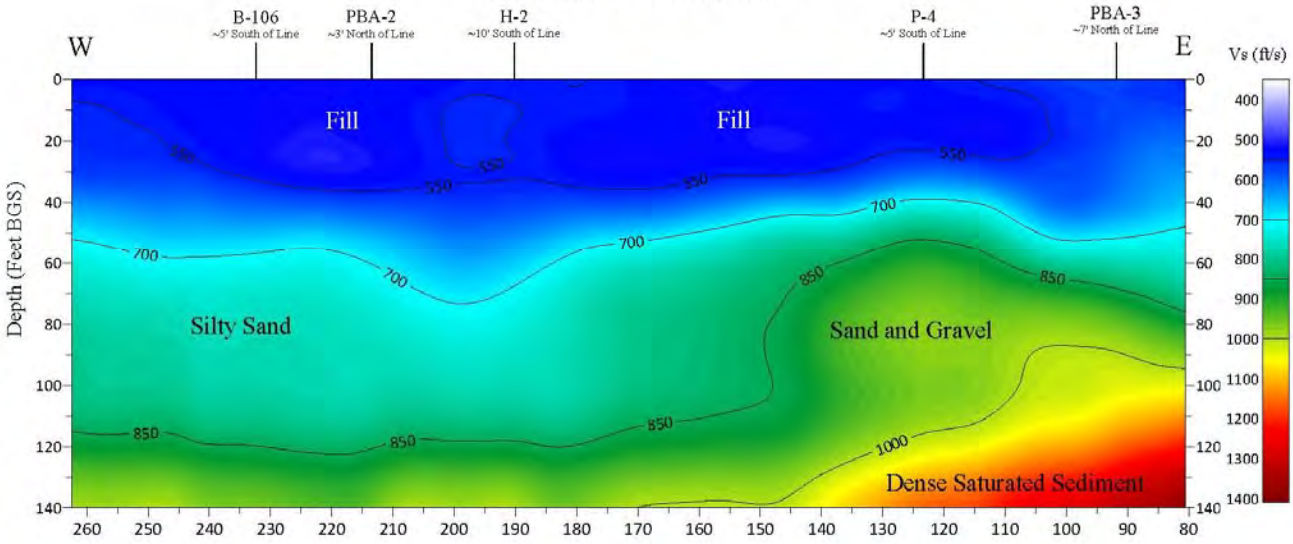
GeoTesting EXPRESS	Project: Prop. Central Falls High School	Location: Central Falls, RI	Project No.: GTX-316607
	Boring No.: ~~P-4~~ B-105	Tested By: trm	Checked By: njh
	Sample No.: T2	Test Date: 1/11/23	Depth: 36-38'
	Test No.: IP-2A	Sample Type: intact	Elevation: ---
	Description: Moist, very dark brown organic clay		
	Remarks: TX-011, Swell Pressure = 0.0839 tsf		
	Displacement at End of Increment		

Appendix D – Geophysical Survey

HAGER GEOSCIENCE
A COLLIER GEOPHYSICS COMPANY

SEISMIC INVESTIGATION FOR SITE CHARACTERIZATION CENTRAL FALLS HIGH SCHOOL CENTRAL FALLS, RHODE ISLAND

Figure S-1
MASW Line 1 - 2D Vs Profile



April, 2023
Project File 2023002

Prepared for:
Lahlaf Geotechnical Consulting, Inc.
100 Chelmsford Road, Suite 2
Billerica, MA 01862

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FIGURES

PLATES

APPENDICES

1.0 INTRODUCTION

This report details the results of a geophysical survey conducted by Hager GeoScience (HGI) for Lahlaf Geotechnical Consulting, Inc. (LGCI) at the location of the proposed Central Falls High School (the Site). The objectives of the survey included:

Pursuant to our revised proposal of January 16th, 2023, the objective of the survey was to determine:

- the Site Classification Code Vs100 value using MASW method
- the thickness of the overburden (depth to bedrock)
- Vs of overburden stratigraphy.

In addition to satisfying site classification definitions of the MA Building Code, the information gathered from the geophysical survey will provide additional input for evaluating earthquake susceptibility of the Site. The field investigation was conducted between February 22 and 27, 2023.

Previous investigations at the Site and published geological information (Figure 1) indicate that the proposed building foundation is situated on artificial fill, saturated fine-grained glacial marine sediments, and recent swamp deposits composed of fine-grained organic silt and peat. Two generations of borehole data reveal that these deposits have low bearing capacity. None of the boreholes confirmed the depth to bedrock, albeit one borehole (PBA-5) hit refusal and retrieved rock fragments at 148.5 feet.

Based on current level of geologic knowledge of the Site, HGI proposed a multi-seismic approach to meet the stated objectives. The geophysical methods included multi-channel analysis of surface waves (MASW), p-wave seismic refraction, s-wave seismic reflection, and horizontal/vertical spectral response (HVSR). Geophysical survey locations are shown on Plate 1.

Plate 1 also illustrates the limited space available for geophysical survey geometries designed to image subsurface conditions along entire survey lines to depths exceeding 150 feet. HGI has been able to integrate the results from the geophysical methods to provide a range of possible depths to bedrock, as part of a complex of dense sediments that also may include till.

2.0 DATA ACQUISITION

The survey location for each geophysical method is shown on Plate 1, an AutoCAD Map3D 2023 plot created from the HGI field notes, GPS data, and Bing map image of the Site. HGI's geophysical investigation consisted of the following surveys:

- MASW survey on Lines 1 and 2
- seismic refraction survey on Lines 1 and 2
- seismic s-wave reflection survey on Lines 1 and 2
- HVSR survey over a total of 8 locations

2.1 MASW Survey

HGI used a combined active and passive data acquisition technique, which allows for the simultaneous recording of broad-band spectra surface waves. An active energy source was used

to generate a broad frequency spectrum of surface waves. The passive survey recorded lower-frequency surface wave energy from distal and nearby sources, including micro-seismic events, highway traffic, and other cultural and natural sources. Data from the active and passive data sets were processed separately and combined for analysis, as necessary, to enhance depth resolution.

For both active and passive data collection, geophone arrays were attached to HGI's Geometrics Geode® 48-channel exploration seismograph unit via a seismic cable that relays the motion-induced electrical signals from individual 4.5-Hz geophones to the seismograph. An array of 48 geophones with seven and ten foot geophone spacing for Lines 1 and 2, respectively. A 90-pound propelled energy generator (PEG) provided the active seismic energy source.

Table 1 shows the pertinent parameters used for the MASW data collection.

Table 1
MASW Survey Acquisition Parameters

Line	Source Offset (ft)	Number of Active Geophones	Station Spacing (ft)	Station Increment (ft)	Sample Interval (ms)	Record Time (sec)
1	42	24	7	7	1	1
2	30	24	10	10	1	1
2	Passive	24&48	10	10	2	30

2.2 P-wave Seismic Refraction Survey

HGI personnel collected seismic refraction data using a linear array of 48 4.5-Hz vertical geophones spaced seven feet apart for Line 1 and ten feet apart for Line 2. Off-end and end shots were made on both ends of each seismic line. A 90-pound accelerated weight drop (PEG) and Betsy seisgun provided the seismic energy. The seisgun was loaded with 8-gauge shotgun industrial blank shells filled with 400-grain black powder. Up to 20 vertical stacks were made at each shot point to improve the signal-to-noise ratio. The quality of the seismic signal was verified in the field at each shot location.

The geophone array was attached to HGI's Geometrics Geode® 24-channel exploration seismograph system via seismic cables that relay the motion-induced electrical signals from individual sensors to the seismograph. The electrical signals are recorded as SEG-2 Rev 1, 32-bit integer data. Our acquisition software provides a number of Windows-based modules that permit on-site display and evaluation of data quality.

Table 2 below shows the pertinent parameters used for the refraction data collection.

Table 2
Seismic Refraction Survey Acquisition Parameters

	Number of Geophones	Geophone Spacing (ft)	Shot Offsets (ft)	In-Line Shot Distance (ft)	Sample Rate (ms)	Recording Time (sec)
1	48	7	80+120	End-mid-qtr	0.25	1
2	48	10	30	mid	0.25	1

2.3 S-wave Seismic Reflection Survey

HGI personnel collected seismic reflection data on Lines1 and 2 using a common shot offset (50 feet) roll-along technique with an active linear array of 24 40-Hz vertical geophones at ten foot stations. The number of active geophones, their spacing, and array move distance are specifically determined for each survey to optimize the amount of data that can be collected while still achieving the desired depth and resolution.

The geophone array was attached to HGI's Geometrics Geode® 48-channel exploration seismograph unit via a seismic cable that relays the motion-induced electrical signals from individual sensors to the seismograph. The electrical signals are recorded as SEG-2 Rev 1, 32-bit integer data. Our acquisition software provides several Windows-based modules that permits on-site display and evaluation of data quality.

A Betsy seisgun was used exclusively used as the seismic source. One stack was collected at each location, and the quality of the seismic signal was verified in the field at each location.

Table 3 below shows the pertinent parameters used for the reflection data collection.

Table 3
Seismic Reflection Survey Acquisition Parameters

Line	Seismic Source	Source Offset (ft.)	Number of Active Geophones	"Roll" Distance (ft.)	# of Shot Pnts	Geophone Spacing	Sample Rate (ms)	Recording Time (sec)
1	PEG	49	18	7	35	7	.125	1
2	PEG & Seisgun	40	20	5	48	5	.125	1

2.4 Horizontal/Vertical Spectral Ratio (HVSR)

HGI collected HVSR data at twelve (12) locations at the Site, using its Guralp Systems® CMG-6TD broadband seismometer. Field collection for the HVSR method consists of recording passive seismic energy, similar to passive MASW surveys. However, HVSR analysis is based on recording horizontal and vertical components of omni-directional passive energy generated by natural and anthropogenic sources, including micro-seismic events, ocean tides, and distant sources of human and natural activity. The seismometer was leveled on soil/grass and set to record for a minimum of 20 minutes. Data were acquired using sampling intervals of 200, 100, and 20 samples per second. HVSR locations are shown on Plate 1.

2.5 GPS

HGI used its Sokkia RTK GRX3 Rover GPS system to locate the geophysical survey locations, as well as select surface features for reference. The Sokkia system provided a relative accuracy of less than 0.164 feet horizontally and 0.328 feet vertically for points in the Rhode Island State Plane coordinate system (RI83-F).

3.0 DATA REDUCTION AND ANALYSIS

Following the field data collection, the geophysical data were downloaded to a PC at the HGI office, where they were archived, processed, and analyzed using the following proprietary software:

- Seismic Refraction analysis: Geogiga Seismic Pro Refractor® 10
- Seismic Reflection Analysis: Geogiga Seismic Pro Reflector® 10
- HVSR Analysis: Geopsy®
- Database Analysis: Microsoft Excel®, Golden Software Surfer® 25
- Graphic presentations: Golden Software Surfer® 25, AutoCAD® Map3D 2023, Adobe Acrobat®

3.1 MASW Survey

MASW survey data were analyzed using ParkSEIS© software and Excel®. ParkSEIS© was used to perform surface-wave dispersion analysis for each shot gather. Active and passive surface wave data for each shot record were combined to develop 1D Vs inversion models representing the midpoint of each array position. Individual 1D profiles were then compiled to form an XYZ matrix of distance, depth, and Vs values for each line. A continuous 2D profile was then created for each line by combining and interpolating individual 1D Vs depth models for each line using a kriging algorithm. The resulting continuous 2D Vs depth model illustrates the Vs trend along each line as color-filled contour plots (Appendix A, Figures S1 and S2).

HGI uses the 2D Vs depth models to determine Vs depth profiles along the survey lines by slicing the 2D Vs models at select distances along the lines. Data from model slices are then used to produce tables and graphs of Vs values at the slice locations. Model slice tables and graphs used for the Site are presented in Appendix A, Tables S—S3.

Vs100 values are based on weighted average calculations for velocity layers representing stratigraphic units known to exist at the Site. Four main stratigraphic units were identified in the overburden from borehole data provided by LGCI: Fill, Silty Sand, Sand, and Sand and Gravel.

Based on the methodology outlined above, a total of nine Vs depth profiles slices were calculated for Line 1 (Table S1) and seven for Line 2 (Table S2). The Vs depth profile values for each line were combined to calculate an average Vs100 value for the site (Table S3).

3.2 P-wave Seismic Refraction Survey

The seismic refraction data were analyzed using Geogiga Technology Corporation's (GTC) Geogiga Refractor® 10 software.

Refraction data reduction and analysis initiated with the determination of arrival times of the direct (where applicable) and refracted waves for each shot-receiver pair. These arrivals were identified and "picked" on a trace-by-trace basis by examining individual seismograms for the break in phase leading the first coherent seismic wavelet arrival. Coherent arrivals were enhanced through the use of frequency filters that remove both coherent (e.g., electrical) and non-coherent (e.g., traffic) noise from individual records.

Direct and refracted wave travel times expressed as a function of source and receiver locations were used to generate the earth model most consistent with all observations. Picked arrival times

were subdivided into individual refractor layers on the basis of refractor geometry. This is accomplished by examining the slope of the line connecting refractor P-wave arrival times plotted as a function of distance. Since the slope of the line depends on a layer's seismic velocity, slope changes may be used to discriminate between layers of differing velocity.

Using layer information, Geogiga Refractor® 10 was used to calculate layer velocities and depths using general reciprocal velocity modelling methods (GRM). This method provides a robust model for determining the depth to acoustic boundaries, such as competent rock. GRM models for Lines 1 and 2 are shown in Appendix B, Figures SR1 and SR2, respectively.

3.3 S-wave Seismic Reflection Survey

Seismic reflection processing was performed using Geogiga Technology Corporation's Geogiga Reflector® 10 software. Individual shot gathers were combined into one file and organized by their survey geometry using a receiver and shot coordinate system. The shot gathers were processed to reduce the effects of cultural interference and non-reflected seismic energy.

Velocity analyses were performed to determine CMP stacking velocities and to develop CMP time and depth stacks. The stacking process produces spatially averaged and smoothed data normally used to map subsurface stratigraphic boundaries as bedrock, and major bedrock structures. The effectiveness of CMP profiles is proportional to the number of stacked traces. Therefore, longer lines produce better CMP imaging. Despite the short distance of Lines 1 and 2, bedrock surface elevation trends and structures have been delineated and are shown in Appendix C, Figures SL-1 and SL-2.

3.4 Horizontal/Vertical Spectral Ratio (HVSR)

HVSR data were analyzed using Geopsy® 3.1. The software calculates the ratio of the Fourier amplitude spectra for the horizontal and vertical components of ambient seismic noise for each individual geophone, which resolves a spectral peak at the site-specific fundamental resonance frequency. The spectral peak frequency can then be used to calculate an approximate depth to an impedance boundary using either a published regression formula (i.e., Ibs-von Seht &Wohlenberg, 1999; Parolai *et al.*, 2004) or a site-specific average soil Vs measurement (Nakamura, 1989; Konno & Ohmachi, 1998)[1,2,3,4].

Geopsy® 3.1 software was used to sort data recordings and merge them according to the North, East, and Vertical components. Optimal time windows were then evaluated to select the data that best represents micro-seismic passive energy. The dominant resonant frequency was selected to calculate the thickness of overburden (depth to acoustic boundary). The power spectra for each HVSR station

[1] Ibs-von Seht, M. and J. Wohlenberg, 1999. Micro tremor measurements used to map thickness of soft sediments, Bulletin of the Seismological Society of America, 89:1, 250-259.
[2] Parolai, S., S.M. Richwalski, C. Milkereit, and P. Bormann, 2004. Assessment of the stability of H/V spectral ratios from ambient noise and comparison with earthquake data in the Cologne area (Germany), Tectonophysics, 390:1-4, 57-73.
[3] Nakamura, Y., 1989. A method for dynamic characteristics estimation of subsurface using micro tremor on the ground surface, Quarterly Report of the RTRI, 30:1, 25-33.
[4] Konno, K. and T. Ohmachi, 1998. Ground-motion characteristics estimated from spectral ratio between horizontal and vertical components of micro tremor, Bulletin of the Seismological Society of America, 88:1, 228-241.

is provided in Appendix D as Figures H-1 to H-8. Table H-1 in Appendix D provides the results of the HVSR analysis.

In order for the HVSR method to provide effective depth results, the acoustic impedance at the lower stratigraphic boundary must be at least 10 times higher than that above it. This contrast produces the measured resonance of seismic signals.

4.0 RESULTS

MASW Vs depth profiles (Figures S-1 and S-2, Appendix A) indicate that at least four significant Vs layers occur in the overburden, the boundaries for which are approximately 500, 700, 850, and 1100 ft/s. The load bearing strata represented by the 700 ft/s boundary occurs at a depth of approximately 60 feet. The combined active and passive MASW results provided VS data to depths of 140 and 150 feet for Lines 1 and 2, respectively. The high-velocity dense layer present below 100 feet on both survey lines is most likely till or weathered bedrock where it occurs below 120 feet.

P-wave Seismic Refraction Vp depth profiles (Figures SR-1 and SR-2, Appendix B) also indicate that at least four significant Vs layers occur in the overburden. However, the boundary definitions vary between Lines 1 and 2, due to the different overburden composition along those lines. Overburden along Line 2 consists of saturated sediments with lower Vp values. Limited refracted bedrock arrivals were obtained due to the limited line lengths afforded for the refraction survey. The data is sufficient to recognize a high-velocity boundary from 130 foot depth on Line 1 to nearly 170 feet on Line 2. At various points along the survey lines, this boundary may represent either dense till or bedrock. An abrupt slope occurs at depth at the west end of Line 1.

Vs Seismic Reflection Fulfilling its primary function of constraining bedrock depth, the CMP reflection model for Lines 1 and 2 (Figures SL-1 and SL-2, respectively in Appendix C) confirms the complexity of high-velocity dense soil or rock indicated in seismic refraction models and HVSR data. In addition, both profiles indicate the possible presence of a structurally controlled bedrock depression. The structural anomalies are shown in blue on Figures SL-1 and SL-2.

Horizontal/Vertical Spectral Ratio (HVSR) Spatial distribution of the eight HVSR stations provided the opportunity to produce a general trend of whatever boundary is calculated. Data from all eight stations produced sharp resonant frequency peaks in the power spectra, thereby, providing confidence in the resulting calculations of overburden thickness. The results were used to map the trend of the measured depth boundary (Plate 2). The trend of the mapped boundary is of a ridge plunging northwest and ranging in depth from approximately 170 to over 235 feet.

5.0 DISCUSSION

With regard to the seismic survey objectives outline in the Introduction, all but the confirmation of bedrock depth have been confirmed. The most reliable means for estimating the bedrock depth is integrating the HVSR and S-wave seismic data. Discrepancies in the depth to the high-velocity boundaries between the P-wave refraction results and the other seismic results is most likely due to jumping layers in the refraction velocity analysis.

More data analysis would be required to refine HVSR and S-wave reflection results, however, these data suggest that the bedrock depth range is between 150 feet on the east side of the Site to a maximum of 250 feet on the west side of the Site.

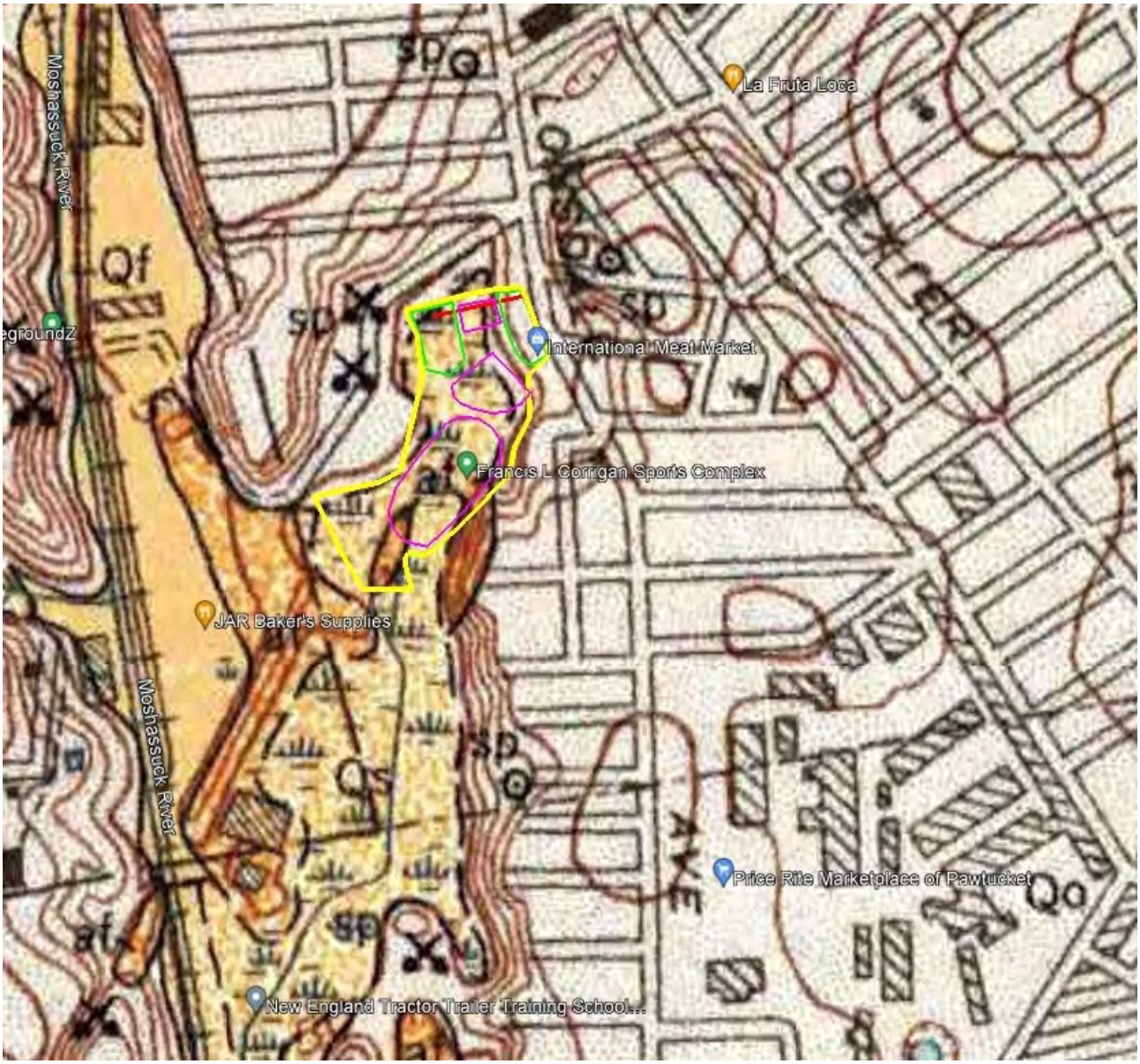


Figure 1 1949 USGS Surficial Geologic Map of the Pawtucket Quadrangle showing valley fill swamp deposits beneath the Site.

6.0 THE GEOPHYSICAL METHODS

6.1 Multi-Channel Analysis of Surface Waves (MASW)

6.1.1 Description of the Method. The multi-channel analysis of surface waves (MASW) method uses the dispersion analysis of Rayleigh-type surface waves to extract a shear wave velocity depth profile. A 2D shear wave velocity field accurate to within 15% can be produced by acquiring many individual multi-channel surface wave data gathers and inverting the surface wave dispersion curves to form a series of 1D shear wave profiles. Discrete individual cells that make up the shear wave velocity field provide a measure of resolution potential and are dependent on the frequency range of the data and source spacing. Variations in the shear wave velocity field representative of an anomalous subsurface can easily be interpreted on shear wave velocity field contours. As generally applied, the method focuses on surface wave energy with frequencies ranging from 2 to over 60 Hz (frequency and associated wavelengths are indicative of depth of investigation) and is relatively insensitive to cultural noise and surface conditions (e.g., asphalt, grass, gravel, mud, etc.). By incorporating common mid-point (CMP)-style roll-along acquisition (seismic reflection method) with multi-channel acquisition, sufficient redundancy and resolution exist to interpret anomalies evident across several 1D profiles.[5] The MASW method can use both active and passive sources to generate surface waves.

Advantages of using the shear wave velocity field (calculated from surface waves) to detect, delineate, and/or map anomalous subsurface materials include the insensitivity of MASW to velocity inversions and cultural noise, ease of generating and propagating surface wave energy in comparison to body wave energy, and its sensitivity to changes in velocity. Compression-wave velocity (V_p) is one of the valuable by-products obtainable from the same data set used for shear wave (V_s) analysis through a different processing step. Standard processing routines are available to enhance record quality prior to the analysis.

6.1.2 Data Collection. We collect seismic data using our Geometrics Geode© exploration seismograph system with 24- or 48-channel geophone arrays and 4.5-Hz OYO geophones/receivers mounted on a land-streamer system. Geophone spacing depends on the depth of investigation, but is between 5 to 30 feet.

For active seismic source surveys, energy is generated by ramming a steel plate with a 90-pound propelled energy generator (PEG-40Kg) or with a Betsy seisgun that uses 8- or 12-gauge industrial blanks to create an airwave. The quality of the seismic signal for each shot point is verified in the field. The seismograph records all seismic data to an internal hard drive and floppy disk, from which it is transferred to a PC.

6.1.3 Data Analysis and Interpretation. Data reduction and analysis of MASW data are performed using ParkSEIS® software. Data reduction and analysis begin with the consolidation and reformatting of individual shot gathers for each line into a single multi-record file format. The survey geometry is defined for each seismic record. Dispersion curve analysis is then performed for each shot gather in the multi-record file by examining the change in phase velocity vs. frequency using the fundamental mode component of the dispersion data. Non-linear

[5] Miller, R.D., Xia, J., Park, C.B., and Ivanov, J., 2000. Shear wave velocity field from surface waves to detect anomalies in the subsurface: Proceedings of the First International Conference on the Application of Geophysical Methodologies to Transportation Facilities and Infrastructure, St. Louis, Dec. 11-15.

inversion modeling of each dispersion curve is performed and results in a 1D mid-point representation of V_s and V_p depth profiles. Interpolation of the 1D data using a kriging algorithm produces a 2D grid of the V_s data. Color-filled contour profile plots are then generated from the V_s grid.

6.1.4 Limitations of the Method. Site-specific testing is required to evaluate background noise levels, to demonstrate the recording of meaningful surface wave data, and to estimate signal-to-noise (S-N) values. Acquisition parameters, such as receiver/shot coupling, shot offset, receiver spacing, sampling rate, record length, and other parameters are also site-specific. For records exhibiting low S-N levels, shots must be added to stack the coherent parts of the signal, which helps mitigate the detrimental effects of random environmental noise.

The MASW and other surface wave methods are primarily designed to obtain Vs of lower velocity soils (relative to high velocity bedrock). Because of the high seismic velocities of most rock types, significantly longer geophone arrays than space allows are required to measure Raleigh wave dispersion in rock.

6.2 Seismic Refraction

6.2.1 Description of the Method. We collect seismic refraction data using our Geometrics Geode® exploration seismograph system with 24- or 48-channel geophone arrays. Geophone spacing depends on the depth of investigation, but is between 5 to 20 feet. Shot points are located at a minimum off the ends of each spread, at the end geophones, and in the middle of the spread.

6.2.2 Data Analysis and Interpretation. HGI analyzes seismic refraction data using Geogiga Technology Corporation's (GTC) Geogiga Seismic Pro® 8.3. Picked arrival times are subdivided into individual refractor layers on the basis of refractor geometry by examining the slope of the line connecting refractor arrival times plotted as a function of distance. Since the slope of the line depends on a layer's seismic velocity, slope changes may be used to discriminate between layers of differing velocity.[6]

Using this layer information, Geogiga Refractor 8.3 offers calculations of layer velocities and depths using approximate and average general reciprocal methods (GRM), delay time, and slope intercept modeling methods. The GRM is used as the primary modeling method because it provides lateral changes in layer velocities and the capability of identifying and modeling stratigraphy where velocity inversion and/or hidden layers are present.

6.2.3 Limitations of the Method. Analysis of seismic refraction data requires an assumption of a model composed of a number of layers, such as bedrock overlain by overburden, or bedrock overlain by till and overburden. Other limiting assumptions are that i) seismic refraction layers are continuous and extend from one end of the refraction line to the other; and ii) layer velocities increase with depth.

Seismic refraction requires a sufficiently strong source so that seismic energy is transmitted to refracting interfaces and returned to the surface to be recorded by each geophone in a seismic

[6] Although this procedure is generally tractable, there are a number of cases where layers cannot be resolved, including situations where a low-velocity layer (LVL) exists beneath a layer of greater velocity, and where layers are too thin to be resolved.

spread. When bedrock is deep and/or overburden velocities are low, explosives or seisgun sources may be required to produce sufficient seismic energy to reach most or all of the geophones in a spread. It is becoming increasingly difficult to use intrusive seismic sources, particularly explosives, at many sites.

Seismic refraction can only distinguish between materials if their seismic velocities are sufficiently different. Thus it may not be possible to distinguish between weathered bedrock and till, particularly if the bedrock is shale.

Electric lines with 60-cycle current (and/or greater harmonics) may create interference with seismic data collection along lines adjacent to or beneath them.

6.3 Seismic Reflection

6.3.1 Description of the Method. Seismic data are collected using Geometrics Geode® Exploration Seismographs that are capable of recording 48-channel geophone arrays. Geophone spacing generally depends on the depth of investigation, but is usually between 2.5 to 10 feet. Shot points are located a minimum of 50 feet off the end of an array to help reduce the debilitating effects of airwave and ground roll noise. The source of seismic energy is anthropogenic and is coupled to the ground through either hammering on a steel plate or with a Betsy seisgun that fires industrial blanks. For the latter source, the nozzle of the seisgun is buried 1.5 to 2 feet below the surface to enhance the amplitude of the signal entering the ground. The quality of the seismic signal for each shot point is verified in the field.

A typical field recording configuration is the common source gather, which involves 24 active geophones and a single source location at a fixed offset from the recording channels. With HGI's 48-channel recording capability, this configuration can be maintained throughout a seismic line by "rolling" the geometrical configuration along the ground surface at 5 feet intervals. In doing so, a number of reflections from different source-receiver geometries are recorded which correspond to the same subsurface reflection point. These can be subsequently stacked to improve the quality of recorded signals.

6.3.2 Data Analysis and Interpretation. HGI analyzes seismic refraction data using Geogiga Technology Corporation's (GTC) Geogiga Reflector® 8.3.

A substantial amount of processing is needed before it is possible to make any geologic interpretation of recorded seismic data. A typical processing sequence includes, but is not restricted to, the following: i) initial frequency filtering; ii) pre-stack F/K filtering; iii) trace edit; iv) first arrival mute; v) common offset to CDP sort; vi) application of datum statistics; vii) normal move out correction; viii) surface consistent residual statistics; ix) CDP stack; x) deconvolution; xi) post-stack F/K filtering; xii) migration; xiii) frequency filtering; and xiv) trace scaling/normalization.

Geologic interpretation is carried out on the CDP stacked data and generally involves identifying continuous reflectors. After reflector horizons have been delineated and stratigraphically assessed, a "time-to-depth" conversion can be applied using velocity information obtained from neighboring borehole data or from typical velocity estimates from compiled tables.

6.3.3 Limitations. Analysis and interpretation of shallow seismic reflection data is inherently limited by a number of factors:

- The ability to resolve thin layers is dependent on the dominant frequency of the interrogating energy source. A general "rule of thumb" is that a layer must be thicker than ¼ of the dominant wavelength to produce a noticeable reflection.
- The ability to isolate an individual reflector is dependent on the ability to separate it from the wavelets of earlier arrivals.
- The magnitude of the reflection from any discontinuous interface is directly related to the impedance contrast across it (where impedance is defined as the product of density and velocity). Thus, situations frequently occur where additional Stratum exist but have an associated impedance contrast too small to be discerned.
    - Seismic energy sources must be strong enough for adequate penetration of seismic energy to the target of interest.

The robustness of any "time-to-depth" conversion is directly correlated with the validity of the velocity profile used. For near-surface seismic reflection investigations, this problem is greatly exacerbated by the possibility of strong lateral variations in the velocity profile.

6.4 H/V Spectral Analysis

6.4.1 Description of the Method. The spectral ratio method, also called the H/V method, is used to determine depth to bedrock and estimate the resonant frequency for a site by analyzing signals generated by both natural and cultural ambient sources of seismic noise. Natural sources of noise include ocean wave- and surf-generated vibrations that are observed even at stations located in the central regions of continents. Anthropogenic sources of seismic noise, including signals generated by vehicle and foot traffic, also provide useful signal for analysis, making the spectral ratio method ideal for work in urban environments.

HGI collects seismic data for H/V interpretation using three-component geophones arranged in either small arrays or in single station configurations with the north channel of each geophone aligned with magnetic north. A Geometrics Geode® 48-channel seismograph records the signal from each channel of each geophone for a period of time long enough to capture several wavelengths of the lowest frequency noises to allow for quality control.

6.4.2 Data Analysis and Interpretation. HGI analyzes ambient seismic data using the Geopsy v. 2.9.0 suite. Data analysis proceeds with applying a Fourier transform to both the horizontal channels and the vertical channel of the time series recorded during the survey. The ratio is taken between the Fourier amplitude spectra of the horizontal and vertical channels of each geophone. The peak frequency of this ratio serves as a good estimate of the site response (or resonant frequency) for most sites. The relationship between the resonant frequency and sediment thickness may then be calculated using a site-specific estimate of the surface shear velocity and change in shear velocity with depth parameter. The regression equations developed by Ibs-von Seht & Wohlenberg (1999) and Parolai et al. (2004) are used to provide estimates of depth to bedrock.

6.4.3 Limitations. Unlike seismic refraction, reflection, and MASW studies, where a continuous profile along the length of a survey line is produced, the H/V method provides a 1D depth to bedrock measurement or determination of site response. In sites where 2- or 3-D geological features are

present, the peak frequency of the H/V ratio should be considered as only a lower bound estimate on the amplification factor and estimates of depth to bedrock may be subject to errors of up to 10%. Additionally, in environments where overburden is very thick or cultural noise is minimal, the peak frequency of the H/V ratio may be particularly low in amplitude and difficult to observe. The method is best-suited as an exploratory tool to use as a precursor to profiling with seismic reflection, refraction, or MASW techniques as it can provide an estimate of depth to bedrock that may be useful for determining seismic profiling survey geometry, or as a constraint on modeling the results from other methods.

6.5 RTK GNSS Global Positioning System (GPS)

6.5.1 Description of the Method. The RTK GPS system consists of a base (reference) receiver and a roving receiver. The base receiver remains stationary during a survey and is mounted on a tribrach and tripod. A rover receiver is used to record points remotely and can be mounted on a staff, vehicle, or other object. The base provides real-time corrections to the rover over a radio connection. The system can produce accuracy on a centimeter scale, but the level of accuracy depends on factors that include the geometry of the transmitting satellites and the receivers' view of the horizons (e.g., the density of buildings and trees). The data can be collected as quickly as 5 Hz or 5 readings per second.

6.5.2 Data Collection and Processing. We perform our GPS surveys using a Sokkia RTK GRX3 GPS system. The base station can be set up over a known or unknown point, with the position taken from satellite information. Once the system has achieved a fixed solution for the rover receiver, data points can be collected with survey-grade (centimeter-scale) precision. When GPS points are being collected at a site where the fixed solution is constantly lost and gained, points are checked multiple times for precision. All data points are saved to a Carlson Surveyor 2 field computer.

The GPS data are corrected automatically by the base receiver in the field prior to being recorded. If the base station is located on an unknown point that is later defined, the GPS data can be corrected in the office to fit the real world coordinates.

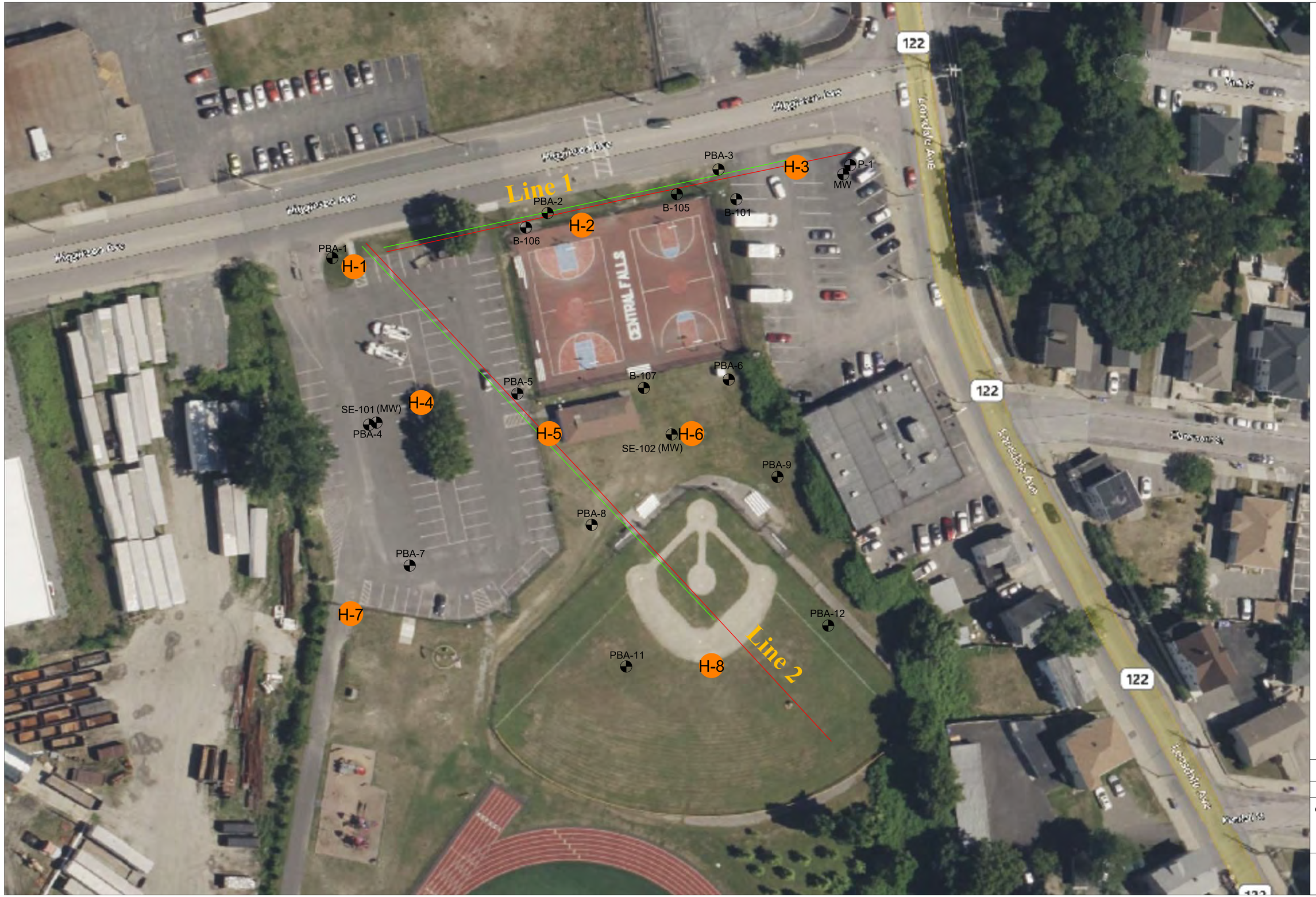
6.5.3 Limitations of the Method. The quality of the GPS signal is site-specific. The base and rover receiver need to have clear views of the horizon and good satellite geometry to achieve the highest level of accuracy and precision. Although a fixed solution can be achieved in wooded environments or sites with taller buildings, it may take more time to achieve the solutions, the fixed solution may be lost frequently when moving the rover, and in some cases the fixed solution may be wrong. Each of these situations requires longer to locate data points accurately and precisely. When the point is too close to a building, beneath a building overhang, under a tree, or obscured by some other object, a fixed solution may not be possible.

When the base station is set up over an unknown point, the survey data location can be at least several tens of meters from the real world location. The data points will have survey grade precision relative to the location of the base station and other data points, but will have a real world accuracy discrepancy.

HGI does not guarantee to produce a surveyor-quality map from its GPS data, as this is not its profession. If survey-level accuracy is critical for a project, we recommend hiring professional surveyors for that purpose.

Respectfully yours,
HAGER GEOSCIENCE
(Collier Geophysics, Inc.)

Mario Carnevale, M.S., P.G.
Operations Manager



Legend

- MASW/Refraction Line
- S-wave Reflection Line
- HVSR Station
- HGI Identified Borehole

N
W E
S

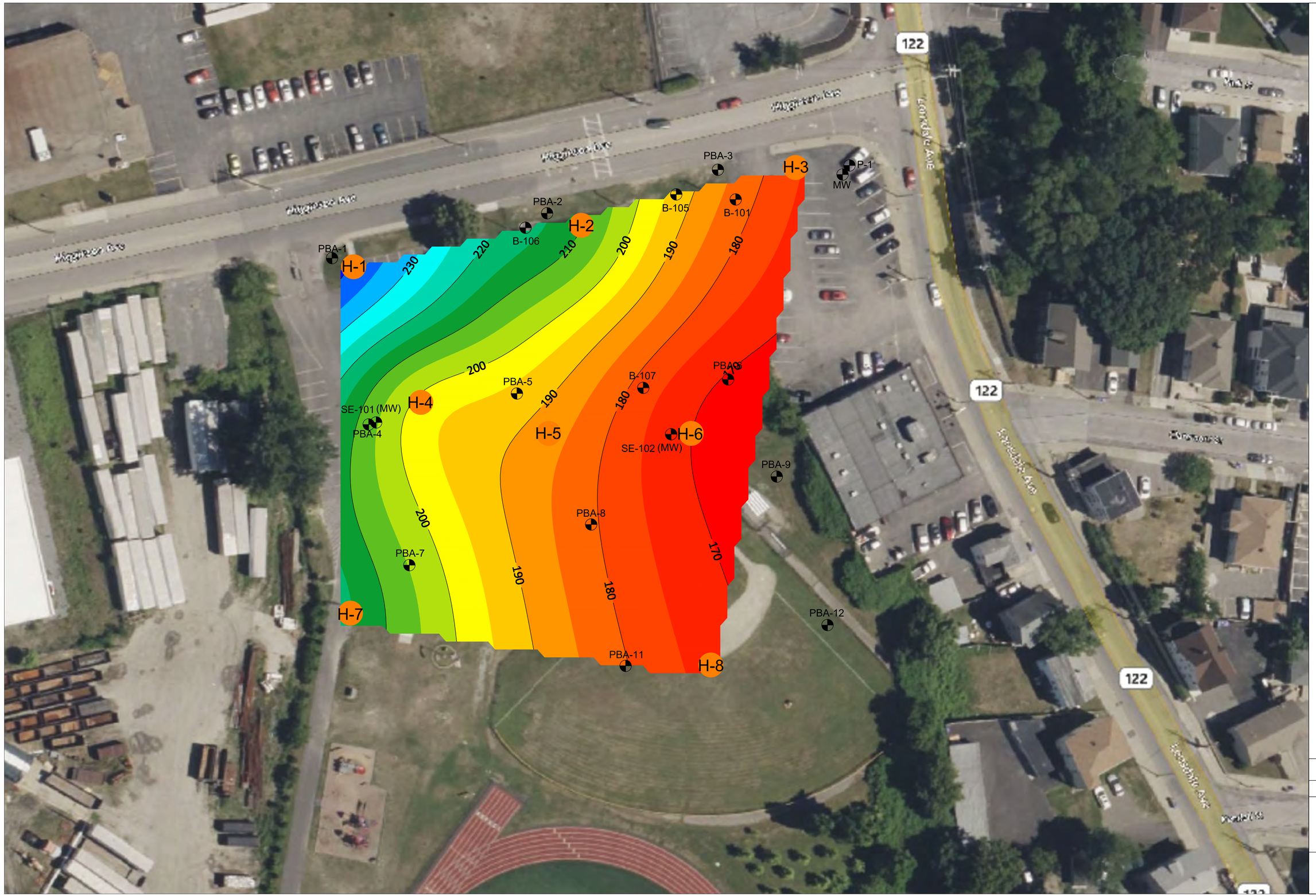
0 30 60 Feet

Plate 1

April 2023	File 2023005

Geophysical Survey Location Map
Proposed Central Falls High School
Central Falls, RI

Hager GeoScience
A Collier Geophysics Company
596 Main Street, Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com



Legend

- HVSR Station
- HGI Identified Borehole

Depth (feet bgs) (CI=5 ft)

165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240

N
W
E
S

0 30 60 Feet

Plate 2

April 2023	File 2023005

HVSR Bedrock Depth Contours
Proposed Central Falls High School
Central Falls, RI

Hager GeoScience
A Collier Geophysics Company
596 Main Street, Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com

APPENDIX A

MASW

Figures

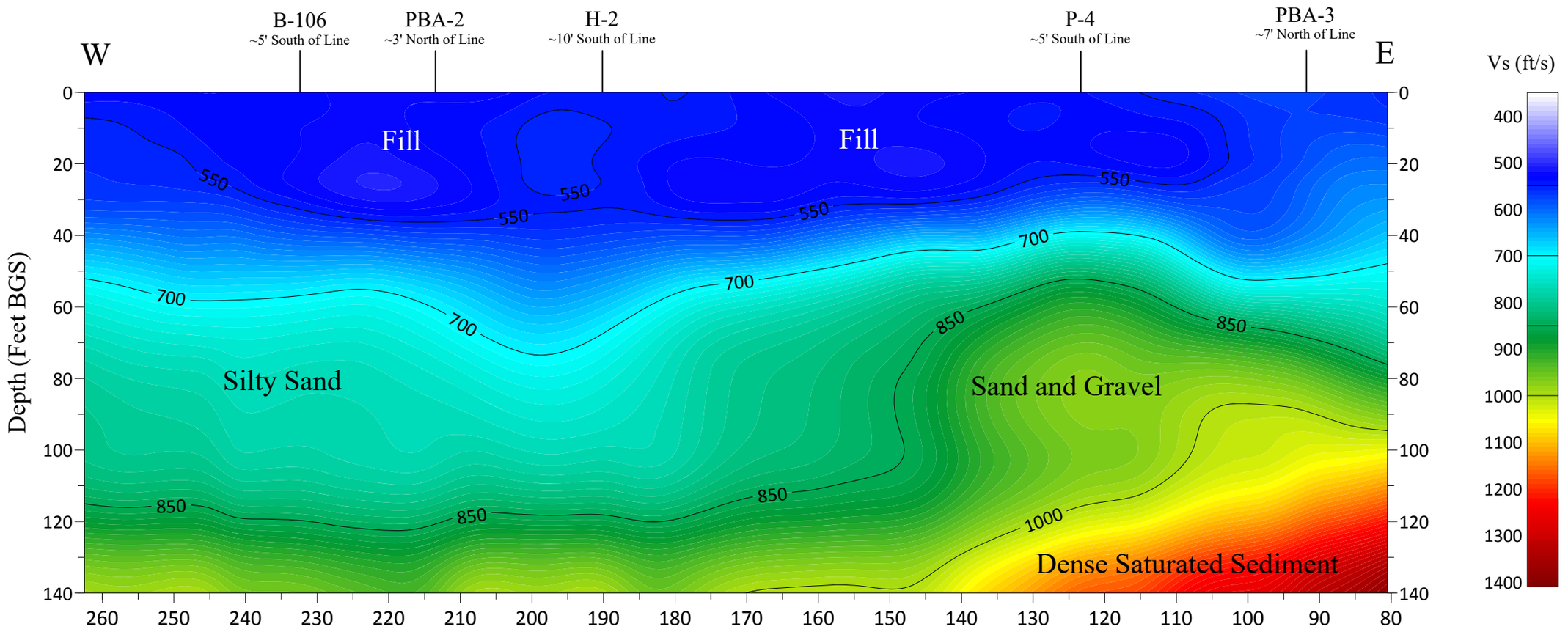
Tables

APPENDIX A

Figures

Figure S-1

MASW Line 1 - 2D Vs Profile



Survey For Seismic Site Characterization
Proposed Central Falls High School
Central Falls, RI

April 2023 File 2023005

V.E. x 2

0 18 36 54

Feet

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A Collier Geophysics Company
596 Main Street - Woburn, MA 01801
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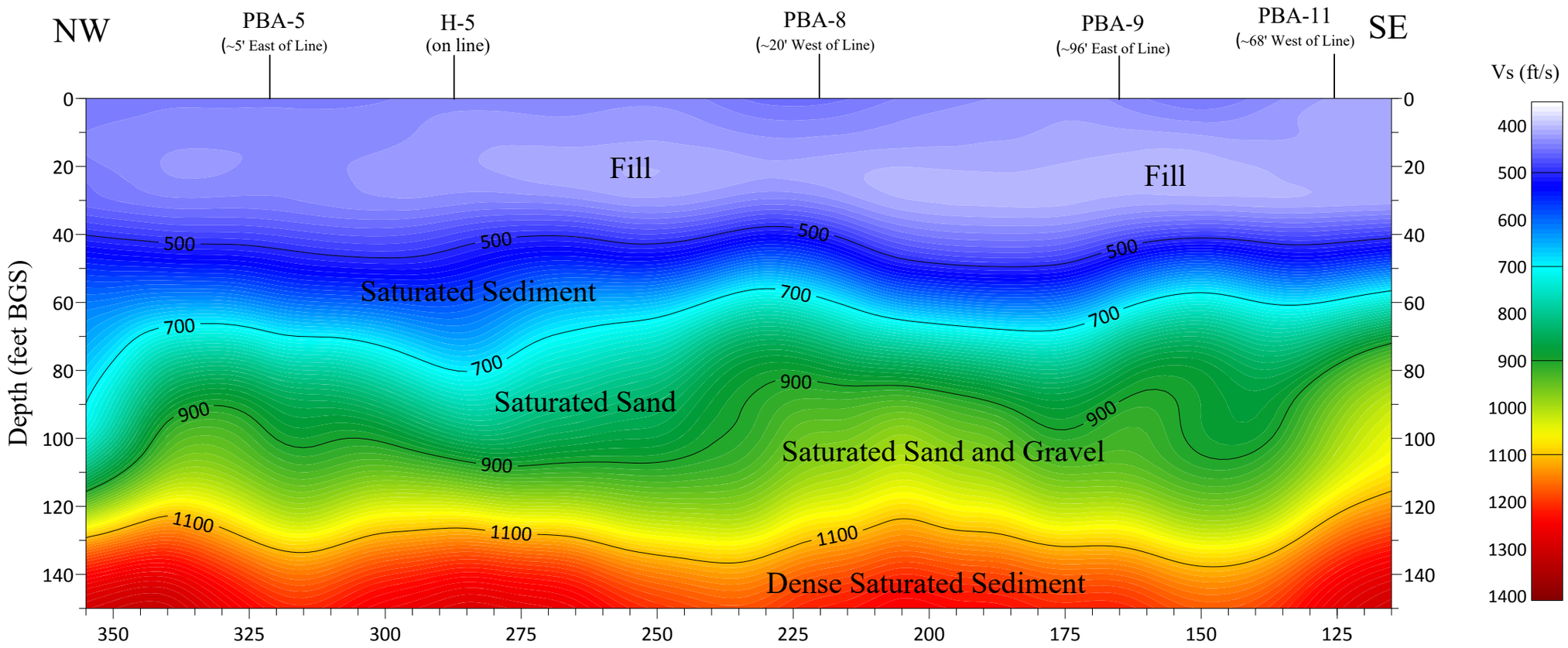
Figure S-2

MASW Line 2 - 2D Vs Profile



Survey For Seismic Site Characterization
Proposed Central Falls High School
Central Falls, RI

April 2023 File 2023005

V.E. x 1.6

0 25 50 75

Feet

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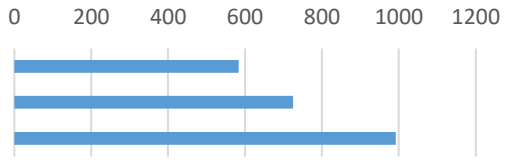
APPENDIX A

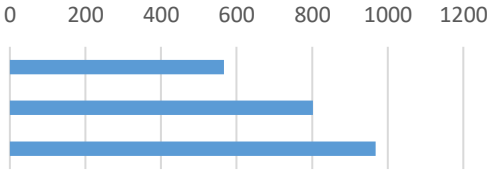
Tables

Table S-1
Line 1 - 1D Vs Profiles

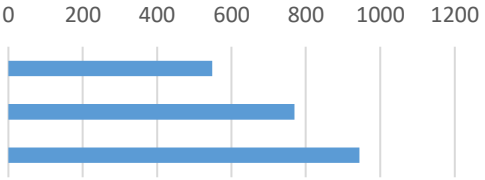
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
90	Dense Fill	25	584
90	Silty Sand	50	725
90	Sand and Gravel	25	993
L1 - Midpoint 90 Vs100 =		**730**	



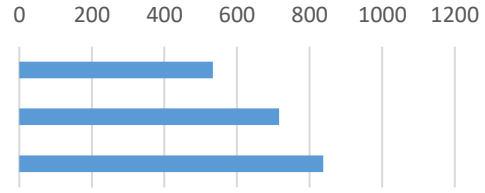
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
110	Dense Fill	40	566
110	Silty Sand	20	802
110	Sand and Gravel	40	968
L1 - Midpoint 110 Vs100 =		**731**	



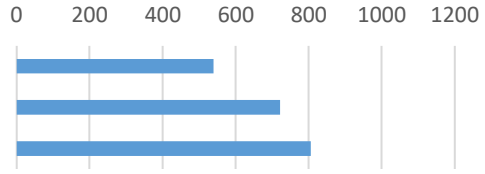
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
130	Dense Fill	30	549
130	Silty Sand	30	770
130	Sand and Gravel	40	944
L1 - Midpoint 130 Vs100 =		**735**	



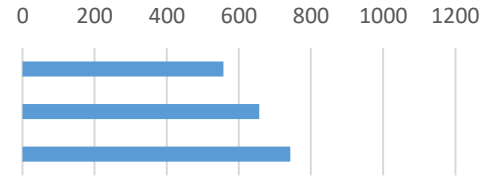
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
150	Dense Fill	35	534
150	Silty Sand	20	716
150	Sand and Gravel	45	838
L1 - Midpoint 150 Vs100 =		**679**	



Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
170	Dense Fill	40	540
170	Silty Sand	30	722
170	Sand and Gravel	30	807
L1 - Midpoint 170 Vs100 =		**655**	



Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
190	Dense Fill	45	557
190	Silty Sand	20	657
190	Sand and Gravel	35	743
L1 - Midpoint 190 Vs100 =		**632**	



Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
210	Dense Fill	40	539
210	Silty Sand	20	648
210	Sand and Gravel	40	745
L1 - Midpoint 210 Vs100 =		**630**	

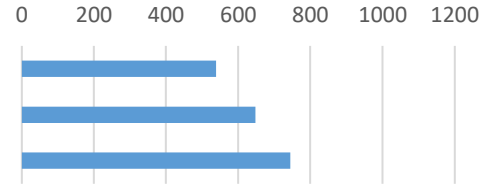
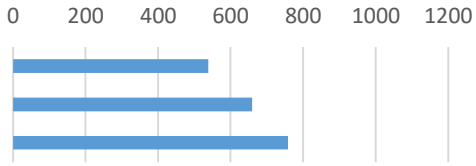


Table S-1
Line 1 - 1D Vs Profiles

Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
230	Dense Fill	40	539
230	Silty Sand	15	660
230	Sand and Gravel	45	759
L1 - Midpoint 230 Vs100 =		**640**	



Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
250	Dense Fill	35	556
250	Silty Sand	20	648
250	Sand and Gravel	45	766
L1 - Midpoint 250 Vs100 =		**656**	

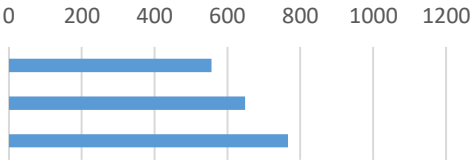
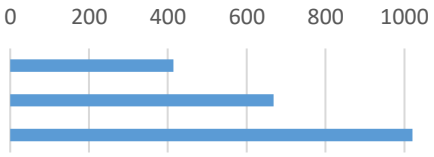
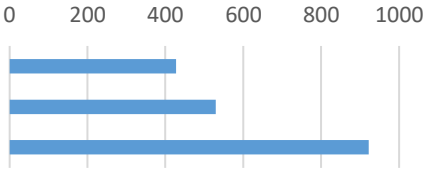


Table S-2
Line 2 - 1D Vs Profiles

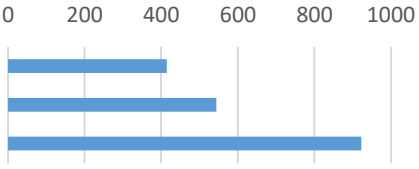
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
120	Fill	25	415
120	Sand	55	668
120	Sand and Gravel	20	1021
L2 - Midpoint 120 Vs100 =		**617**	



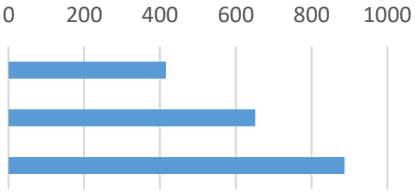
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
160	Fill	15	428
160	Sand	50	530
160	Sand and Gravel	35	922
L2 - Midpoint 160 Vs100 =		**597**	



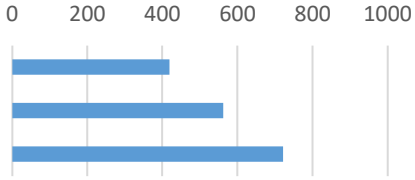
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
200	Fill	30	415
200	Sand	40	545
200	Sand and Gravel	30	923
L2 - Midpoint 200 Vs100 =		**561**	



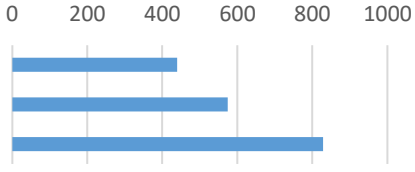
Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
240	Fill	40	416
240	Sand	25	651
240	Sand and Gravel	35	888
L2 - Midpoint 240 Vs100 =		**575**	



Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
280	Fill	35	419
280	Sand	30	562
280	Sand and Gravel	35	722
L2 - Midpoint 280 Vs100 =		**540**	



Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
320	Fill	40	440
320	Sand	30	575
320	Sand and Gravel	30	829
L2 - Midpoint 320 Vs100 =		**558**	



Midpoint (ft)	Layer	Thickness (ft)	Average Vs (ft/s)
350	Fill	35	438
350	Sand	50	609
350	Sand and Gravel	15	748
L2 - Midpoint 350 Vs100 =		**550**	

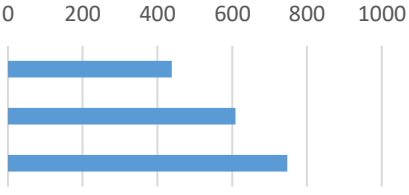


Table S-3
Vs 100 Summary Table

Line	Midpoint	Vs100 (ft/s)	Averaged Vs100 (ft/s)
1	90	730	
1	110	731	
1	130	735	
1	150	679	
1	170	655	676
1	190	632	
1	210	630	
1	230	640	
1	250	656	
2	120	617	
2	160	597	
2	200	561	
2	240	575	571
2	280	540	
2	320	558	
2	350	550	

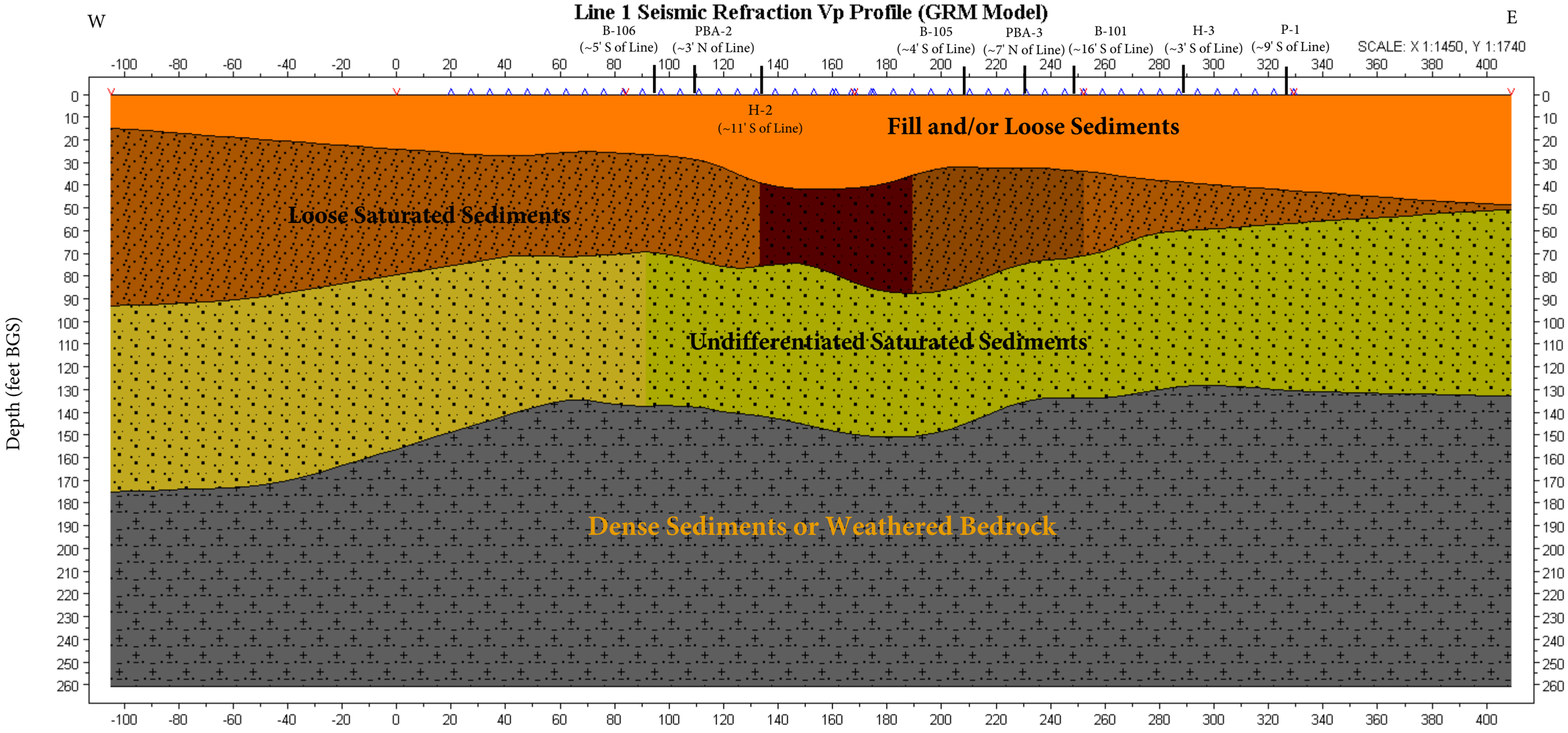
Vs 100 (ft/s) Site Average 624

APPENDIX B

SEISMIC REFRACTION

Figures

Figure SR-1



SURVEY FOR SEISMIC SITE CHARACTERIZATION
CENTRAL FALLS HIGH SCHOOL
CENTRAL FALLS, RI

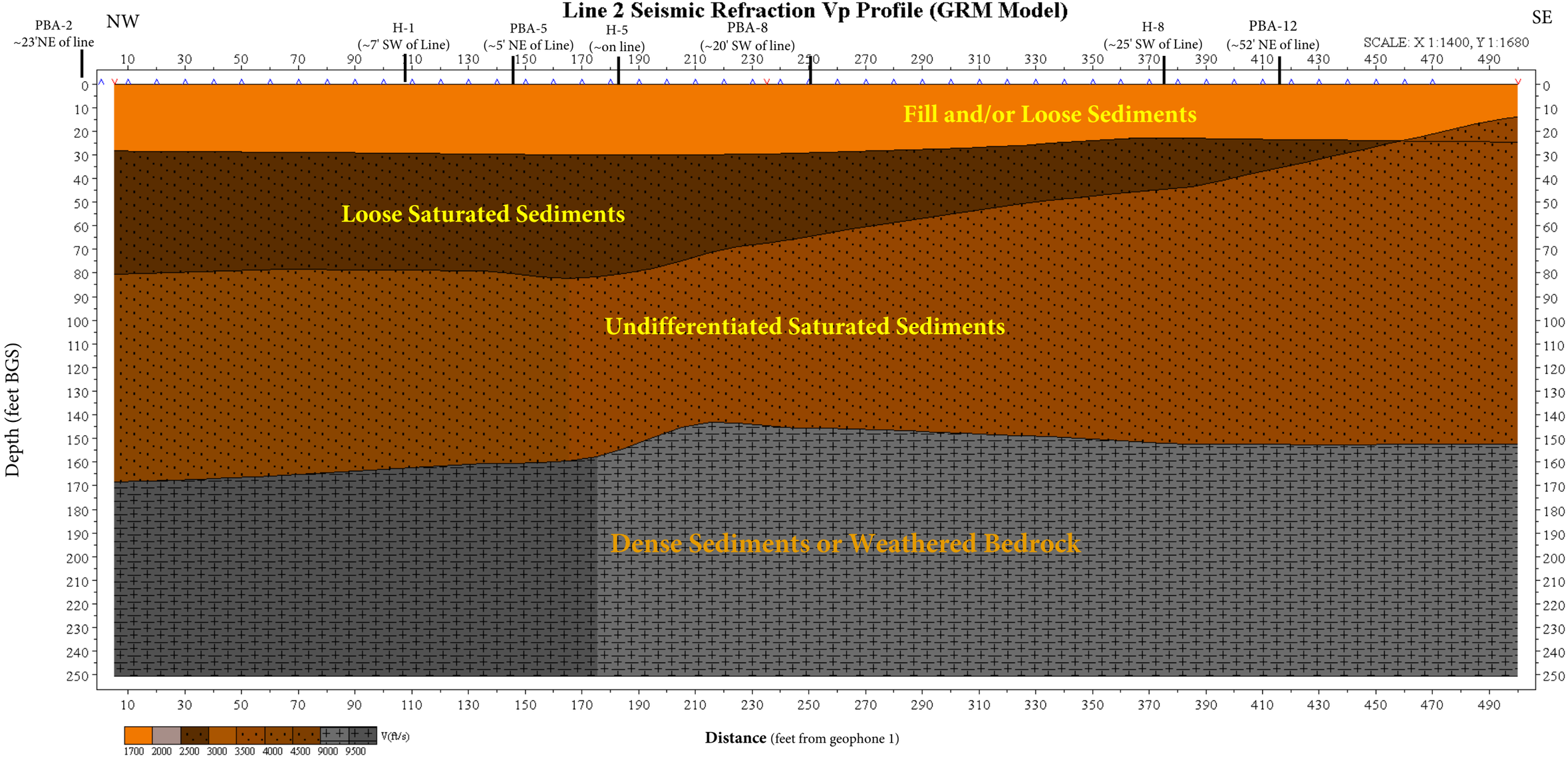
April 2023 File 2023005

Hager GeoScience, Inc.
(A Collier Geophysics Company)
596 Main Street
Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com

HAGER GEOSCIENCE

Figure SR-2

Line 2 Seismic Refraction Vp Profile (GRM Model)



SURVEY FOR SEISMIC SITE CHARACTERIZATION
CENTRAL FALLS HIGH SCHOOL
CENTRAL FALLS, RI

April 2023 File 2023005

V.E. x 0.8
1.0 in

1 inch ~ 35 feet

Hager GeoScience, Inc.
(A Collier Geophysics Company)
596 Main Street
Woburn, MA 01801
(781) 935-8111 hgi@hagergeoscience.com

HAGER GEOSCIENCE

APPENDIX C

SEISMIC REFLECTION

Figures

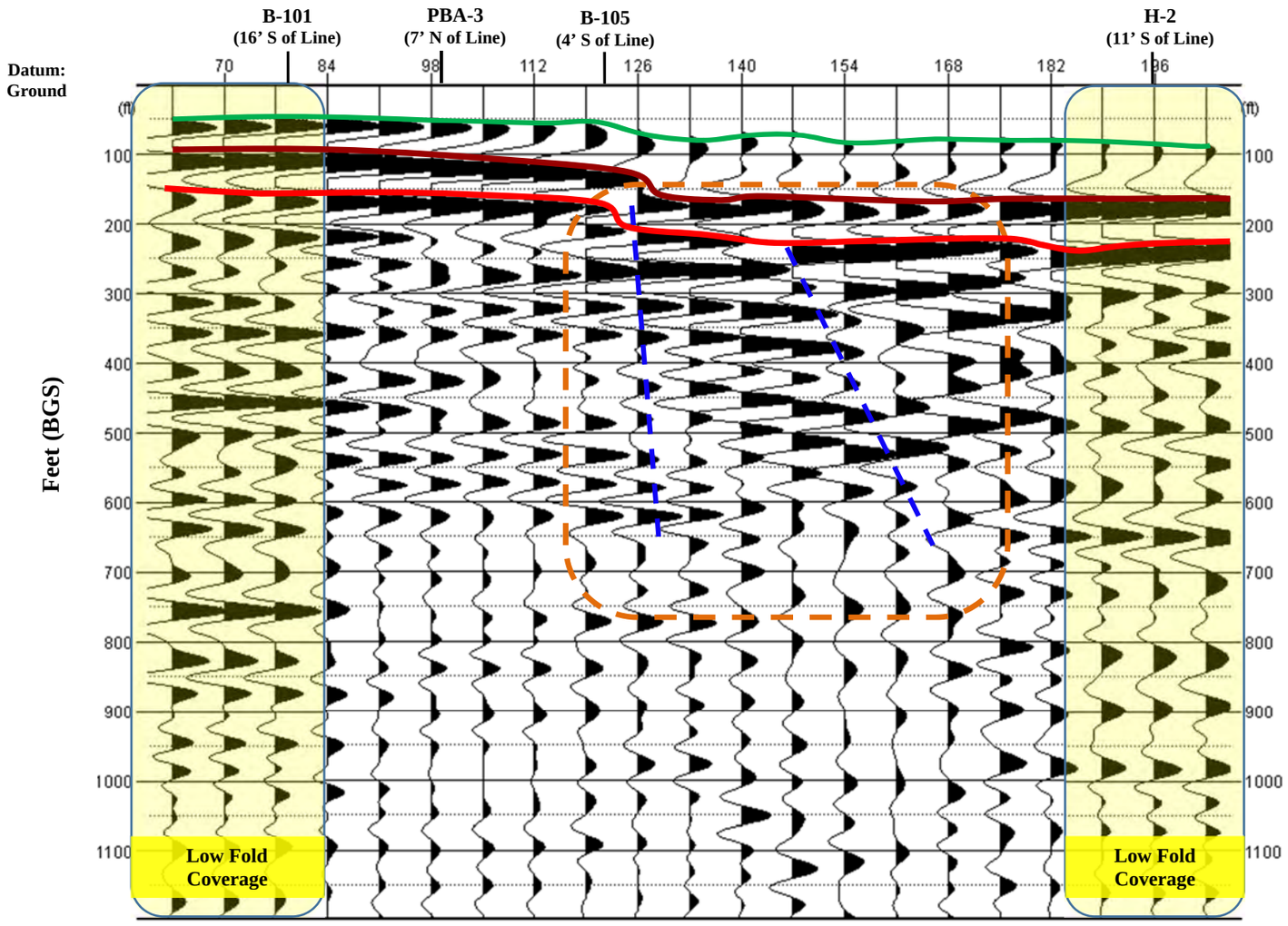
Figure SL-1 Line 1 Seismic Reflection Vs Model (GRM)
Figure SL-2 Line 2 Seismic Reflection Vs Model (GRM)

Stratum Boundary
Stratum Boundary
Bedrock Boundary?

General Location of
Bedrock Structural Anomaly

Bedrock Fracture

Figure SL-1
Line 1 Vs Seismic Reflection Profile (CMP Depth Stack)
Distance (feet-relative to Station 0)



Hager GeoScience (Collier)
596 Main St. Woburn, MA 01801

Line: 1
Date: 4-4-23
Location: Central Falls
Client: LGCI

ACQUISITION PARAMETERS

SEISMOGRAPH: Geode	**RECORD LENGTH:** 1000/rs500 m
SOURCE: PEG+Seisgun	**SAMPLE RATE:** 0.125
STACKS: 7 Positive	**SHOT OFFSET:** 49 feet In-Line
SHOT INCR: 5 feet	**CABLE:** 48 Ch.
ACTIVE STA: 18	**STA. INT.** 7 feet
SPREAD LENGTH: 119 feet	**# OF SHOTS:** 35 Full Spread
FILTERS: OUT	**NOTCH: OUT**

PROCESSING REGIMEN

PRE-STACK
1. FILTERS: Yes
   FREQUENCY: BP 37 – 120 Hz
   FK: No TauP: No
2. TRACE SCALING: No
3. TRACE EDIT: Edit Bad Traces
4. FIRST ARRIVAL MUTE: Yes
5. DECONVOLUTION: No
6. SORT:
   CDP: Yes CS: CO: CR:
7. FIELD STATICS:
   DATUM= Ground VEL= NA
8. RESIDUAL STATICS: No
9. NMO CORRECTION: No
10. STACK: CDP FOLD: 9 Max

POST-STACK
11. FILTERS: BP 40-80 Hz
12. MIGRATION: No
13. TRACE SCALING: AGC
14. TRACE MUTING: Top

Hager GeoScience (Collier)
596 Main St. Woburn, MA 01801

Line: 2
Date: 4-4-23
Location: Central Falls
Client: LGCI

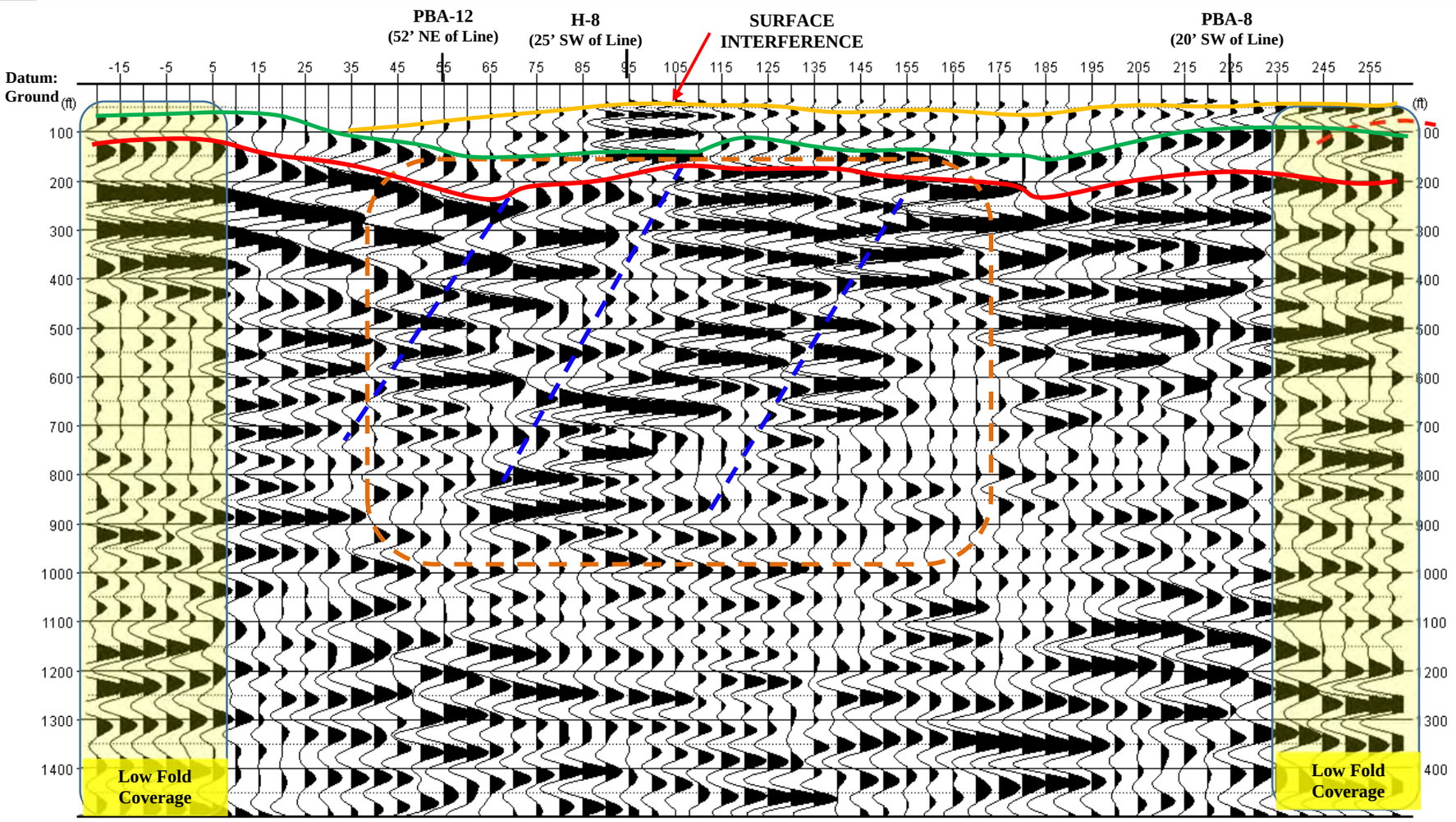
Soil Layer

Bedrock Surface

General Location of Bedrock Structure Zone

Bedrock Fracture

Figure SL-2
Line 2 Vs Seismic Reflection Profile (CMP Depth Stack)
Distance (feet - relative to Station 0)



ACQUISITION PARAMETERS	
SEISMOGRAPH: Geode	**RECORD LENGTH:** 1000/rs500 ms
SOURCE: PEG-90lb	**SAMPLE RATE:** 0.125
STACKS: 1 Positive	**SHOT OFFSET:** 40 feet In-Line
SHOT INCR: 5 feet	**CABLE:** 48 Ch.
ACTIVE STA: 19	**STA. INT.** 5 feet
SPREAD LENGTH: 90 feet	**# OF SHOTS:** 48 Full Spread
FILTERS: OUT	**NOTCH: OUT**

PROCESSING REGIMEN

PRE-STACK
1. FILTERS: Yes
   FREQUENCY: BP 37 – 120 Hz
   FK: No TauP: No
2. TRACE SCALING: No
3. TRACE EDIT: Edit Bad Traces
4. FIRST ARRIVAL MUTE: Yes
5. DECONVOLUTION: No
6. SORT:
   CDP: Yes CS: CO: CR:
7. FIELD STATICS:
   DATUM= Ground VEL= NA
8. RESIDUAL STATICS: No
9. NMO CORRECTION: No
10. STACK: CDP FOLD: 9 Max

POST-STACK
11. FILTERS: BP 40-80 Hz
12. MIGRATION: No
13. TRACE SCALING: AGC
14. TRACE MUTING: Top

APPENDIX D

HVSR

Tables

Table H1: HVSR Depth Calculations

Figures

Figures H1-H8 HVSR Response Spectra-Stations 1-8

HVSR

Table

Table H1: HVSR Depth Calculations

Table H-1
HVSR Station Results

HVSR Station	H/V Res. Peak (Hz)	Calculated Depth (meters)		Calculated Depth (feet)		Averaged Depths	
		Ibs-von Seht & Wohlenberg (1999)	Parolai et al (2004)	Ibs-von Seht & Wohlenberg (1999)	Parolai et al (2004)	Meters	Feet
H-1	1.21	74	81	243	265	78	254
H-2	1.33	64	69	211	227	67	219
H-3	1.53	53	56	175	183	55	179
H-4	1.41	59	63	195	207	61	201
H-5	1.46	57	60	187	197	59	192
H-6	1.57	52	54	169	177	53	173
H-7	1.31	66	71	217	234	69	226
H-8	1.54	53	55	173	181	54	177

HVSR

Figures

Figures H1-H8 HVSR Response Spectra-Stations 1-8

Figure H-1
HVSR Station 1

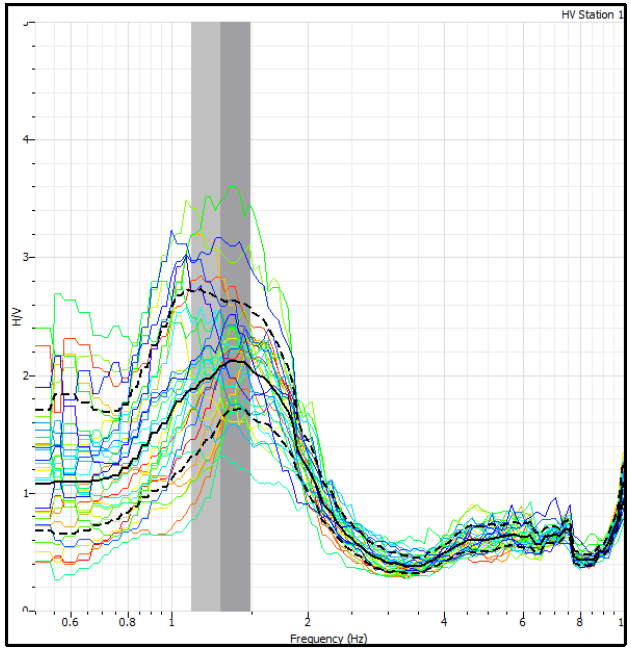


Figure S-3. Response for HVSR Station 1. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.2Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 243 feet below ground level (Table S-3).

Figure H-2
HVSR Station 2

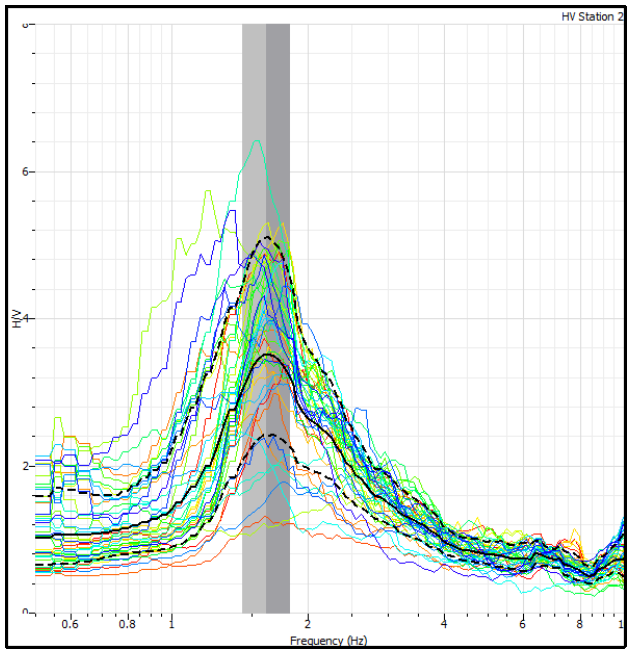


Figure S-4. Response for HVSR Station 2. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.33Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 211 feet below ground level (Table S-3).

Figure H-3
HVSR Station 3

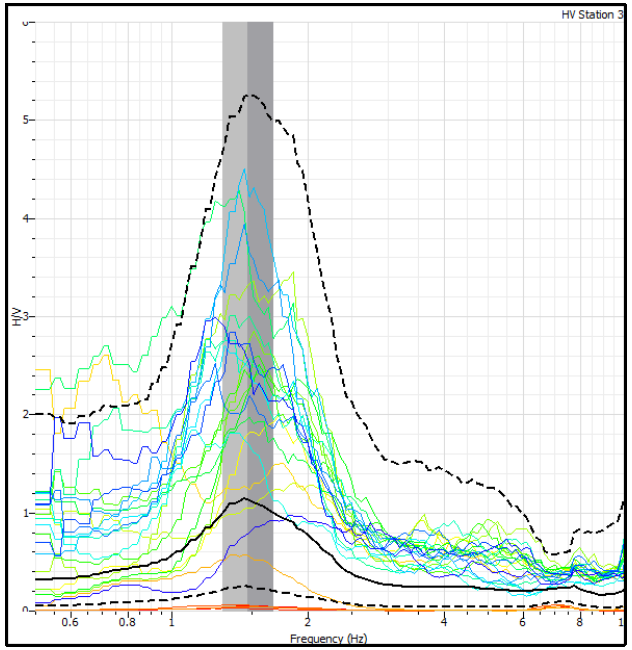


Figure S-5. Response for HVSR Station 3. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.53Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 175 feet below ground level (Table S-3).

Figure H-4
HVSR Station 4

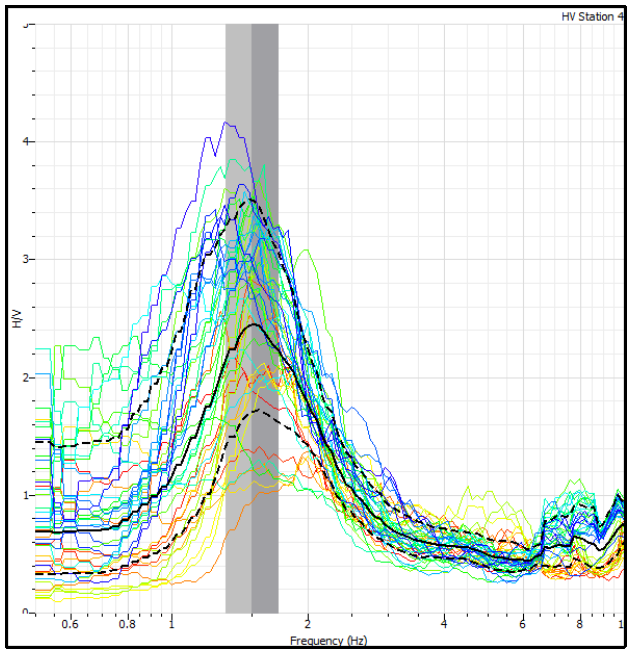


Figure S-6. Response for HVSR Station 4. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.41Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 195 feet below ground level (Table S-3).

Figure H-5
HVSR Station 5

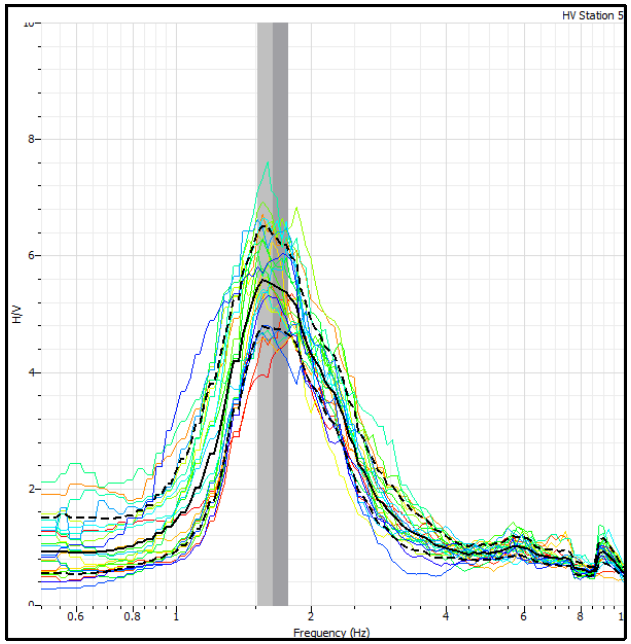


Figure S-7. Response for HVSR Station 5. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.46Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 187 feet below ground level (Table S-3).

Figure H-6
HVSR Station 6

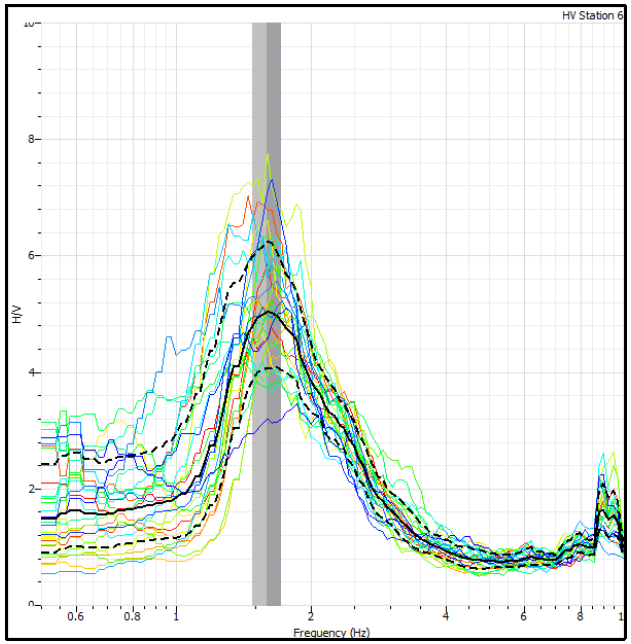


Figure S-8. Response for HVSR Station 6. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.57Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 169 feet below ground level (Table S-3).

Figure H-7
HVSR Station 7

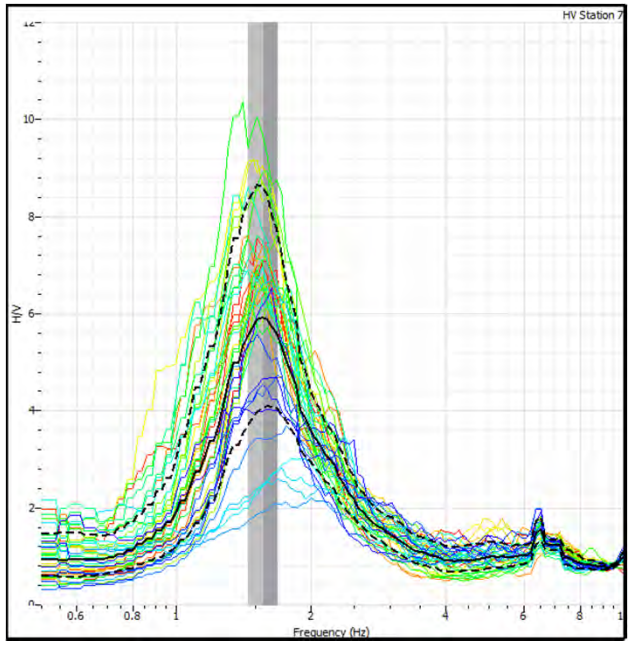


Figure S-9. Response for HVSR Station 7. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.31Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 217 feet below ground level (Table S-3).

Figure H-8
HVSR Station 8

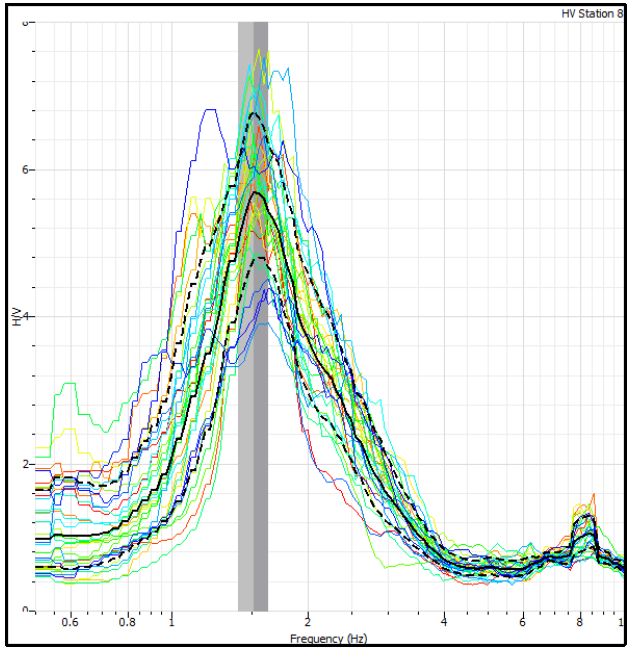


Figure S-10. Response for HVSR Station 8. The solid line (used for interpretation) represents the average spectrum of the time windows used (colored lines) for the H/V ratio, while dashed lines indicate +/- standard deviation from the average curve. The grey shaded area represents the numerical average frequency for all values calculated from the time windows used. The main impedance peak at 1.54Hz (solid line) suggests the presence of a boundary (possibly bedrock) at an approximate depth of 173 feet below ground level (Table S-3).

Appendix E – Seismic CPTs

PRESENTATION OF SITE INVESTIGATION RESULTS

Francis L Corrigan Sports Complex
Central Falls, Rhode Island

Prepared for:

Lahlaf Geotechnical Consulting, Inc

ConeTec Job No: 23-53-25669

Project Start Date: 19-Apr-2023
Project End Date: 19-Apr-2023
Report Date: 3-May-2023

Prepared by:

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436 Commerce Lane, Unit C
West Berlin, NJ 08091

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Toll Free: (800) 504-1116

ConeTecNJ@conetec.com
www.conetec.com
www.conetecdataservices.com

Introduction

The enclosed report presents the results of the site investigation program conducted by ConeTec Inc. for Lahlaf Geotechnical Consulting, Inc of Billerica, Massachusetts. The program consisted of seismic cone penetration tests carried out for the Francis L Corrigan Sports Complex project located in Central Falls, Rhode Island. The program was completed under supervision of Lahlaf Geotechnical Consulting, Inc personnel (Madjid Lahlaf). Please note that this report, which also includes all accompanying data, are subject to the 3rd Party Disclaimer and Client Disclaimer that follow in the 'Limitations' section of this report.

Project Information

Project	
Client	Lahlaf Geotechnical Consulting, Inc
Project	Francis L Corrigan Sports Complex, Central Falls, RI
ConeTec project number	23-53-25669

An aerial overview from CESIUM including the SCPTu test locations is presented below.

Rig Description	Deployment System	Test Type
CPT Truck Rig	25 ton truck mounted (twin cylinders)	SCPT

Coordinates		
Test Type	Collection Method	EPSG Number
SCPT	GPS (GlobalSat MR-350)	32619 (WGS 84 / UTM North)

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (bar)
861:T1500F15U35	861	15	225	1500	15	35
Cone 861 was used for all soundings.						

Cone Penetration Test (CPTu)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.
Pore pressure dissipation (PPD) tests	Three pore pressure dissipation tests were completed to determine the phreatic surface.
Additional plots	• Advanced plots with Ic, Su, phi and N1(60) • Soil Behavior Type (SBT) scatter plots • Seismic plots with shear wave velocity

Calculated Geotechnical Parameter Tables	
Additional information	The Normalized Soil Behavior Type Chart based on Q_{tn} (SBT Q_{tn}) (Robertson, 2009) was used to classify the soil for this project. A detailed set of calculated CPTu parameters have been generated and are provided in Excel format files in the release folder. The CPTu parameter calculations are based on values of corrected tip resistance (q_t) sleeve friction (f_s) and pore pressure (u_2). Effective stresses are calculated based on unit weights that have been assigned to the individual soil behavior type zones and the assumed equilibrium pore pressure profile. Soils were classified as either drained or undrained based on the Q_{tn} Normalized Soil Behavior Type Chart (Robertson, 2009). Calculations for both drained and undrained parameters were included for materials that classified as silt mixtures (zone 4). Calculations for both drained and undrained parameters were included for materials that classified as sand mixtures – silty sand to sandy silt (zone 5). For calculating undrained shear strength based on pore pressure ($S_u(N_{\Delta u})$) and undrained shear strength based on cone tip resistance ($S_u(N_{kt})$), an $N_{\Delta u}$ value of 6 and an N_{kt} value of 15 were selected.

Limitations

3rd Party Disclaimer

This report titled “Francis L Corrigan Sports Complex, Central Falls, RI”, referred to as the (“Report”), was prepared by ConeTec for Lahlaf Geotechnical Consulting, Inc. The Report is confidential and may not be distributed to or relied upon by any third parties without the express written consent of ConeTec. Any third parties gaining access to the Report do not acquire any rights as a result of such access. Any use which a third party makes of the Report, or any reliance on or decisions made based on it, are the responsibility of such third parties. ConeTec accepts no responsibility for loss, damage and/or expense, if any, suffered by any third parties as a result of decisions made, or actions taken or not taken, which are in any way based on, or related to, the Report or any portion(s) thereof.

Client Disclaimer

ConeTec was retained by Lahlaf Geotechnical Consulting, Inc to collect and provide the raw data (“Data”) which is included in this report titled “Francis L Corrigan Sports Complex, Central Falls, RI”, which is referred to as the (“Report”). ConeTec has collected and reported the Data in accordance with current industry standards. No other warranty, express or implied, with respect to the Data is made by ConeTec. In order to properly understand the Data included in the Report, reference must be made to the documents accompanying and other sources referenced in the Report in their entirety. Any analysis, interpretation, judgment, calculations and/or geotechnical parameters (collectively “Interpretations”) included in the Report, including those based on the Data, are outside the scope of ConeTec’s retainer and are included in the Report as a courtesy only. Other than the Data, the contents of the Report (including any Interpretations) should not be relied upon in any fashion without independent verification and ConeTec is in no way responsible for any loss, damage or expense resulting from the use of, and/or reliance on, such material by any party.

Cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd., a subsidiary of ConeTec.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and two geophone sensors for recording seismic signals. All signals are amplified and measured with minimum 16 bit resolution down hole within the cone body, and the signals are sent to the surface using a high bandwidth, error corrected digital interface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 mm diameter over a length of 32 mm with tapered leading and trailing edges) located at a distance of 585 mm above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is 6 mm thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meet or exceed those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

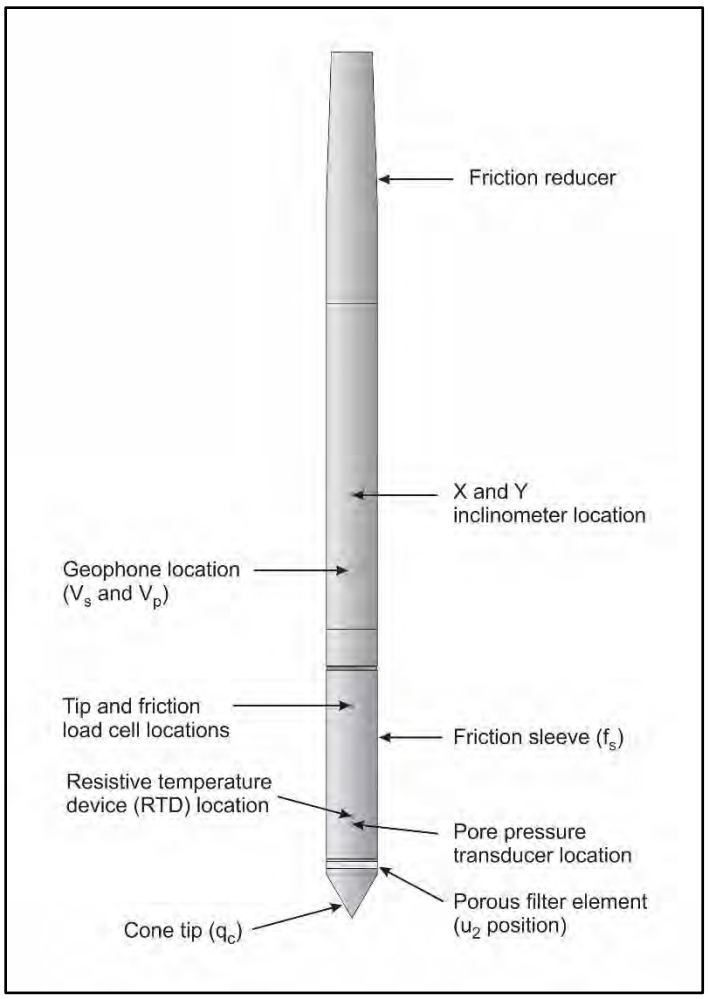


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal interface box and power supply. The signal interface combines depth increment signals, seismic trigger signals and the downhole digital data. This combined data is then sent to the Windows based computer for collection and presentation. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording interval is 2.5 cm; custom recording intervals are possible.

The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPT operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with either glycerin or silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of 2 cm/s, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil under vacuum pressure prior to use
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson et al. (1986) and Robertson (1990, 2009). It should be noted that it is not always possible to accurately identify a soil behavior type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al. (1986):

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of files with calculated geotechnical parameters were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the methods used is also included in the data release folder.

For additional information on CPTu interpretations and calculated geotechnical parameters, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

References

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM, West Conshohocken, US.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, “Cone Penetration Testing in Geotechnical Practice”, Blackie Academic and Professional.

Mayne, P.W., 2013, “Evaluating yield stress of soils from laboratory consolidation and in-situ cone penetration tests”, Sound Geotechnical Research to Practice (Holtz Volume) GSP 230, ASCE, Reston/VA: 406-420.

Mayne, P.W. and Peuchen, J., 2012, “Unit weight trends with cone resistance in soft to firm clays”, Geotechnical and Geophysical Site Characterization *4,* Vol. 1 (Proc. ISC-4, Pernambuco), CRC Press, London: 903-910.

Mayne, P.W., 2014, “Interpretation of geotechnical parameters from seismic piezocone tests”, CPT’14 Keynote Address, Las Vegas, NV, May 2014.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, “Use of Piezometer Cone Data”, Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158.

Robertson, P.K., 2009, “Interpretation of cone penetration tests – a unified approach”, Canadian Geotechnical Journal, Volume 46: 1337-1355.

Shear wave velocity (Vs) testing is performed in conjunction with the piezocone penetration test (SCPTu) in order to collect interval velocities. For some projects seismic compression wave velocity (Vp) testing is also performed.

ConeTec's piezocone penetrometers are manufactured with one horizontally active geophone (28 hertz) and one vertically active geophone (28 hertz). Both geophones are rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip. The vertically mounted geophone is more sensitive to compression waves.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances an auger source or an imbedded impulsive source maybe used for both shear waves and compression waves. The hammer and beam act as a contact trigger that initiates the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded in the memory of the cone using a fast analog to digital converter. The seismic trace is then transmitted digitally uphole to a Windows based computer through a signal interface box for recording and analysis. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

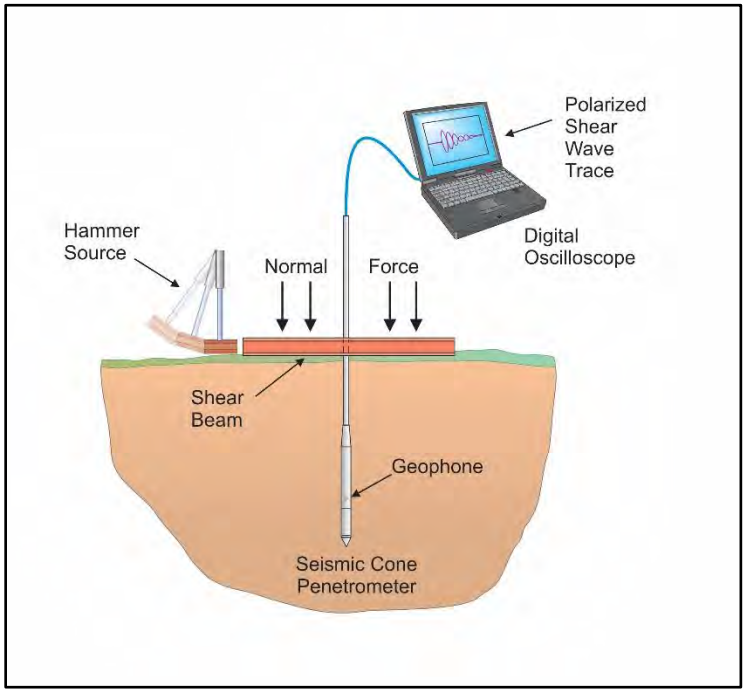


Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to ConeTec's SCPTu operating procedures which are in general accordance with the current ASTM 5778 and ASTM D7400 standards.

Prior to the start of a SCPTu sounding, the procedures described in the Cone Penetration Test section are followed. In addition, the active axis of the geophone is aligned parallel to the beam (or source) and the horizontal offset between the cone and the source is measured and recorded.

Prior to recording seismic waves at each test depth, cone penetration is stopped and the rods are decoupled from the rig to avoid transmission of rig energy down the rods. Typically, five wave traces for each orientation are recorded for quality control purposes and uncertainty analysis. After reviewing wave traces for consistency the cone is pushed to the next test depth (typically one meter intervals or as requested by the client). Figure SCPTu-2 presents an illustration of a SCPTu test.

For additional information on seismic cone penetration testing refer to Robertson et. al. (1986).

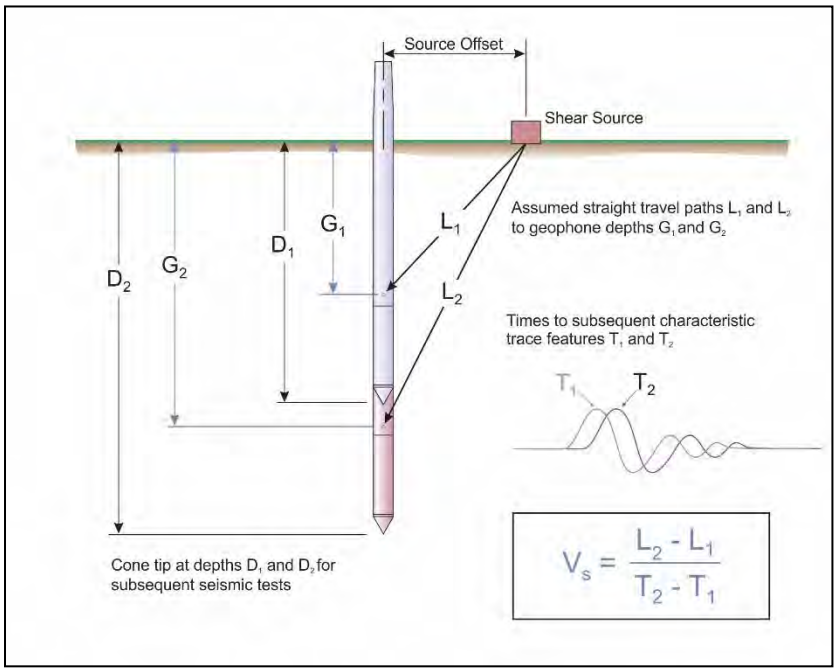


Figure SCPTu-2. Illustration of a seismic cone penetration test

Calculation of the interval velocities are performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the recorded wave sets and taking the difference in ray path divided by the time difference between subsequent features. Ray path is defined as the straight line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

The average shear wave velocity to a depth of 100 feet (30 meters) ($\bar{v}_s$) has been calculated and provided for all applicable soundings using the following equation presented in ASCE (2010).

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

where: $\bar{v}_s$ = average shear wave velocity ft/s (m/s)
d_i = the thickness of any layer between 0 and 100 ft (30 m)
v_{si} = the shear wave velocity in ft/s (m/s)
$\sum_{i=1}^{n} d_i$ = 100 ft (30 m)

Average shear wave velocity, $\bar{v}_s$ is also referenced to V_{s100} or V_{s30}.

The layer travel times refers to the travel times propagating in the vertical direction, not the measured travel times from an offset source.

Tabular results and SCPTu plots are presented in the relevant appendix.

References

American Society of Civil Engineers (ASCE), 2010, “Minimum Design Loads for Buildings and Other Structures”, Standard ASCE/SEI 7-10, American Society of Civil Engineers, ISBN 978-0-7844-1085-1, Reston, Virginia.

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM, West Conshohocken, US.

ASTM D7400-14, 2014, "Standard Test Methods for Downhole Seismic Testing", ASTM, West Conshohocken, US.

Robertson, P.K., Campanella, R.G., Gillespie D and Rice, A., 1986, “Seismic CPT to Measure In-Situ Shear Wave Velocity”, Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8: 791-803.

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

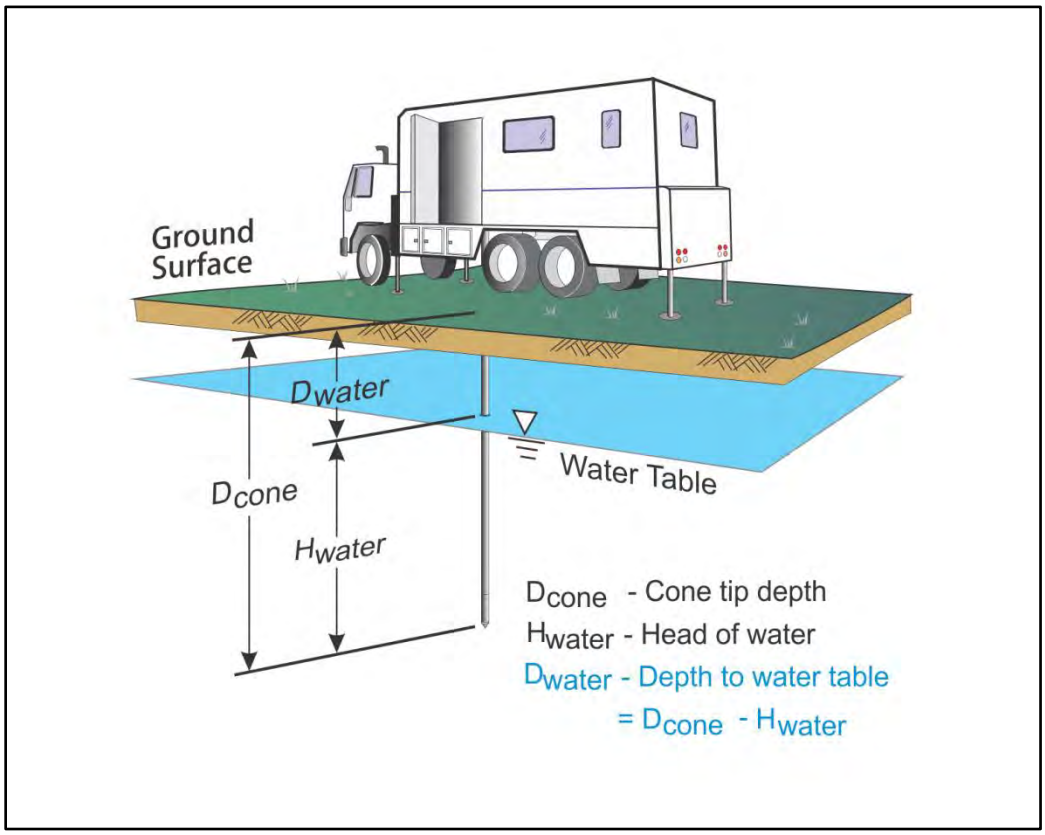


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behavior.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

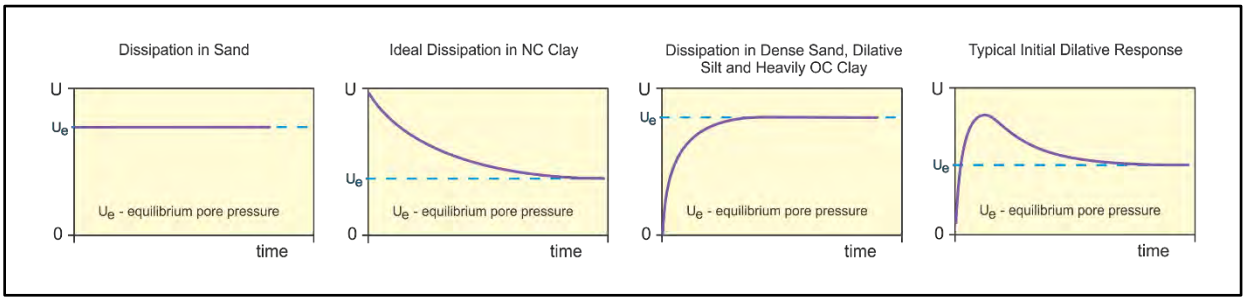


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve in Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby (1991))

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby (1991)), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

References

Burns, S.E. and Mayne, P.W., 1998, "Monotonic and dilatory pore pressure decay during piezocone tests", Canadian Geotechnical Journal 26 (4): 1063-1073.

Burns, S.E. and Mayne, P.W., 2002, "Analytical cavity expansion-critical state model cone dissipation in fine-grained soils", Soils & Foundations, Vol. 42(2): 131-137.

Jones, G.A. and Van Zyl, D.J.A., 1981, "The piezometer probe: a useful investigation tool", Proceedings, 10th International Conference on Soil Mechanics and Foundation Engineering, Vol. 3, Stockholm: 489-495.

Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G., 1992, "Estimating coefficient of consolidation from piezocone tests", Canadian Geotechnical Journal, 29(4): 551-557.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils", Canadian Geotechnical Journal, 36(2): 369-381.

Teh, C.I., and Houlsby, G.T., 1991, "An analytical study of the cone penetration test in clay", Geotechnique, 41(1): 17-34.

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Advanced Cone Penetration Test Plots with Ic, Su(Nkt), Phi and N1(60)Ic
- Seismic Cone Penetration Test Plots
- Seismic Cone Penetration Test Shear Wave (Vs) Traces
- Seismic Cone Penetration Test Tabular Results
- Soil Behavior Type (SBT) Scatter Plots
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

CONETEC

Job No: 23-53-25669
Client: Lahlaf Geotechnical
Project: Francis L Corrigan Sports Complex, Central Falls, RI
Start Date: 19-Apr-2023
End Date: 19-Apr-2023

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Shear Wave Velocity Tests	Northing[2] (m)	Easting[2] (m)	Refer to Notation Number
SCPT23-01	23-53-25669_SP01	19-Apr-2023	861:T1500F15U35	4.0	70.46	14	4639917	300708	
SCPT23-02	23-53-25669_SP02	19-Apr-2023	861:T1500F15U35	6.0	7.38		4639948	300650	3
SCPT23-03	23-53-25669_SP03	19-Apr-2023	861:T1500F15U35	6.4	91.94	19	4639931	300701	
SCPT23-04	23-53-25669_SP04	19-Apr-2023	861:T1500F15U35	6.6	100.06	8	4639972	300683	
Totals	4 soundings				269.85	41			

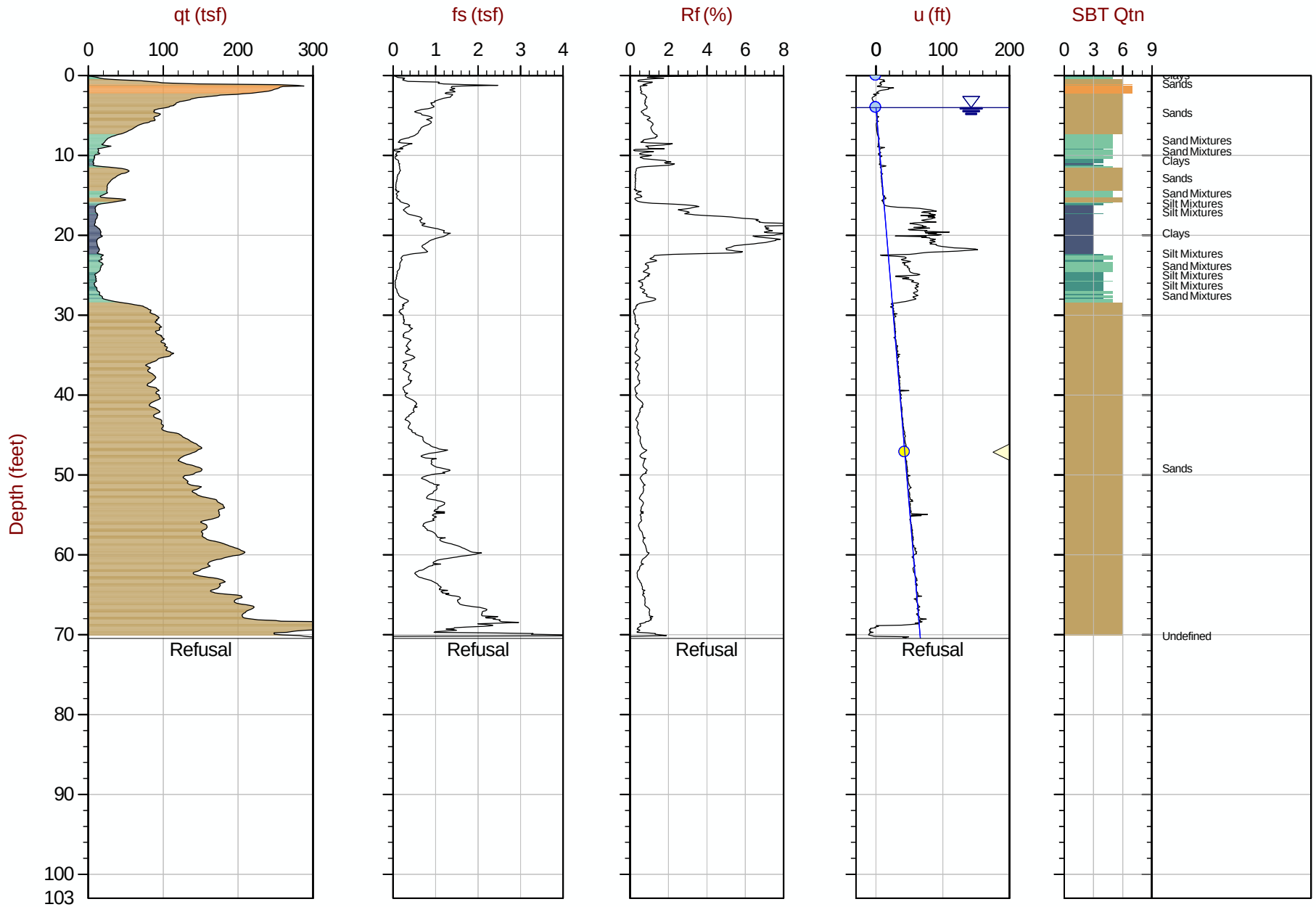
1. The assumed phreatic surface was based on pore pressure dissipation tests. Hydrostatic data were used for the calculated parameters.
2. Coordinates were acquired using a MR-350 GlobalSat GPS Receiver in datum: WGS84 / UTM Zone 19 North.
3. The assumed phreatic surface was estimated from the dynamic pore pressure data.

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 10:26
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-01
Cone: 861:T1500F15U35



Max Depth: 21.475 m / 70.46 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639917m E: 300708m

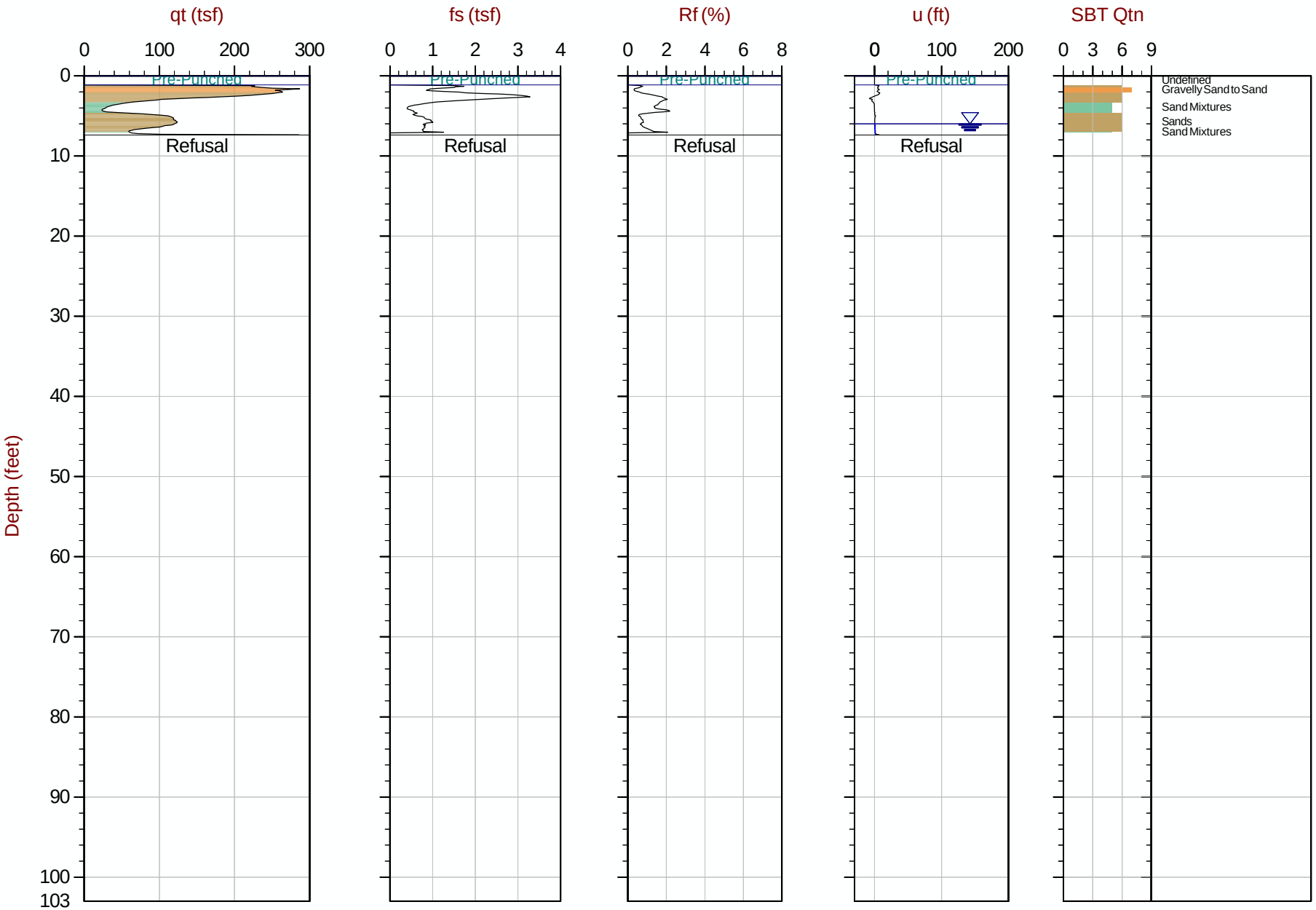
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 07:32
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-02
Cone: 861:T1500F15U35



Max Depth: 2.250 m / 7.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639948m E: 300650m

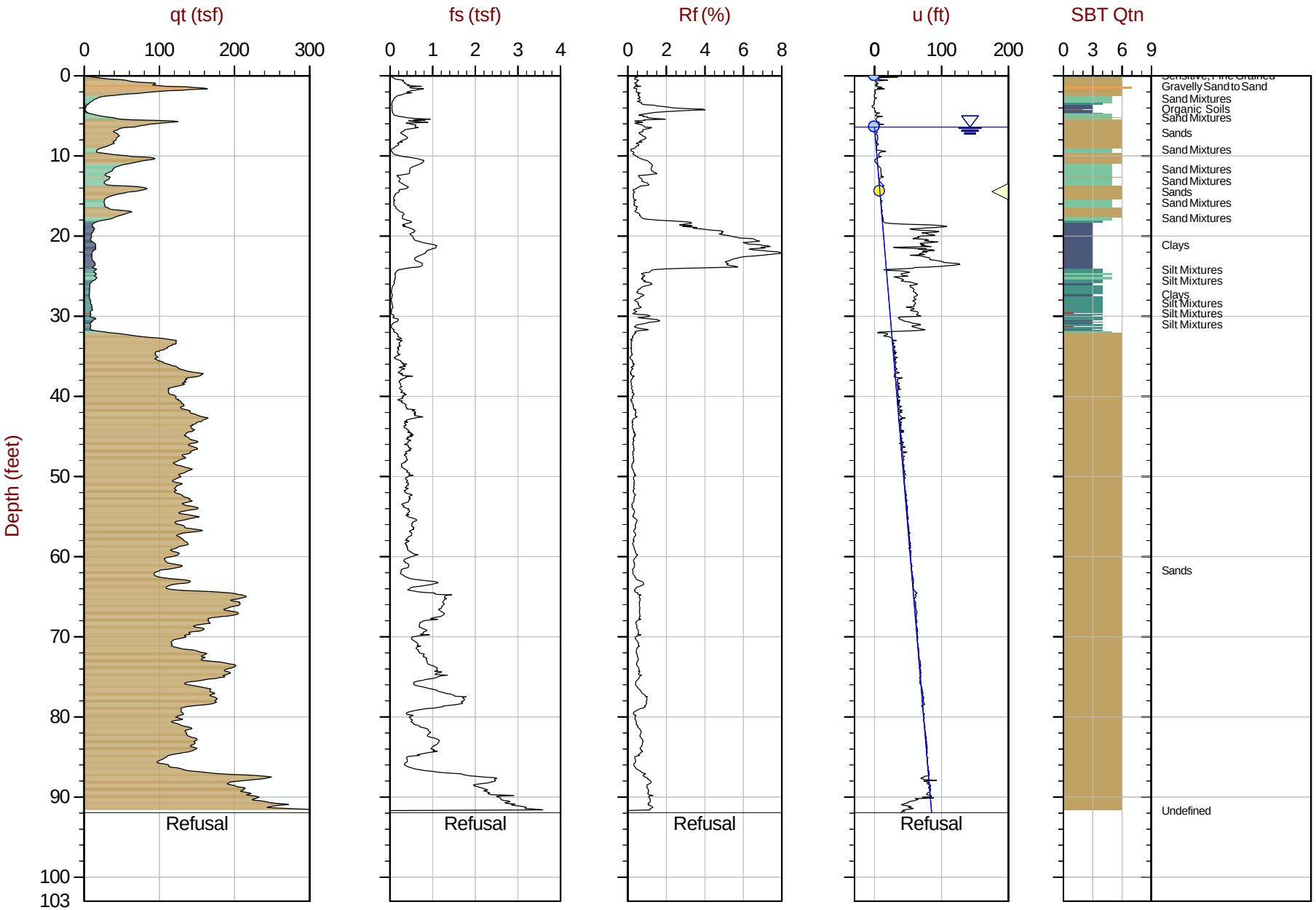
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 11:37
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-03
Cone: 861:T1500F15U35



Max Depth: 28.025 m / 91.94 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639931m E: 300701m

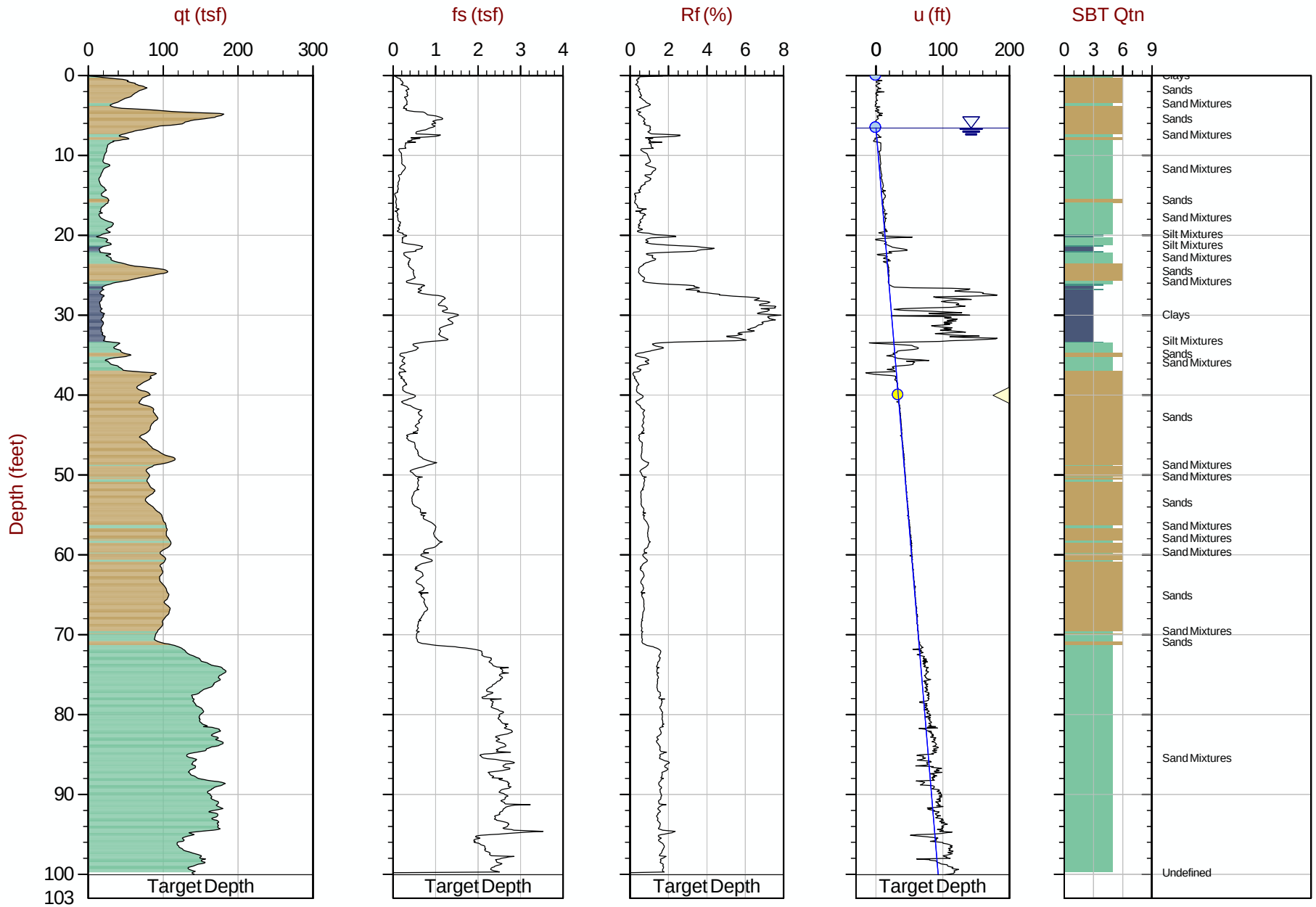
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 13:34
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-04
Cone: 861:T1500F15U35



Max Depth: 30.500 m / 100.06 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639972m E: 300683m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Advanced Cone Penetration Plots with Ic, Su(Nkt), Phi and N1(60)Ic

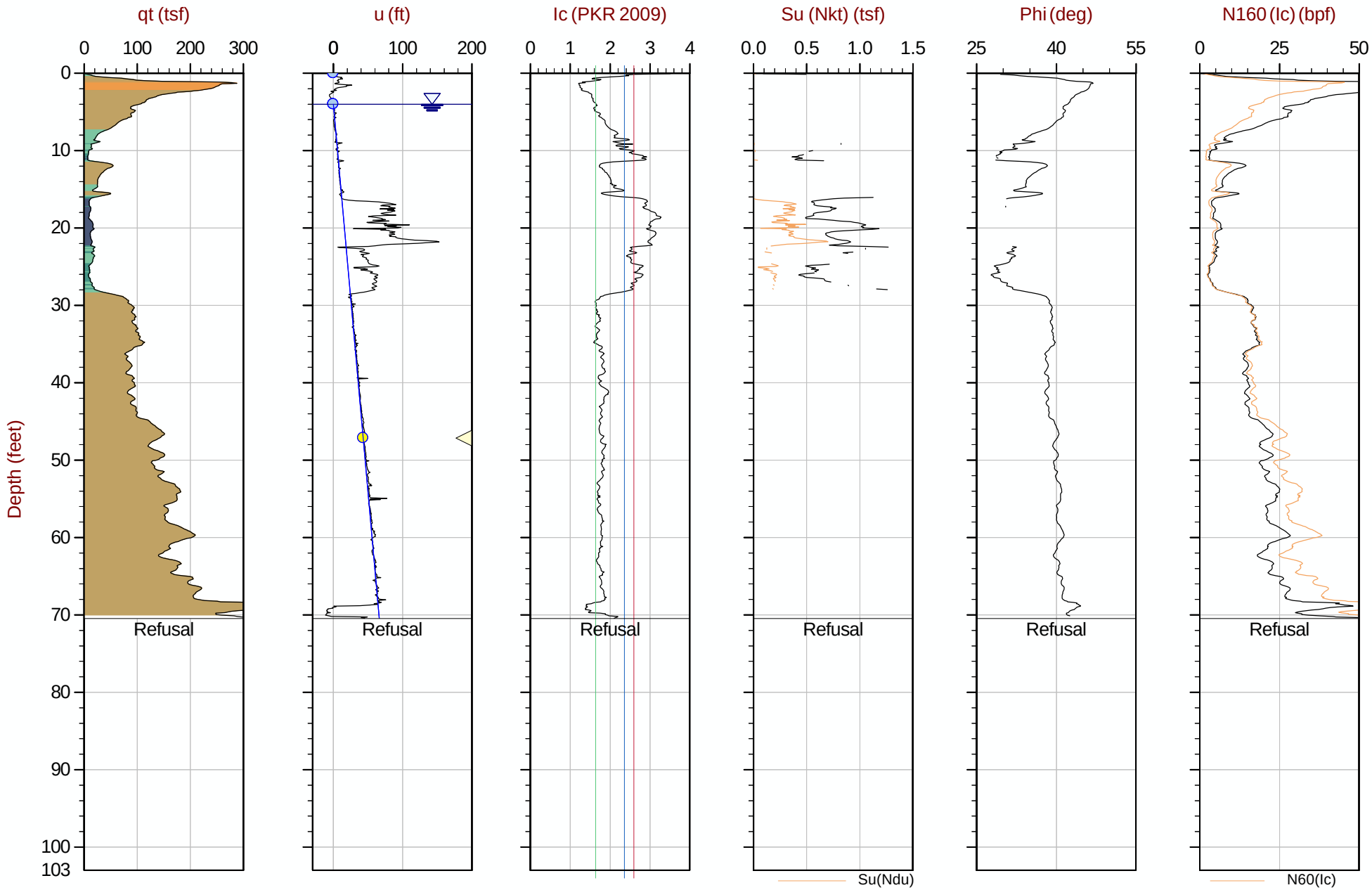
CONETEC

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 10:26
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-01
Cone: 861:T1500F15U35



Max Depth: 21.475 m / 70.46 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 6.0

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639917m E: 300708m

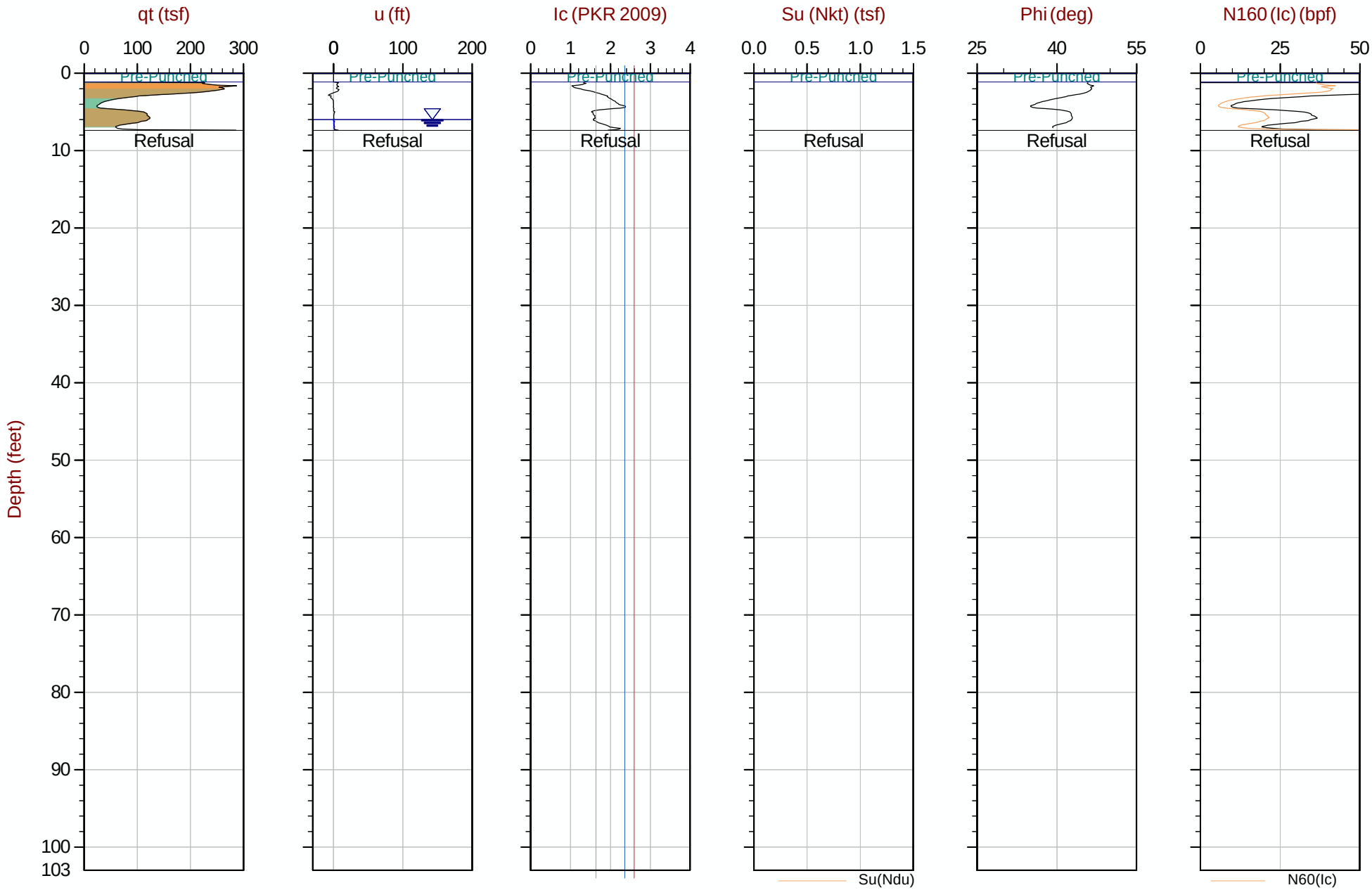
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 07:32
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-02
Cone: 861:T1500F15U35



Max Depth: 2.250 m / 7.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 6.0

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639948m E: 300650m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

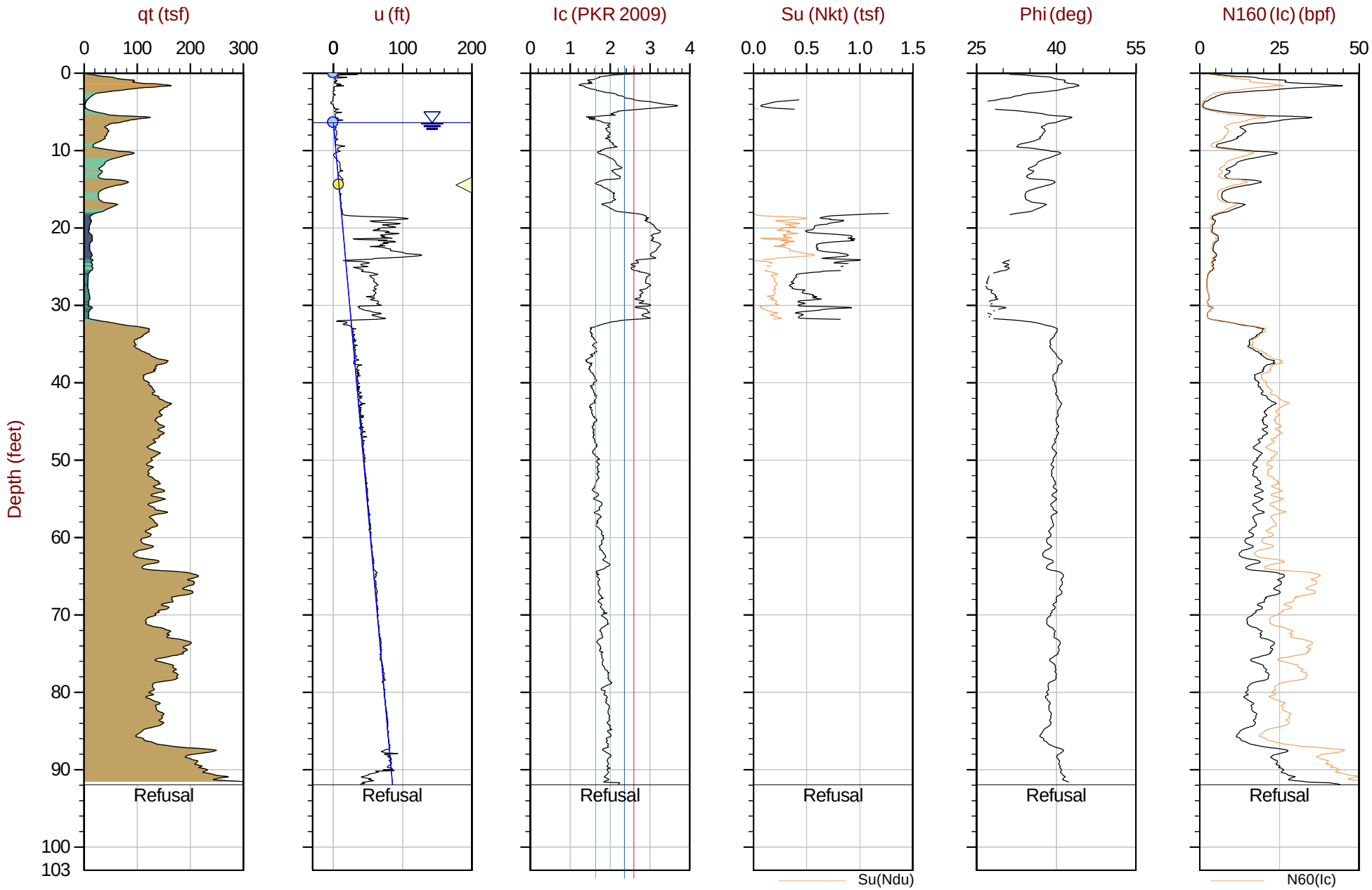
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 11:37
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-03
Cone: 861:T1500F15U35



Max Depth: 28.025 m / 91.94 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP03.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 6.0

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639931m E: 300701m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

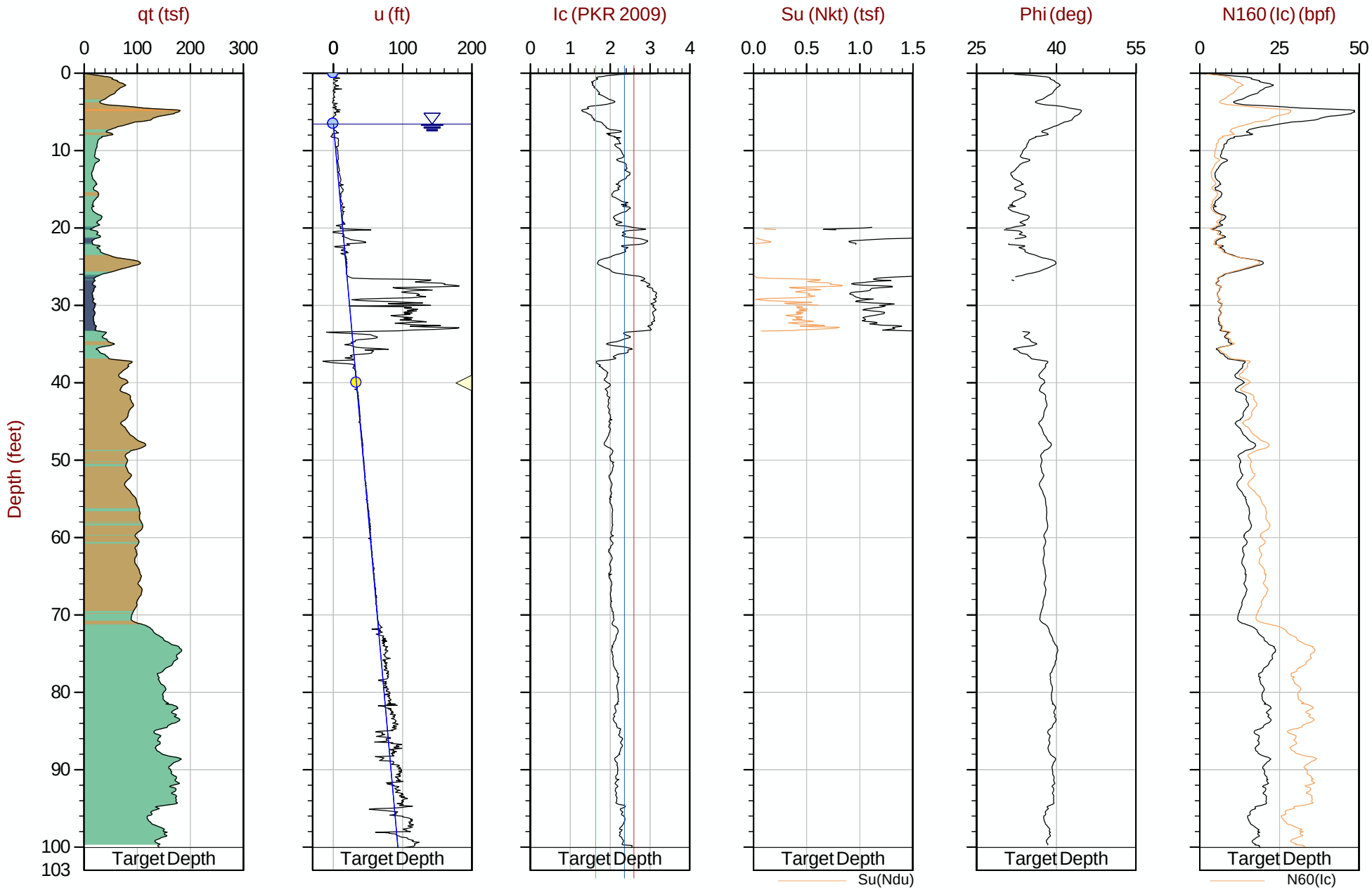
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 13:34
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-04
Cone: 861:T1500F15U35



Max Depth: 30.500 m / 100.06 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP04.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 6.0

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639972m E: 300683m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

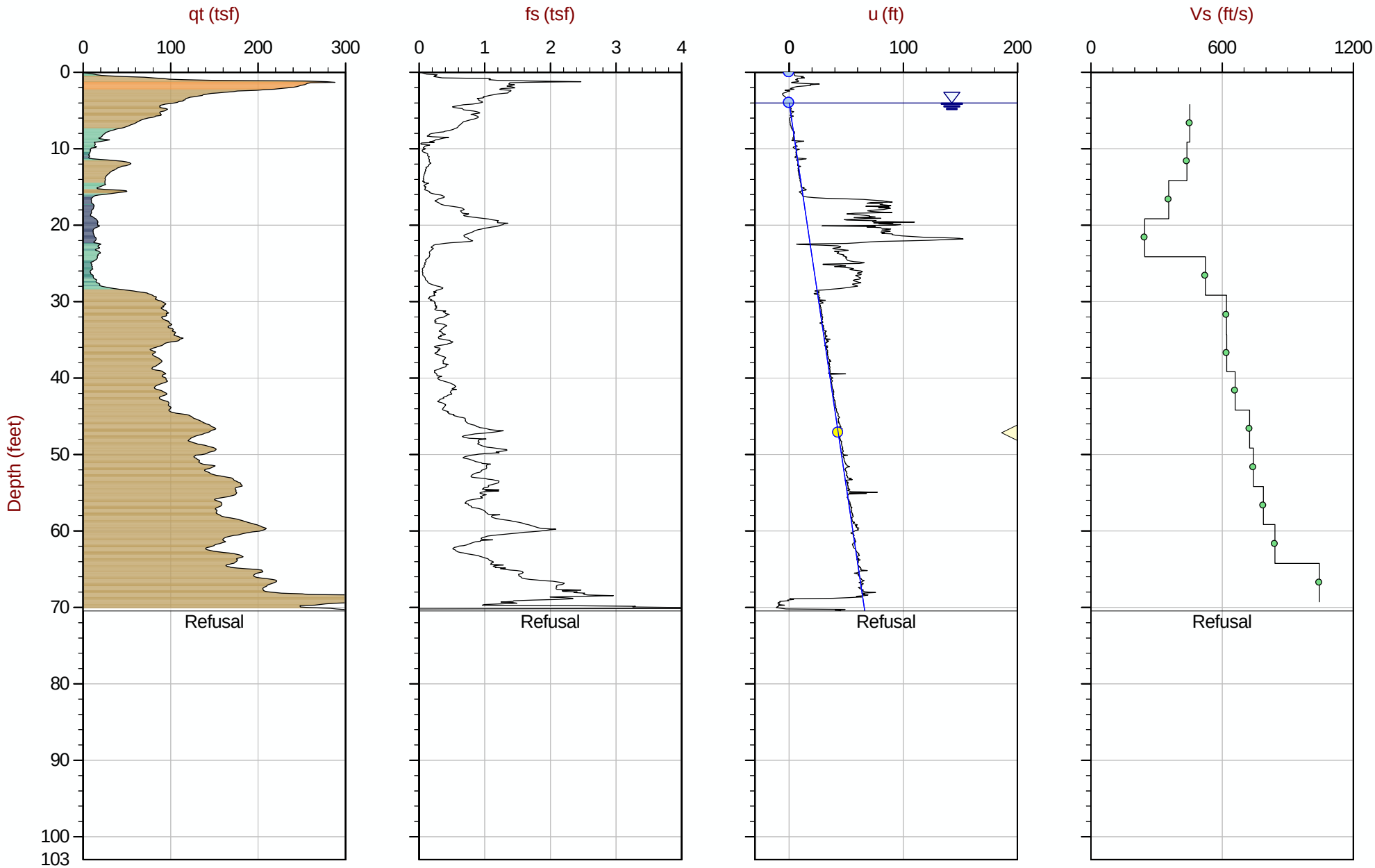
Seismic Cone Penetration Test Plots

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 10:26
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-01
Cone: 861:T1500F15U35



Max Depth: 21.475 m / 70.46 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639917m E: 300708m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

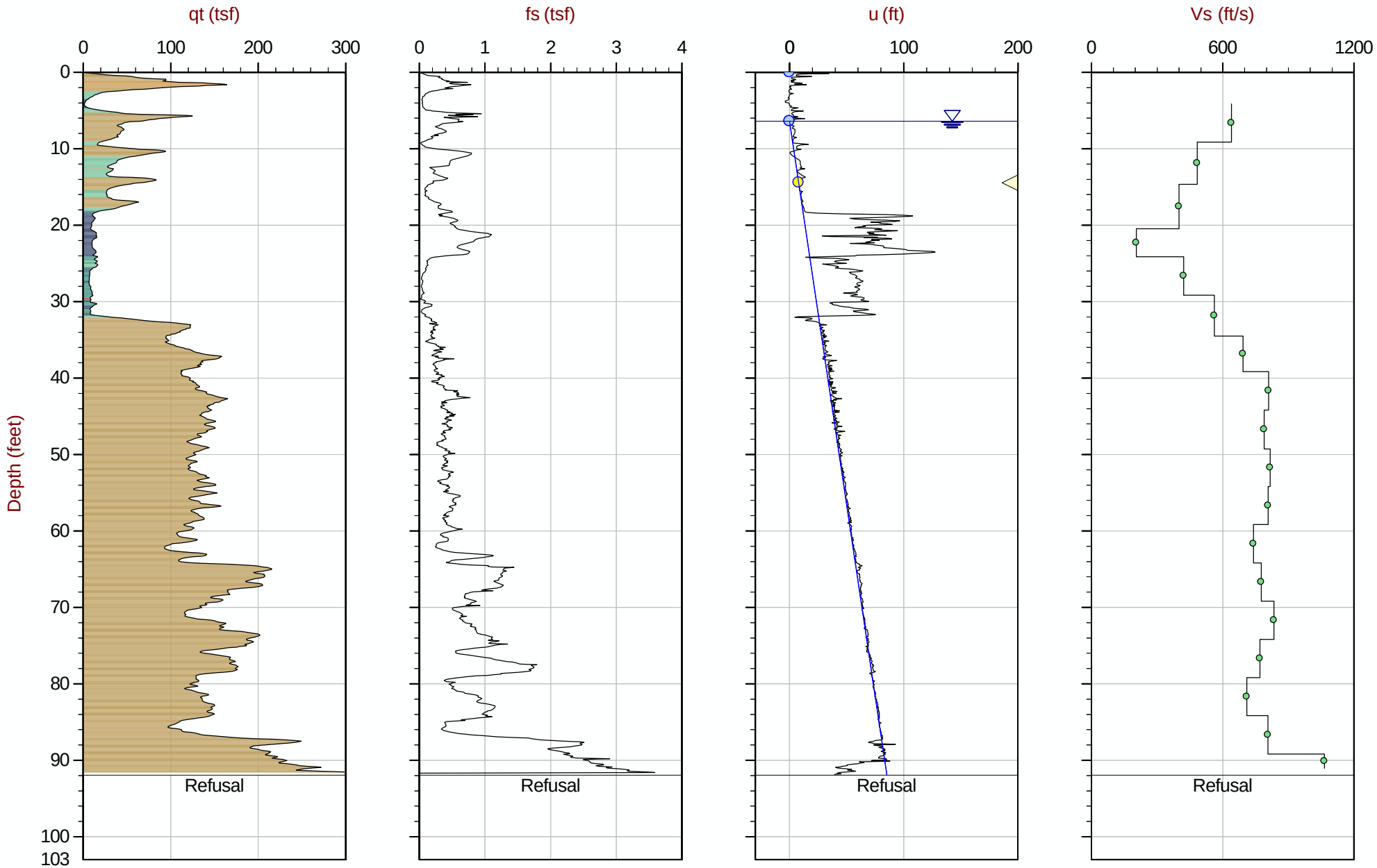
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 11:37
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-03
Cone: 861:T1500F15U35



Max Depth: 28.025 m / 91.94 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639931m E: 300701m

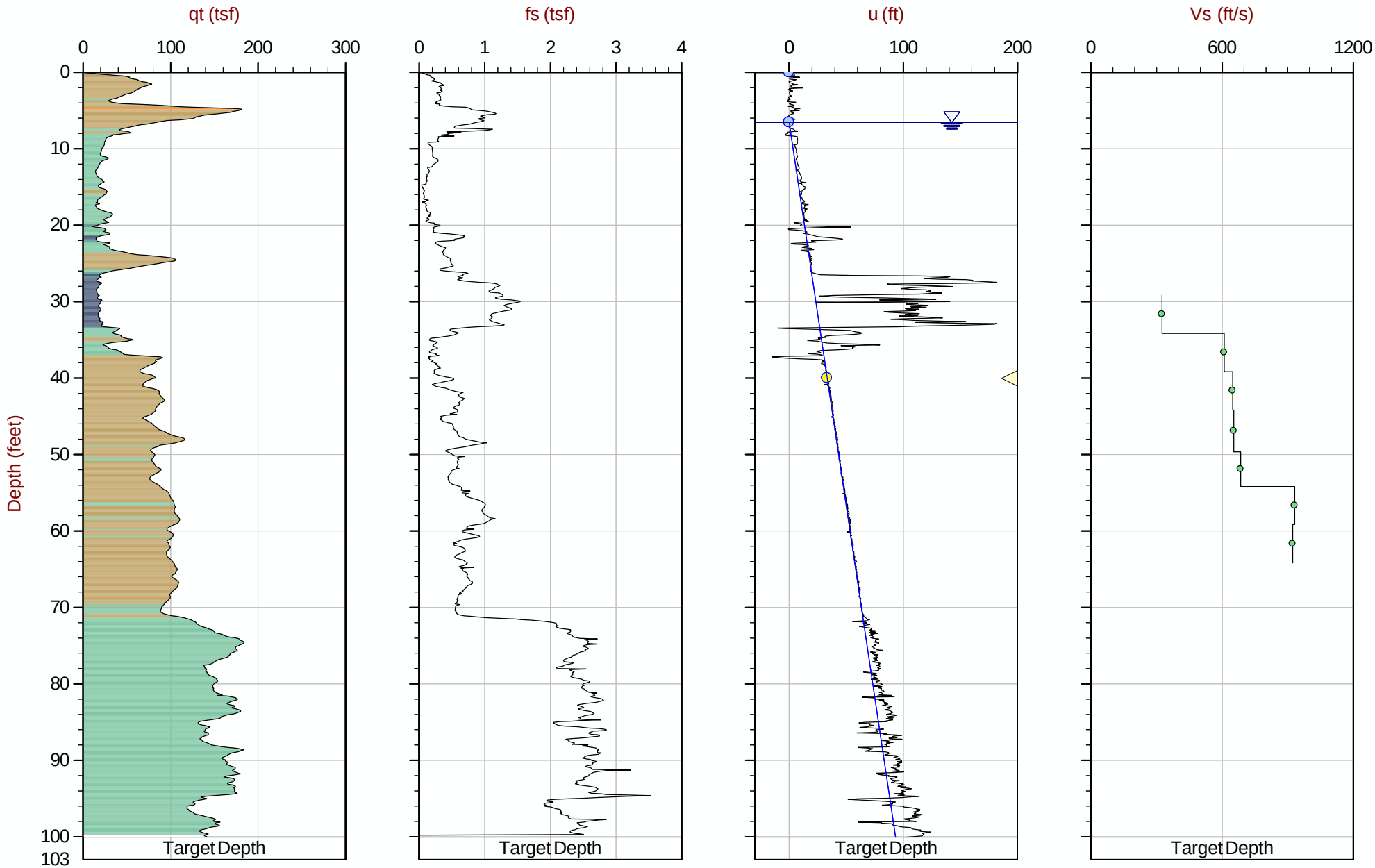
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 13:34
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-04
Cone: 861:T1500F15U35



Max Depth: 30.500 m / 100.06 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-53-25669_SP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM Zone 19 N: 4639972m E: 300683m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Shear Wave (Vs) Traces

CONETEC

CONETEC

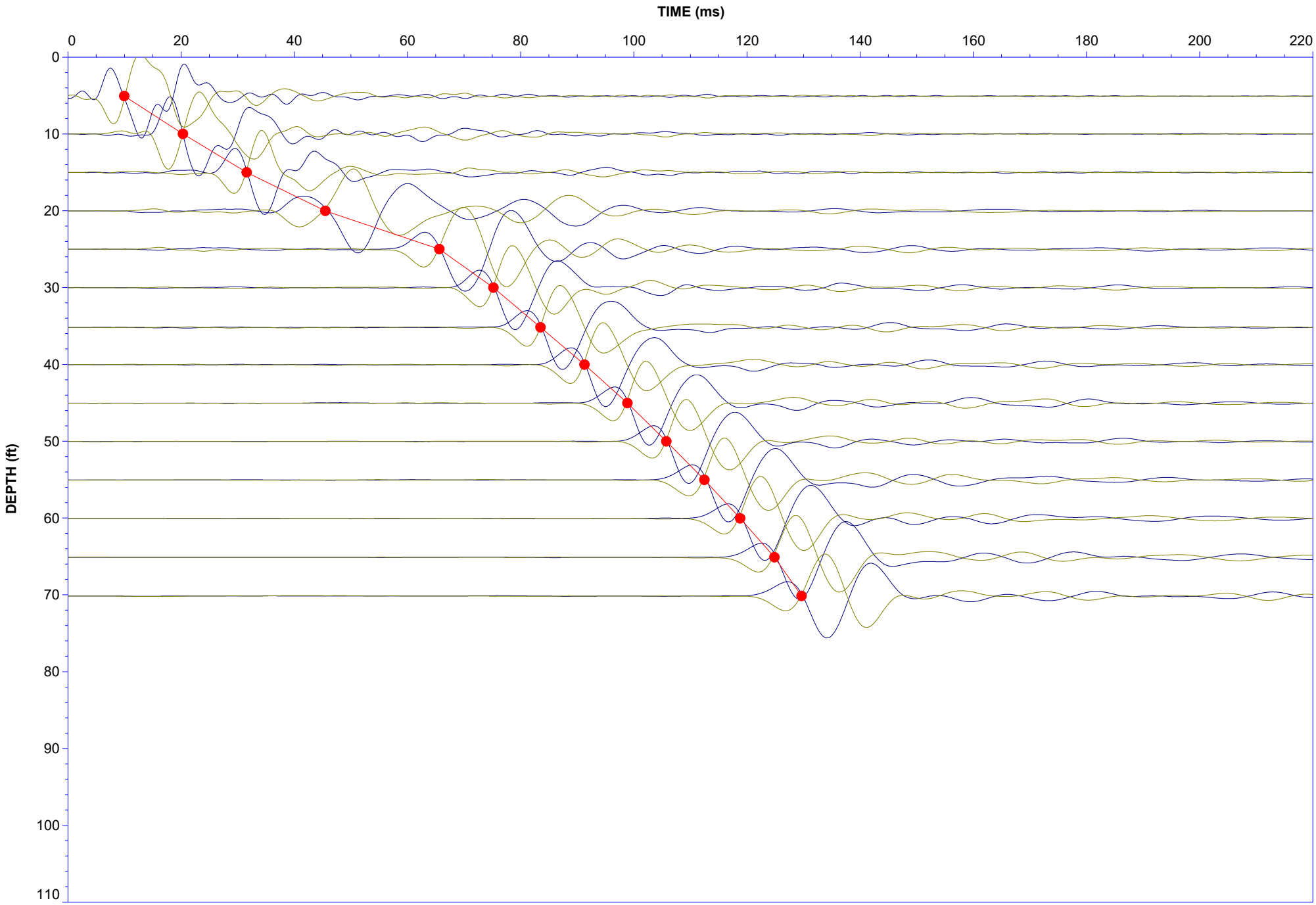
Job No: 23-53-25669
Date: 19-Apr-2023

Client: Lahlaf Geotechnical

Project: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-01

Filter: 0-250Hz



CONETEC

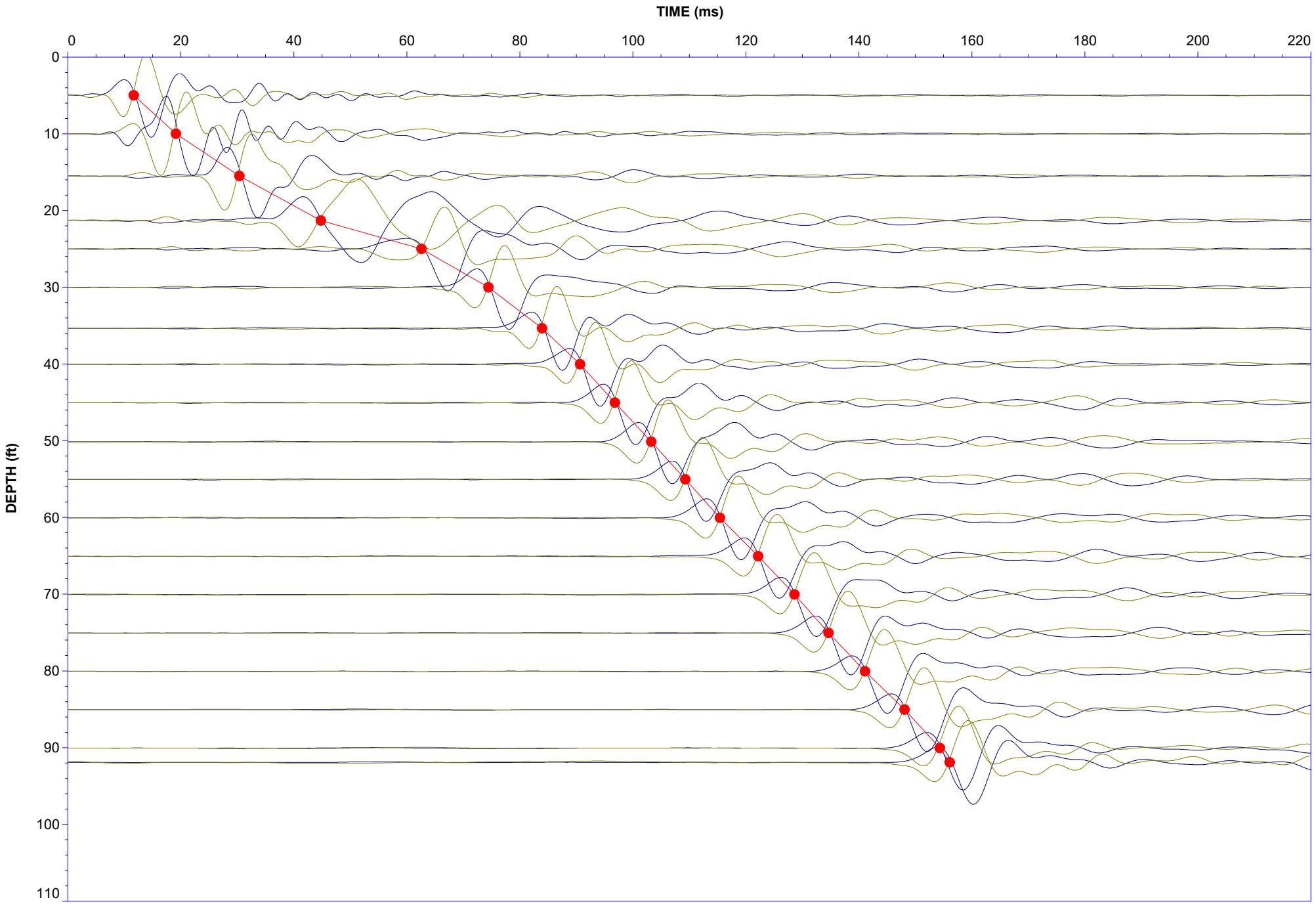
Job No: 23-53-25669
Date: 19-Apr-2023

Client: Lahlaf Geotechnical

Project: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-03

Filter: 0-250Hz



CONETEC

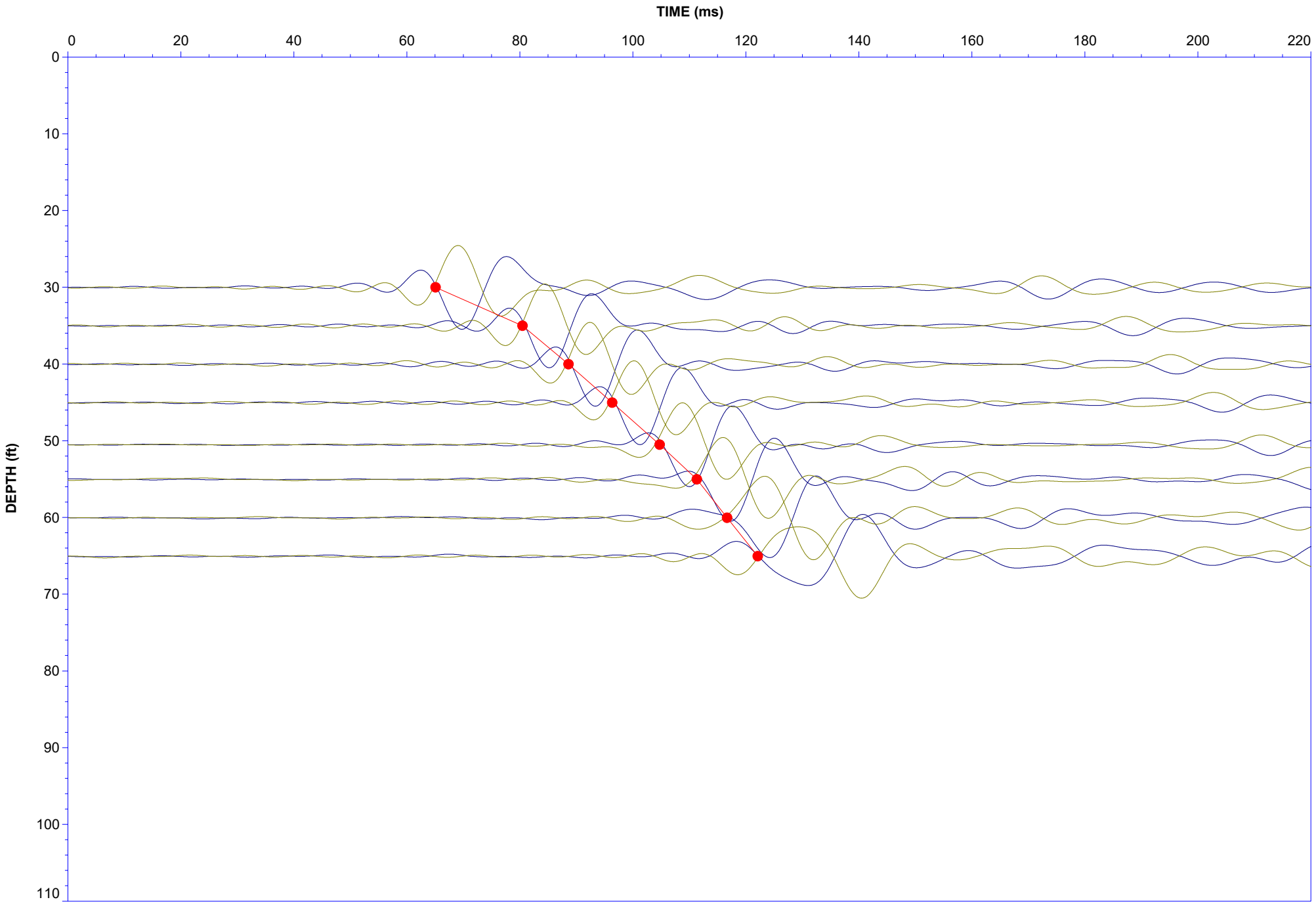
Job No: 23-53-25669
Date: 19-Apr-2023

Client: Lahlaf Geotechnical

Project: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-04

Filter: 10-100Hz



Seismic Cone Penetration Test Tabular Results

CONETEC

Job No:	23-53-25669
Client:	Lahlaf Geotechnical
Project:	Francis L Corrigan Sports Complex, Central Falls, RI
Sounding ID:	SCPT23-01
Date:	19-Apr-2023
Seismic Source:	Beam
Seismic Offset (ft):	1.97
Source Depth (ft):	0.00
Geophone Offset (ft):	0.85

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
5.09	4.23	4.67			
10.01	9.15	9.36	4.70	10.37	453
15.03	14.17	14.31	4.95	11.26	439
20.01	19.16	19.26	4.95	13.92	356
25.00	24.15	24.23	4.97	20.14	247
30.02	29.17	29.23	5.01	9.56	523
35.20	34.35	34.41	5.17	8.33	621
40.03	39.17	39.22	4.82	7.75	621
45.05	44.19	44.24	5.01	7.60	660
50.03	49.18	49.22	4.98	6.86	726
55.05	54.20	54.24	5.02	6.75	744
60.04	59.19	59.22	4.98	6.32	789
65.13	64.27	64.30	5.08	6.04	841
70.14	69.29	69.32	5.02	4.80	1045

Job No:	23-53-25669
Client:	Lahlaf Geotechnical
Project:	Francis L Corrigan Sports Complex, Central Falls, RI
Sounding ID:	SCPT23-03
Date:	19-Apr-2023
Seismic Source:	Beam
Seismic Offset (ft):	1.97
Source Depth (ft):	0.00
Geophone Offset (ft):	0.85

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.99	4.13	4.58			
10.01	9.15	9.36	4.78	7.47	641
15.52	14.67	14.80	5.43	11.23	484
21.33	20.47	20.57	5.77	14.41	401
25.00	24.15	24.23	3.66	17.81	206
30.02	29.17	29.23	5.01	11.86	422
35.37	34.51	34.57	5.34	9.49	563
40.03	39.17	39.22	4.65	6.71	693
45.05	44.19	44.24	5.01	6.19	811
50.13	49.28	49.32	5.08	6.43	790
55.05	54.20	54.24	4.92	6.01	818
60.04	59.19	59.22	4.98	6.17	809
65.06	64.21	64.24	5.02	6.77	742
70.05	69.19	69.22	4.99	6.41	777
75.07	74.21	74.24	5.02	6.01	834
80.05	79.20	79.22	4.99	6.47	771
85.04	84.19	84.21	4.99	7.02	711
90.06	89.21	89.23	5.02	6.22	808
91.93	91.08	91.10	1.87	1.75	1066

Job No:	23-53-25669
Client:	Lahlaf Geotechnical
Project:	Francis L Corrigan Sports Complex, Central Falls, RI
Sounding ID:	SCPT23-04
Date:	19-Apr-2023
Seismic Source:	Beam
Seismic Offset (ft):	1.97
Source Depth (ft):	0.00
Geophone Offset (ft):	0.85

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
30.02	29.17	29.23			
35.04	34.19	34.24	5.01	15.37	326
40.03	39.17	39.22	4.98	8.16	611
45.05	44.19	44.24	5.01	7.73	648
50.53	49.67	49.71	5.47	8.37	654
55.05	54.20	54.24	4.52	6.60	686
60.04	59.19	59.22	4.98	5.35	932
65.06	64.21	64.24	5.02	5.43	924

Soil Behavior Type (SBT) Scatter Plots

CONETEC

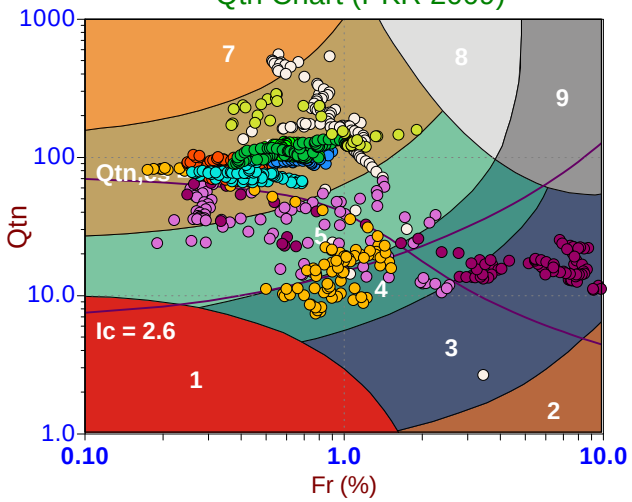
CONETEC

Lahlaf Geotechnical

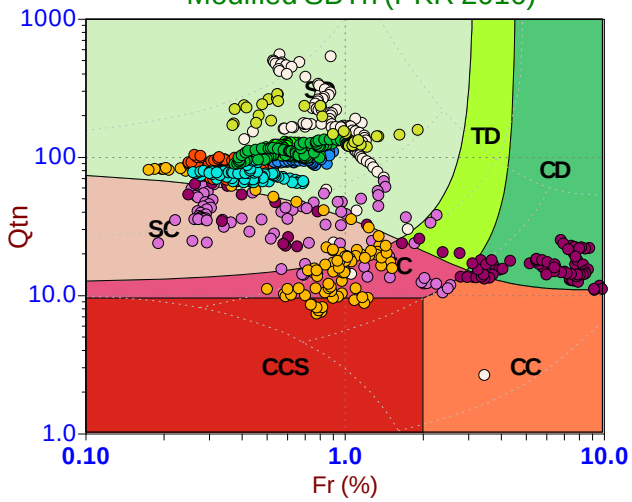
Job No: 23-53-25669
Date: 2023-04-19 10:26
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-01
Cone: 861:T1500F15U35

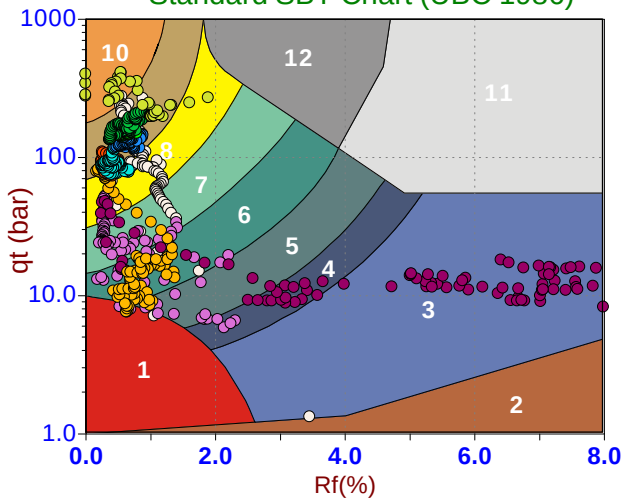
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



Depth Ranges

- >0.0 to 7.5 ft
- >7.5 to 15.0 ft
- >15.0 to 22.5 ft
- >22.5 to 30.0 ft
- >30.0 to 37.5 ft
- >37.5 to 45.0 ft
- >45.0 to 52.5 ft
- >52.5 to 60.0 ft
- >60.0 to 67.5 ft
- >67.5 to 75.0 ft
- >75.0 ft

Legend

- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend

- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Legend

- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

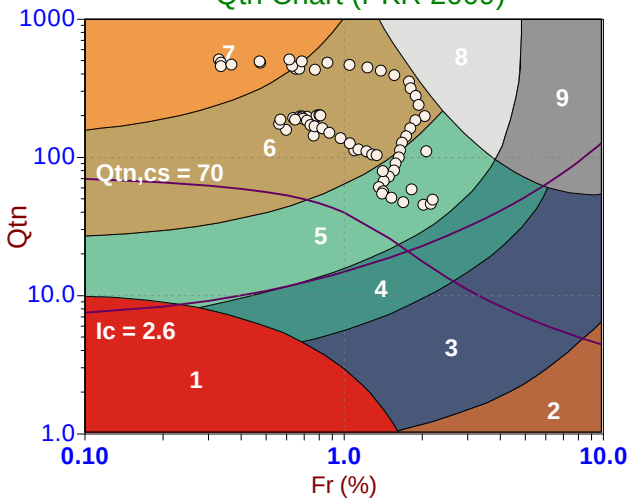
CONETEC

Lahlaf Geotechnical

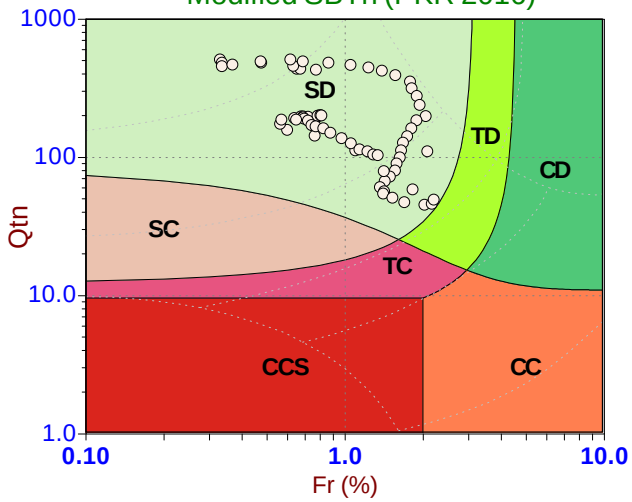
Job No: 23-53-25669
Date: 2023-04-19 07:32
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-02
Cone: 861:T1500F15U35

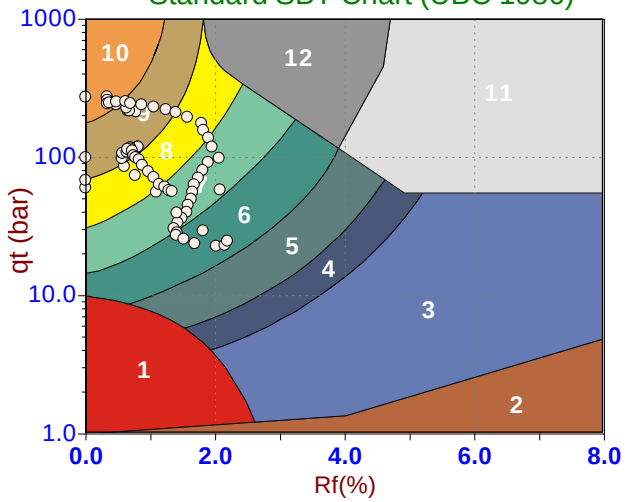
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



Depth Ranges

- >0.0 to 7.5 ft
- >7.5 to 15.0 ft
- >15.0 to 22.5 ft
- >22.5 to 30.0 ft
- >30.0 to 37.5 ft
- >37.5 to 45.0 ft
- >45.0 to 52.5 ft
- >52.5 to 60.0 ft
- >60.0 to 67.5 ft
- >67.5 to 75.0 ft
- >75.0 ft

Legend

- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend

- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Legend

- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

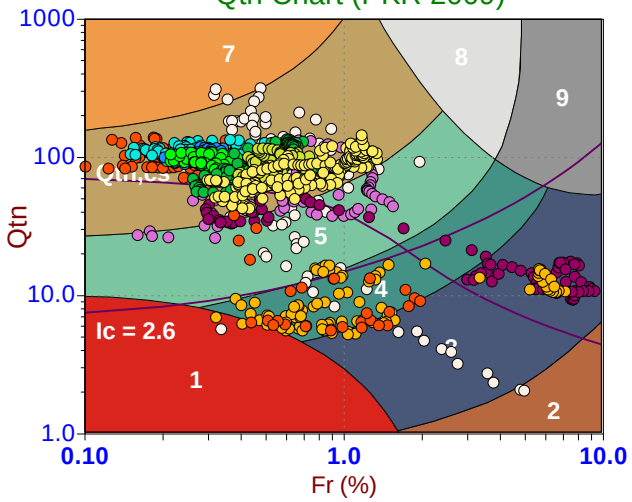
CONETEC

Lahlaf Geotechnical

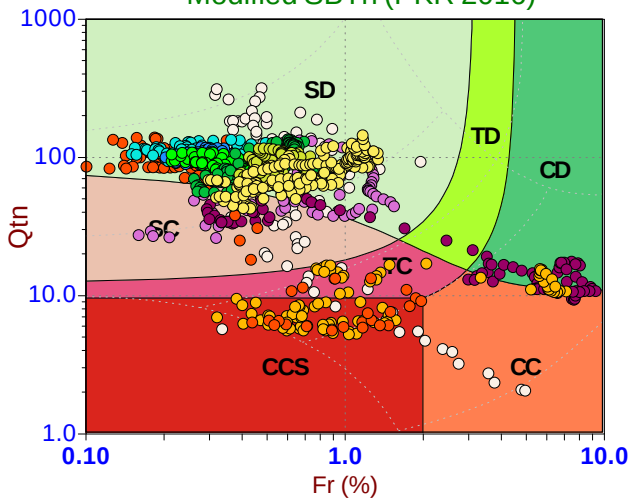
Job No: 23-53-25669
Date: 2023-04-19 11:37
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-03
Cone: 861:T1500F15U35

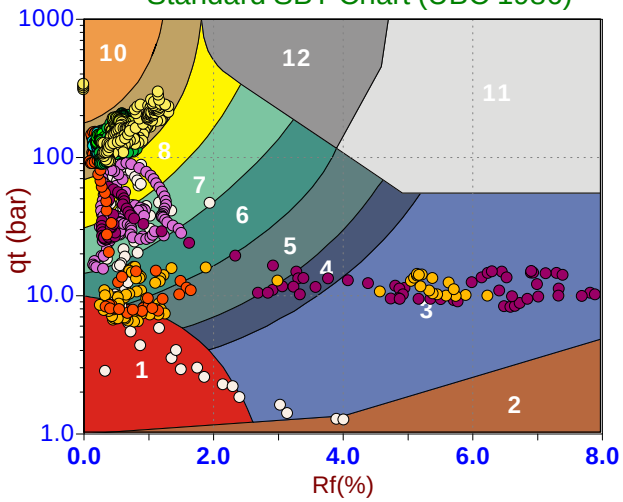
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



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- >0.0 to 7.5 ft
- >7.5 to 15.0 ft
- >15.0 to 22.5 ft
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- >30.0 to 37.5 ft
- >37.5 to 45.0 ft
- >45.0 to 52.5 ft
- >52.5 to 60.0 ft
- >60.0 to 67.5 ft
- >67.5 to 75.0 ft
- >75.0 ft

Legend

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- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

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- Silty Clay
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- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

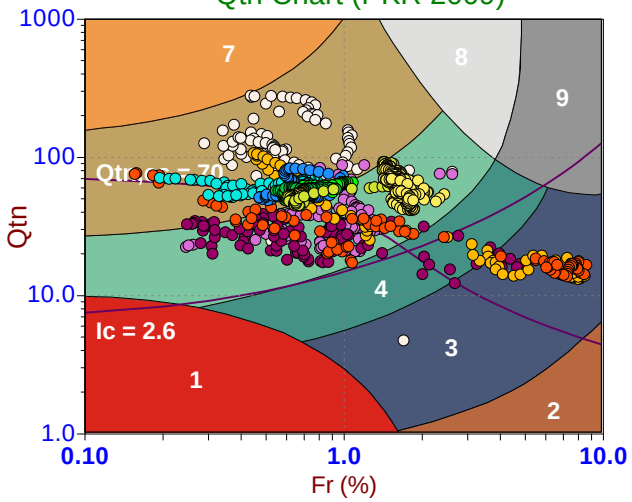
CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 2023-04-19 13:34
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-04
Cone: 861:T1500F15U35

Qtn Chart (PKR 2009)



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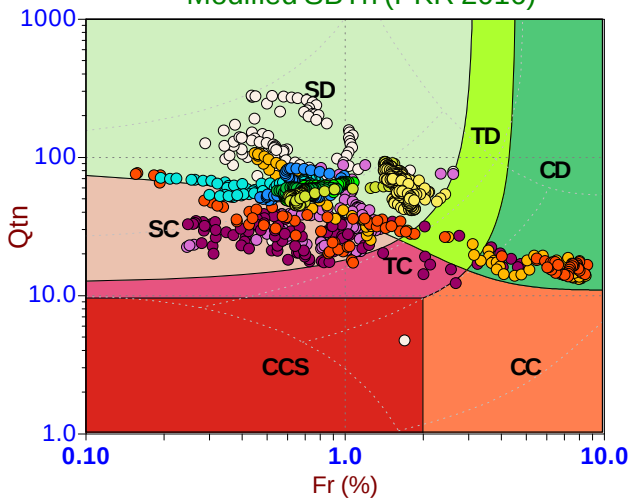
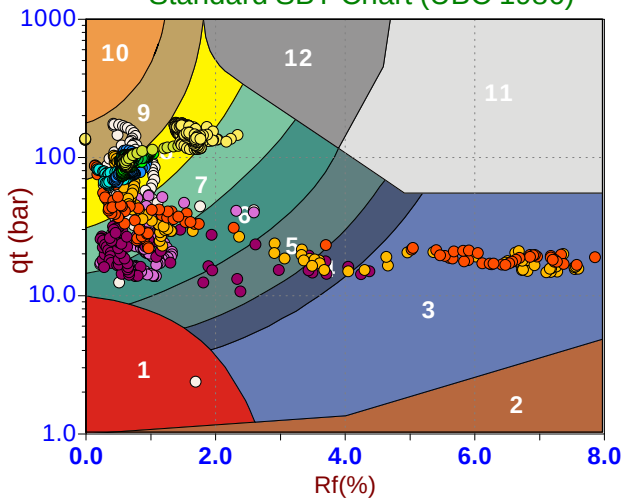


Standard SBT Chart (UBC 1986)



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- >52.5 to 60.0 ft
- >60.0 to 67.5 ft
- >67.5 to 75.0 ft
- >75.0 ft

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- Silt Mixtures
- Sand Mixtures
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- Gravelly Sand to Sand
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- Very Stiff Fine Grained

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- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Job No:	23-53-25669
Client:	Lahlaf Geotechnical
Project:	Francis L Corrigan Sports Complex, Central Falls, RI
Start Date:	19-Apr-2023
End Date:	19-Apr-2023

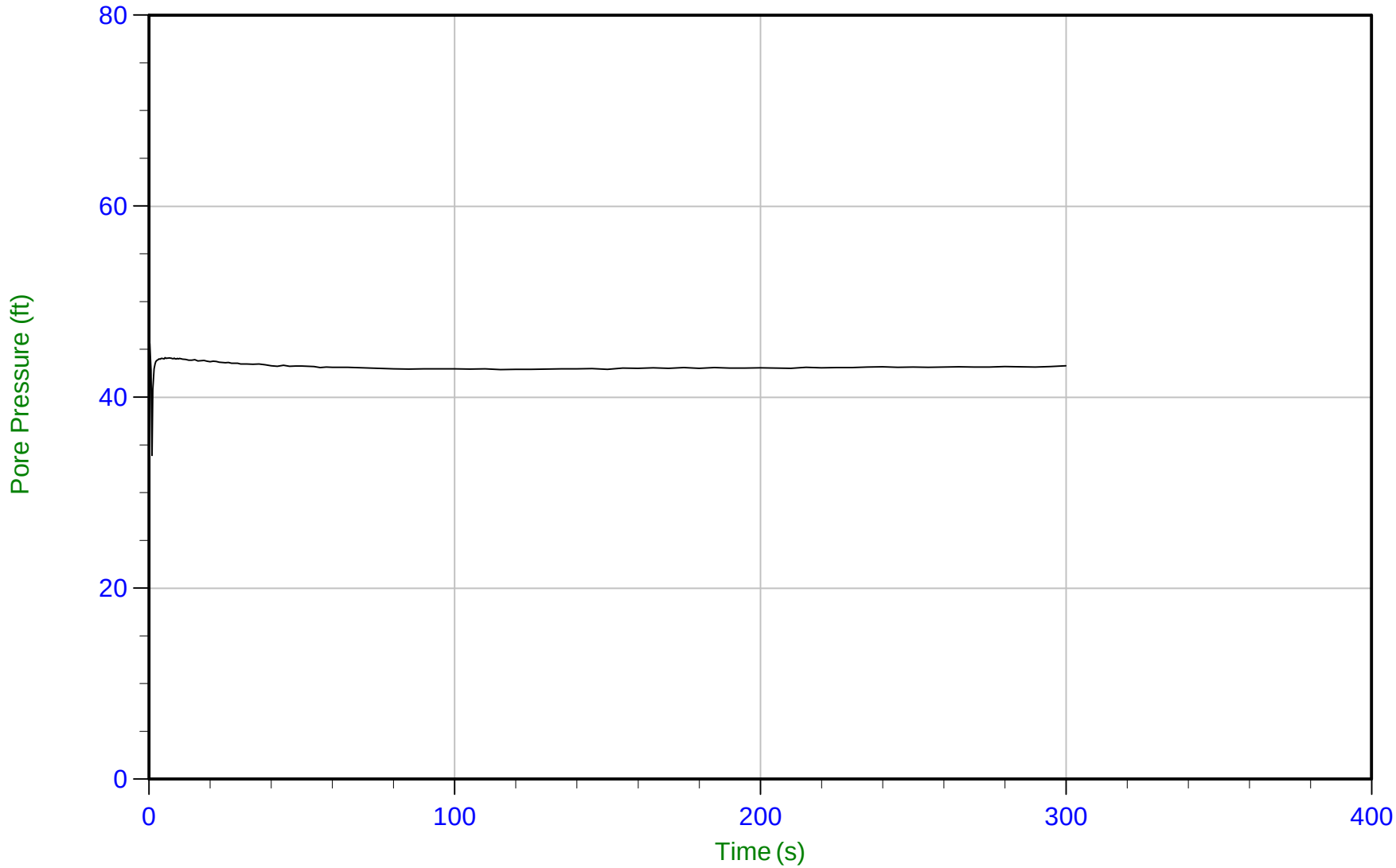
CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)
SCPT23-01	23-53-25669_SP01	15	300	47.16	43.1	4.0
SCPT23-03	23-53-25669_SP03	15	305	14.44	8.0	6.4
SCPT23-04	23-53-25669_SP04	15	435	40.03	33.5	6.6
Total Duration	3 dissipations		17.3 min			

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669 Sounding: SCPT23-01
Date: 04/19/2023 10:26 Cone: 861:T1500F15U35 Area=15 cm²
Site: Francis L Corrigan Sports Complex, Central Falls, RI



Trace Summary:

Filename: 23-53-25669_SP01.PPF2
Depth: 14.375 m / 47.162 ft
Duration: 300.0 s

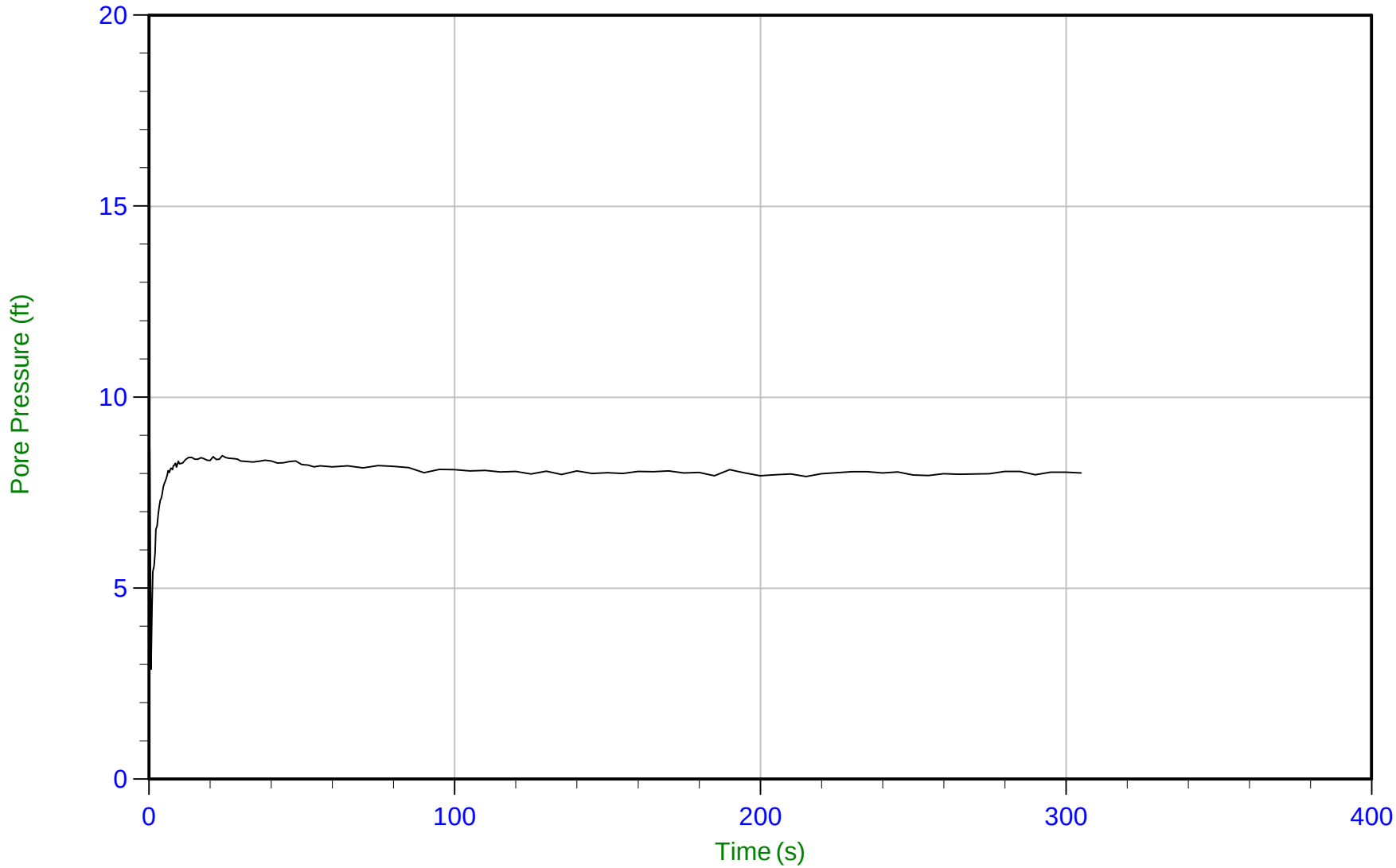
u Min: 33.9 ft
u Max: 45.7 ft
u Final: 43.3 ft

WT: 1.225 m / 4.020 ft
Ueq: 43.1 ft

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669 Sounding: SCPT23-03
Date: 04/19/2023 11:37 Cone: 861:T1500F15U35 Area=15 cm²
Site: Francis L Corrigan Sports Complex, Central Falls, RI



Trace Summary:

Filename: 23-53-25669_SP03.PPF2
Depth: 4.400 m / 14.436 ft
Duration: 305.0 s

u Min: 2.9 ft
u Max: 8.9 ft
u Final: 8.0 ft

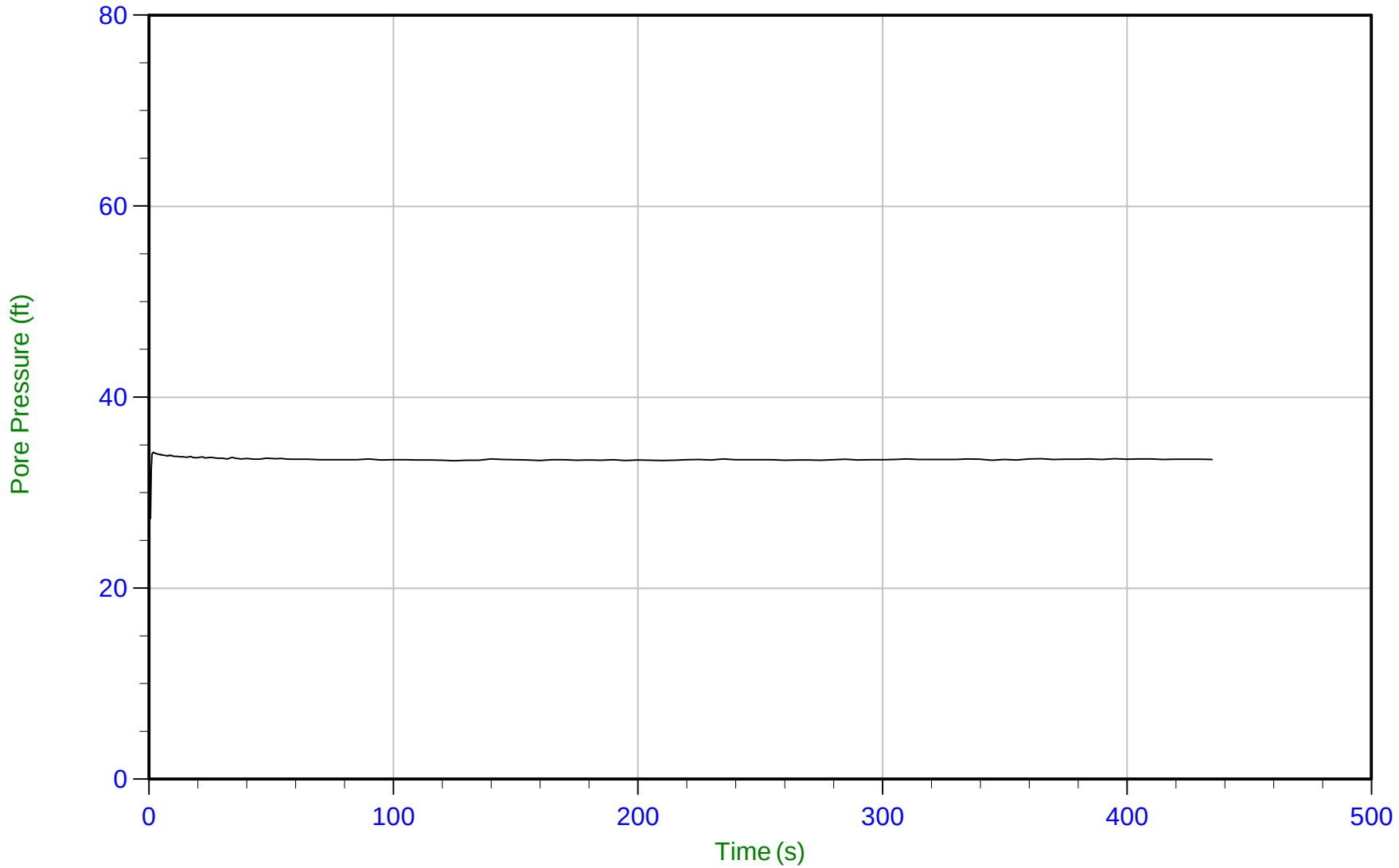
WT: 1.954 m / 6.410 ft
Ueq: 8.0 ft

CONETEC

Lahlaf Geotechnical

Job No: 23-53-25669
Date: 04/19/2023 13:34
Site: Francis L Corrigan Sports Complex, Central Falls, RI

Sounding: SCPT23-04
Cone: 861:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 23-53-25669_SP04.PPF2
Depth: 12.200 m / 40.026 ft
Duration: 435.0 s

u Min: 27.3 ft
u Max: 34.3 ft
u Final: 33.5 ft

WT: 2.001 m / 6.565 ft
Ueq: 33.5 ft

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