



THE SCHOOL DISTRICT OF
PHILADELPHIA

**BOARD OF EDUCATION
Office of Capital Programs
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Addendum No. 002

**Subject: Rhawnhurst Elementary School- Additions and Renovations
SDP Contracts No. B-070, B-071, B-072 and B-073 of 2019/20**

**Location: Rhawnhurst Elementary School
7809 Castor Avenue
Philadelphia, Pennsylvania 19152**

This Addendum, dated March 23, 2021 shall modify and become part of the Contract Documents for the work of this project. Any items not mentioned herein, or affected by, shall be performed strictly in accordance with the original documents.

ATTENTION ALL BIDDERS – IMPORTANT NOTICE

- 1. The Bid DUE DATE has been extended to: Tuesday, April 6, 2021.**
- 2. The following clarifications and additions are being issued for the specifications and plans:**
- 3. Questions and Answers follow clarifications and additions.**

ARCHITECTURAL SPECIFICATIONS

SECTION 033000 – BUILDING CAST-IN-PLACE CONCRETE

1. ADD 2.5.G.1.a as follows:

1. MVRA 900 moisture reduction admixture by ISE Loqik Industries, Inc. shall be an accepted equal to the basis of design.

SECTION 071416 – COLD FLUID-APPLIED WATERPROOFING

2. REVISE 2.2.A.1.c as follows:

2. Meadows, W.R., Inc.; HYDRALASTIC 836 & HYDRALASTIC SL

SECTION 099123 PAINTING

1. REVISE 2.1.B.4

4. Glidden to PPG.

SECTION 101112 -SPECIALTY BUILDING PRODUCTS

1. ADD 2.1.A.1.c. as follows

- c. Kiln shall be 208v, 1 phase to coordinate with power shown on electrical drawings.

MECHANICAL SPECIFICATIONS

SECTION 230900 ATC Systems

1. REPLACE with the attached section.

SECTION 230835 HVAC Equip

2. ADD paragraph 2.11 as follows:

2.1 BIPOLAR IONIZATION AIR PURIFICATION

- A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be manufactured by Plasma Air International (www.plasma-air.com).

2.2 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA

- A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator with bipolar ionization output as described here within.
- B. The Bi-polar Ionization system shall be capable of:
 1. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
 2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
 3. Reducing space static charges.
 4. Reducing space particle counts.
 5. When mounted to the air entering side of a cooling coil, keep the cooling coil free

from pathogen and mold growth.

6. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:

1. MS2 Bacteriophage (COVID):	99.0% in 10 minutes or less
2. MRSA:	99.5% in 60 minutes or less
3. E. Coli:	99.4% in 30 minutes or less
4. H1N1:	86.6% in 60 minutes or less
5. H1N5:	99.0% in 60 minutes or less
6. Staphylococcus Aureus	91.5% in 60 minutes or less
7. Aspergillus Niger:	97.1% in 60 minutes or less
8. Candida Albicans:	36.0% in 30 minutes or less
9. Pseudomonas Aeruginosa	99.9% in 60 minutes or less
10. Cladosporium	97.7% in 60 minutes or less
11. Dichobotrys Abundans	90.0% in 60 minutes or less
12. Penicillium	95.0% in 60 minutes or less
13. Bacillus Subtilis var Niger	89.3% in 60 minutes or

less Manufacturers not providing the equivalent space kill rates shall not be acceptable.

- C. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.
1. Airflow rates may vary through the full operating range of a VAV system. The quantity of air exchange shall not be increased due to the air purification system requirements.
 2. Velocity Profile: The air purification device shall not have a maximum velocity profile.
- D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions to the air purification system.
- E. Ionization Equipment Requirements:
1. Electrode Specifications (Bi-polar Ionization):
 - a. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
 - b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
 - c. Ionization output when tested in the occupied space shall be between 800 to 1200 ions/cm³.
 - d. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air stream will not be accepted.
 2. Air Handler mounted units
 - a. Ion generators for air handling units 25 tons and larger shall be Plasma Air's BAR product furnished in a linear or bar mounted configuration so as to minimize the space required for installation. Ionization BAR shall be 3.5" deep

in the direction of airflow.

- b. The mechanical contractor shall mount the plasma ionization BAR and connect it to the remote mount power supply panel using only low voltage wiring. Low voltage wiring shall be defined as 12V. The use of high voltage cabling (600V or higher) shall not be acceptable due to safety concerns.
- c. The remote mount power supply panel shall be capable of directly accepting voltage of 12V DC or 24V AC. The panel shall have an on/off switch, ionizer indicator LED, and a set of dry contacts which will feedback ionizer functionality. Dry contacts that indicate power available only shall not be acceptable.
- d. For systems that do not include a feedback electronic signal indicating ion production, provide a duct mounted ion sensor powered from 12V DC or 24V AC. Ion sensor to be user adjustable from 500 to 20,000 ions per cm³ and contain a dry contact BMS interface. To be clear, for systems that only indicate power available to the ionizer, vendor must provide duct mounted ion sensor described herein.
- e. Needles on air handler mounted units shall be recessed for safety and to avoid fouling of any exposed needles.

3. Certifications

- a. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners and/or UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.
- b. The operation of the electrodes or bipolar ionization units shall conform to UL 867/2998 with respect to ozone generation.

F. Electrical Requirements:

- 1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the air handling unit served. Ion generators requiring a loose 24V, 120V or 230V transformer or power supply shall not be accepted.
- 2. Wiring, conduit and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.

G. Control Requirements:

- 1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
- 2. All BAR, 7000 and 660 series plasma ion generators shall include an external BMS interface to indicate ion generator status and alarm.

SECTION 230890 Ductwork systems
ADD paragraph 2.11 as follows:

1.1 DUCT SILENCER

A. Manufacturer:

- 1. POTTORFF, OR APPROVED EQUAL BY PRICE OR KINETICS

B. Duct Silencers:

- 1. GENERAL: FURNISH AND INSTALL FACTORY PRE-FABRICATED DUCT SILENCERS OF THE TYPES AND SIZES SHOWN ON THE PLANS AND/OR LISTED IN THE

SCHEDULE. ANY CHANGE OR EXCEPTION TO THIS SPECIFICATION MUST BE SUBMITTED AND APPROVED IN WRITING BY THE ENGINEER AT LEAST 10 DAYS BEFORE THE BID DATE.

2. FIRE PERFORMANCE: COMBUSTION RATING FOR THE ACOUSTIC FILL SHALL NOT BE GREATER THAN THE FOLLOWING WHEN TESTED IN ACCORDANCE WITH ASTM E84, NFPA STANDARD 255, OR UL NO. 723: FLAME SPREAD CLASSIFICATION – 24, SMOKE DEVELOPMENT RATING - 50
- C. Tubular Silencers including Models CFP: Outer casings shall be fabricated from type ASTM A653/653M, G60 galvanized lock former quality perforated steel.
- D. Interior partitions for tubular silencers shall be fabricated from not less than ASTM A653/653M, 22-gauge, die-formed, type G60 galvanized lock former quality perforated steel.
- E. Fill Material:
1. DISSIPATIVE AND FILM LINED SILENCERS: FILL MATERIAL SHALL BE OF INORGANIC GLASS FIBER OF A PROPER DENSITY TO OBTAIN THE SPECIFIED ACOUSTIC PERFORMANCE AND BE PACKED UNDER NOT LESS THAN 5% COMPRESSION TO ELIMINATE VOIDS DUE TO VIBRATION AND SETTLING. MATERIALS SHALL BE INERT, VERMIN AND MOISTURE PROOF.
 2. MEDIA PROTECTION: FILL MATERIAL SHALL BE ENCASED AND SEALED WITH A THIN LAYER OF POLYMERIC FILM MEMBRANE.
- F. Construction:
1. UNITS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE ASHRAE GUIDE RECOMMENDATIONS FOR HIGH PRESSURE DUCTWORK. SEAMS SHALL BE LOCK FORMED AND MASTIC FILLED. RECTANGULAR CASING SEAMS SHALL BE IN THE CORNERS OF THE SILENCER SHELL TO PROVIDE MAXIMUM UNIT STRENGTH AND RIGIDITY. INTERIOR PARTITIONS SHALL BE FABRICATED FROM SINGLE PIECE, PERFORATED SHEETS AND SHALL HAVE DIE-FORMED ENTRANCE AND EXIT SHAPES SO AS TO PROVIDE THE MAXIMUM AERODYNAMIC EFFICIENCY AND MINIMUM SELF-NOISE CHARACTERISTICS IN THE DUCT SILENCER. BLUNT NOSES OR SQUARED OFF PARTITIONS WILL NOT BE ACCEPTED.
 2. ATTACHMENT OF INTERIOR PARTITIONS TO THE CASING SHALL BE BY MEANS OF AN INTERLOCKING TRACK ASSEMBLY. TRACKS SHALL BE SOLID GALVANIZED STEEL AND SHALL BE PERMANENTLY ATTACHED TO THE ASSEMBLY. TRACKS SHALL BE SOLID GALVANIZED STEEL AND SHALL BE PERMANENTLY ATTACHED TO THE OUTER CASING. ATTACHMENT OF THE INTERIOR PARTITIONS TO THE TRACKS SHALL BE SUCH THAT A MINIMUM OF 4 THICKNESSES OF METAL EXISTS AT THIS LOCATION. THE TRACK ASSEMBLY SHALL STIFFEN THE EXTERIOR CASING, PROVIDE A REINFORCED ATTACHMENT DETAIL FOR THE INTERIOR PARTITIONS, AND SHALL MAINTAIN A UNIFORM AIRSPACE WIDTH ALONG THE LENGTH OF THE SILENCER FOR CONSISTENT AERODYNAMIC AND ACOUSTIC PERFORMANCE.
 3. INTERIOR PARTITIONS SHALL BE ADDITIONALLY SECURED TO THE OUTER CASING WITH PERMANENTLY ATTACHED NOSE CLIPS AT BOTH WENDS OF THE DUCT SILENCER.
 4. THE SILENCE SIDE SHEETS CASINGS SHALL BE UNDERSIZED IN COMPARISON TO THE HEIGHT OF THE INTERIOR PERFORATED ACOUSTIC SPLITTERS TO MAINTAIN A TIGHT SEAM BETWEEN THE SPLITTERS AND THE SILENCER CASING.
 5. ATTACHMENT OF INTERIOR PARTITIONS FOR TUBULAR SILENCERS SHALL BE SECURED WITH GALVANIZED STEEL RADIAL MOUNTING BRACKETS WELDED TO THE PARTITION AND THE OUTER CASING. THE RADIAL BRACKETS SHALL BE INSTALLED AT 90° ANGLES TO EACH OTHER TO ASSURE UNIFORM SPACING FOR CONSISTENT AERODYNAMIC AND ACOUSTIC PERFORMANCE.
 6. ALL INTERIOR PARTITIONS SHALL BE LOCATED TO PROVIDE A MINIMUM 1" PERIMETER CLEARANCE AT BOTH ENDS OF THE SILENCER SHELL SO AS TO

ALLOW FOR THE FIELD INSTALLATION OF "DUCT-MATE" OR SIMILAR FLANGING WHEN REQUIRED.

7. SOUND ATTENUATING UNITS SHALL NOT FAIL STRUCTURALLY WHEN SUBJECTED TO A DIFFERENTIAL AIR PRESSURE OF 8" WATER GAUGE FROM INSIDE TO OUTSIDE THE CASING.
8. AIRTIGHT CONSTRUCTION WHEN REQUIRED SHALL BE PROVIDED BY USE OF A DUCT SEALING COMPOUND ON THE JOBSITE, MATERIAL AND LABOR FURNISHED BY THE CONTRACTOR.
9. DUCT TRANSITIONS: WHEN TRANSITIONS ARE REQUIRED TO ADAPT SILENCER DIMENSIONS TO CONNECTING DUCTWORK, THEY SHALL BE FURNISHED BY THE INSTALLING CONTRACTOR.

G. Source Quality Control:

1. ACOUSTIC PERFORMANCE:

- a. 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 ASTM Specification E477.
- b. The test set-up and procedure shall be such that all effects due to end reflection, directivity, flaring transmission, standing waves and test chamber sound absorption are eliminated.
- c. Acoustic ratings shall include Dynamic Insertion Loss (DIL) and Generated Noise (GN) Power Levels both for FORWARD FLOW (air and noise in same direction) and REVERSE FLOW (air and noise in opposite directions) with airflow of at least 1000 fpm entering face velocity.
- d. Delta for acoustic performance shall include Dynamic Insertion Loss (DIL) and Generated Noise (GN) Power levels for octave band center frequencies from 31.5 Hz to 8,000 Hz.

Aerodynamic Performance: Static pressure loss of silencers shall not exceed those listed in the silencer schedule at the airflow indicated. Airflow measurements shall be made in accordance with ASTM Specification E477 and in a NVLAP accredited laboratory. Tests shall be reported on the identical units for which acoustic data is presented. Static pressure loss measurements shall be taken in the same set-up and at the same time as DIL and GN.

SECTION 230533 Heat Trace for HVAC Piping
ADD the attached section.

ELECTRICAL SPECIFICATIONS

SECTION 262420 Panelboard Schedules

1. Panel F: **REVISE** branch circuit #28 description to "RTU-2,3,8 Bipolar Ionization" and add note 13.
2. Panel LCK: **REVISE** branch circuit #69 description to "RTU-4,6 Bipolar Ionization".
3. Panel LC1B: **REVISE** branch circuit #16 description to "RTU-1,5,7 Bipolar Ionization".

CIVIL DRAWINGS

DRAWING C-500 Utility Plan

1. **ADD** Cleanouts for all basin inflow points.
2. **ADD** Approx. Size and Location of Grease Interceptor.
3. **ADD** Jellyfish Filter Outlet Control Structure.
4. **ADD** Callout for 13.5'Lx6'W PWD Standard Meter Pit w/ Access Manhole.
5. **ADD** Callout for Curb Cut w/ Velocity Dissipater (Typ. Of 2)
6. **ADD** Callout for Utility Pole Relocation (By Others)

DRAWING C-600 Erosion and Sediment Control Plan

1. **ADD** Silt Sock surrounding surface basin and in front of curb cuts.
2. **REVISED** Erosion and Sediment Control Notes.

DRAWING C-601 Erosion and Sediment Control Notes and Detail

1. **REVISED** Construction Sequence.

DRAWING C-701 Utility Details 2

1. **REVISED** Water Meter Pit detail to include an additional 9 ½" flanged Coupling adapter.
2. **ADD** 4'x4' Inlet Box with Frame and Cover Detail.

DRAWING C-702 Utility Details 3

1. **REVISED** Catch Basin/Outlet Control Structure Abutment Detail.

DRAWING C-705 SMP-2 Sections

1. **REVISED** Elevation View C2-C2 to include Jellyfish Outlet Control Structure.

ARCHITECTURAL DRAWINGS

DRAWING A-1 – COLOR SCHEME PACKAGE

1. **ADD** this drawing in its entirety.

DRAWING A6.1 – ROOM FINISH SCHEDULE

1. **ADD** remark R59 to B206 Media Center.
2. **DELETE** 'PNT' at C107 gymnasium wainscot finish.
3. **REVISE** B107 base to RB.
4. **ADD** general note 11 as follows: 11.GC SHALL BE RESPONSIBLE FOR PAINTING ALL EXPOSED DUCTWORK, STRUCTURE & PIPING WHERE ROOMS ARE SCHEDULED TO RECEIVE PSTR.
5. **ADD** remark R53 @ C128 Lobby & C129 Vestibule.

DRAWING I7.10 – OVERALL SECOND FLOOR – FINISH PLAN

1. **ADD** finish line to stain the existing wood bench at B206 Media Center.

MECHANICAL DRAWINGS

DRAWING M0.1 – MECHANICAL SITE PLAN

1. **ADD** heat trace to all above ground chilled water piping.

DRAWING M3.0 – MECHANICAL SCHEDULES

2. **ADD** Bipolar ionization air purification to ALL Roof top air handling units. RTU-1 through 8.

FIRE PROTECTION DRAWINGS

DRAWING FP2.0 – BASEMENT UNIT A & B FIRE PROTECTION

1. **REPLACE.** Replace Drawing FP2.0 as part of Addendum #2.

ELECTRICAL DRAWINGS

DRAWING E3.6 – ROOF POWER

1. **REPLACE.** Replace Drawing E3.6 as part of Addendum #2.

BIDDER QUESTIONS SUBMITTED TO DATE & RESPONSES ARE AS FOLLOWS:

1. **Specification section 011000 Paragraph 4.a.8 calls for the provision of “New pathways for new low voltage cabling” please clarify what other pathway systems, not already listed in this sections, is the EC responsible for? Are the BAS pathway included in the MC or EC SOW?**

Answer: The EC is responsible for pathways for all systems specified in Divisions 26, 27, 28 and as required in Section 260180. The MC is responsible for pathways for BAS system cabling as specified in Section 230100.

2. **Please confirm that all Prime Contractors are responsible for any cutting and patching related to their work.**

Answer: All contractors are responsible for cutting and patching related to their work. Bidders are responsible to review cutting and patching as detailed in the contract documents.

3. **At the site visit, it was mentioned that all testing and inspections, including building envelope testing is to be provided by the SDP/CM. Please confirm.**

Answer: This is incorrect, The School District of Philadelphia is responsible for LEED Enhanced Commissioning of HVAC, plumbing and electrical system as described in the specifications, contractors are responsible to coordinate with SDP's Commissioning Agent (CxA) as described in commissioning specifications issued in Addendum #1, including but not limited to owner testing.

Please be aware that the general contractor does have responsibilities for the building envelope commissioning as described in Specification 070800 – COMMISSIONING OF BUILDING ENCLOSURE issued in Addendum #1.

As described in the Specification 230990 -TESTING, ADJUSTING & BALANCING issued in Addendum #1, HVAC Contractor is to provide balancing. Reference specification for complete responsibilities.

All other testing and inspections required for the progress of the work and to obtain Certificates of Occupancy are the responsibility of the contractors.

Owner shall commission a third party special inspection agency to perform the required special inspections under a separate contract. The lead design consultant of the project (AOR) shall perform the role of "Design Professional in Responsible Charge of Special Inspections" (DPRC-SI). Each role of Owner, DPRC-SI, and Contractor shall be performed according to the roles defined by the City of Philadelphia Department of Licenses and Inspections.

4. Will the SDP/CM provide all commissioning, including LEED commissioning?

Answer: See Answer to Number 3 above.

5. Is the entire project (including renovations to the existing building) seeking LEED Gold certification or just the new addition?

Answer: The entire building is seeking LEED Gold Certification.

6. Please provide the voltage and phase needed for the Kiln. The specified manufacturer will need this information in order to provide pricing and it is not provided in the specifications.

Answer: Voltage as per the electrical drawings is 208v, 1 phase. A clarification is being added to Specification 101112 Specialty Building Products as part of Add#2.

7. Specification section 102238 is provided for Operable Panel Partitions. Where on the project are these partitions located?

Answer: See SGI C209 & SGI C211 on the second floor shown on A1.8. The operable partition divides the two rooms. Please also see 2.2.B.1.a that confirms location SGI C209/C211.

8. The architectural drawings have wall tags shown throughout (M1, S2, etc.), however a wall schedule/legend and associated details for each tag used are not provided.

Answer: Please see Sheet CS.2 General Information, it is the first page after the cover sheet for Volume 1 drawings. Wall Types are provided in the bottom left corner of the page for both masonry and stud wall types.

ATTACHMENTS

This Addendum includes the following attachments:

Mechanical Specifications

SECTION 230533 – Heat Tracing for HVAC Piping

B-070, B-071, B-072 & B-073 of 2019/2020

SECTION 230900 – ATC System

Civil Drawings

Drawing C-500	Utility Plan (Revised for Addendum #2)
Drawing C-600	E&SC Plan (Revised for Addendum #2)
Drawing C-601	E&SC Notes and Details (Revised for Addendum #2)
Drawing C-701	Utility Details 2 (Revised for Addendum #2)
Drawing C-702	Utility Details 3 (Revised for Addendum #2)
Drawing C-701	SMP-2 Sections (Revised for Addendum #2)

Rhawnhurst ADA Ramp Construction Plans for the intersection of Large Street and Chandler Street

Architectural Drawings:

DRAWING A6.1	ROOM FINISH SCHEDULE
DRAWING A-1	COLOR SCHEME SCHEDULE
DRAWING I7.10	OVERALL SECOND FLOOR – FINISH PLAN

Fire Protection Drawings

DRAWING FP2.0	BASEMENT UNIT A & B FIRE PROTECTION
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Electrical Drawings

DRAWING E3.6	ROOF POWER
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END OF ADDENDUM #002

SECTION 230533 – HEAT TRACING FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Heat Trace

1.2 REFERENCES

- A. ANSI/NFPA 70 – National Electrical Code
- B. ASME B40.1 – Gauges Pressure Indicating Dial Type Elastic Element.
- C. ASTM E1 – Specification for ASTM Thermometers.
- D. ASTM E77 – Verification and Calibration of Liquid in Glass Thermometers.
- E. UL 393 – Indicating Pressure Gauges for Fire and Protection Services.
- F. ASTM F708 – Design and Installation of Rigid Pipe Hangers.
- G. MSS SP58 – Pipe Hangers and Supports Materials, Design and Manufacturer.
- H. MSS SP69 – Pipe Hangers and Supports Selection and Application.
- I. MSS SP89 – Pipe Hangers and Supports Fabrication and Installation Practices.
- J. ASME A13.1 – Scheme for the Identification of Piping Systems.

1.3 COORDINATION OF RESPONSIBILITIES

- A. The Mechanical Contractor shall provide the complete heat trace system including the heating cables, heat tracing control system, accessories and all required final connections.
- B. The Electrical Contractor shall provide the circuit breaker in the panelboard, NEMA 3R non-fused disconnect at the heat trace and wiring/conduit from the panel to the heat trace via the disconnect.

1.4 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Section 230010.
- B. Shop Drawings: The following items shall be submitted for review and approval:
 - 1. Submittal booklet to include the following:
 - a. Reference to Specification Section.
 - b. A list of all equipment to be provided and installed.
 - c. Data sheets to indicate equipment and electrical requirements with specific items or model numbers highlighted.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Submit under provisions of Section 230010.
- B. Record actual locations of Products.
- C. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
- D. Testing: Completed system test report.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing of equipment specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by UL or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Inspect and report concealed damage to carrier within their required time-period.
- B. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.
- C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris and traffic.

1.9 WARRANTY

- A. Provide the warranty specified in Section 230010.

PART 2 - PRODUCTS

2.1 MANUFACTURES

- A. Basis of Design: Raychem, a brand of nVent
- B. Thermon
- C. Nelson

2.2 SYSTEM DESCRIPTION

- A. Complete pipe freeze protection system for piping indicated on the drawings.

- B. System consists of a self-regulating heating cable, connection kits, accessories, and energy-efficient control, monitoring, and Building Management System (BMS) communication capabilities.
- C. The heating cable shall have a polyolefin jacket for above ground, water piping, and a fluoropolymer jacket for below ground grease waste or fuel piping.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage manufacturer to design complete and functional heat-tracing system as required by Project documents.

2.4 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES FOR PIPE FREEZE PROTECTION

- A. Basis-of-Design: RAYCHEM, a brand of nVent; XL-Trace Pipe Freeze/Flow Maintenance.
- B. Source Limitations: Obtain heat-tracing components and controllers from single manufacturer. To ensure system integrity and meet warranty requirements, only components and controllers supplied by cable manufacturer are to be used.
- C. Heating cable and connection kit shall be included in a UL Listed and FM Approved system.
- D. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end with a watertight end seal. Cable shall be capable of crossing over itself without overheating.
- E. Electrical Insulating Jacket: Flame-retardant modified polyolefin.
- F. Ground Braid: Tinned-copper braid. Minimum 70 % for ground path and mechanical ruggedness.
- G. Outer Jacket Requirements.
 - 1. For aboveground freeze protection of water lines where fuel oil or aqueous chemicals are not present, use a modified polyolefin with ultraviolet inhibitor. Outer jacket to be printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).
 - 2. For below-grade applications, grease waste, or where fuel oil and aqueous chemicals are present, use fluoropolymer with ultraviolet inhibitor. Outer jacket to be printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).
- H. Maximum Operating Temperature (Power On): 150°F.
- I. Maximum Exposure Temperature (Power Off): 150°F.
- J. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- K. Capacities and Characteristics:
 - 1. Maximum Heat Output at 50°F: 8 W/ft
 - 2. Piping Diameter: Per Drawings

3. Electrical Characteristics for Single-Circuit Connection:
 - a. Volts: 120
 - b. Phase: Single
 - c. Full-Load Amperes: 24
 - d. Maximum Overcurrent Protection: 30

2.5 HEATING CABLE CONNECTION KITS

- A. Basis-of-Design Product: RAYCHEM; RayClic.
- B. Provide power connections, splices/tees, and end seal kits to properly connect and terminate heating cable circuit along specified length of the piping.
- C. Install splices, tees, and crosses underneath the pipe insulation with service loops installed to allow for future service of piping.
- D. Connection kits shall be rated NEMA 4X to prevent water ingress and corrosion. All components shall be UV stabilized and shall not require cutting into heating-cable core to expose bus wires.
- E. Certification: UL Listed and FM approved.
- F. Locate connection kits above grade for buried applications.

2.6 HEAT TRACING CONTROL SYSTEM

- A. Single Circuit Local Digital Controller for Freeze Protection and Flow Maintenance.
 1. Basis-of Design Product: RAYCHEM; C910-485.
 2. Control self-regulating heating cable via an energy-saving, programmable single-circuit controller to provide adjustable maintained temperatures in the range of -40 to 140°F.
 3. Controller to include self-test function to verify heat-tracing integrity at least once every 24 hours.
 4. Controller Capabilities:
 - a. Supply Voltage: 100 to 277 V ac.
 - b. Enclosure: NEMA 4X FRP.
 - c. Operating Temperature Range: - 40 to 140°F.
 - d. Display: Six-character, alphanumeric LED.
 - e. Control: DP mechanical relay type.
 - f. Control Algorithms: On/Off. PASC for energy savings.
 - g. Monitoring:
 - 1) Temperature:
 - a) Low Alarm: 0 to 180°F.
 - b) High Alarm: 0 to 200°F.
 - 2) Ground Fault:
 - a) Alarm Range: 20 to 100 mA.
 - b) Trip Range: 20 to 100 mA
 - 3) Current:
 - a) Low Alarm Range: 3. to 20 A, or off.
 - 4) Autocycle Test: Interval of 1 to 240 minutes or 1 to 240 hours.
 - h. Temperature Sensor Inputs:
 - 1) Quantity: Two.
 - 2) Type: 100-ohm, platinum, 3-wire, shielded.
 - i. Alarm Outputs:
 - 1) AC Relay: Isolated solid state triac, SPST, 0.75 A maximum, 100 to 277 V ac nominal.

- 2) Dry Contact Relay: Pilot duty, 48 V ac/dc, 500mA maximum, 10 V maximum resistive switching.
- 3) Outputs: Normally open or normally closed.
- j. Stored Parameters:
 - 1) Minimum temperature.
 - 2) Maximum temperature.
 - 3) Maximum ground fault current.
 - 4) Maximum heater current.
 - 5) Contactor cycle count.
 - 6) Time in use.
- k. Alarm Conditions:
 - 1) Low and high temperature.
 - 2) Low current.
 - 3) Ground fault alarm and trip.
 - 4) RTD failure.
 - 5) Loss of programmed values.
 - 6) EMR failure.
- l. Communications:
 - 1) Protocol: Modbus RTU.
 - 2) Topology: Daisy Chain.
 - 3) 26 AWG shielded twisted pair.
- 5. Temperature Sensors:
 - a. For each controller, provide the following:
 - 1) RTD10CS: 100-ohm platinum RTD with 10' stainless steel corrugated sheath.
 - 2) RTD-200: RTD, ambient, cable style

B. Provide 1 heat tracing control system with sensors for each location of heat trace.

2.7 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, cable ties, connection kits, and end seals all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Identification: Provide "Electric Heat Traced" labels on exterior of pipe insulation every 10 ft. on opposite sides of pipe, and on all splices, tees, crosses, and power connections for the entire length of heat traced piping.

2.8 SYSTEM APPROVAL

- A. Complete heat trace system (heating cable, connection kits, and controller) shall be listed by an NRTL, and marked for intended freeze protection of metallic and non-metallic piping associated with HVAC, Plumbing, Domestic Hot-Water-Temperature Maintenance, and Fire Suppression systems.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Prior to installation of heating cable system, verify that all piping that will be heat traced has passed all hydrostatic/pressure test and is signed off by plumbing inspector.

2. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Preinstallation Testing: Prior to installing heating cable on piping, an insulation resistance test shall be performed by installing contractor to ensure integrity of heating cable as described in the installation and maintenance manual.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect all heating cable ends from moisture ingress until cable is terminated with end seals.

3.3 INSTALLATION

A. All heat-tracing components including power connections, splices, tees, crosses, or end seal, must be installed above grade and protected from abuse or damage. In accordance with NEC and CEC, electrical connections are not permitted to be installed below grade.

B. In the field, all heating cables shall be meggered with a minimum of 2,500 V dc for self-regulating cable. The following field megger readings shall be taken on each heating cable:

1. Heating cable shall be meggered when received at Project site before installation.
2. Heating cable shall be meggered after installation, but before insulation is installed.
3. Heating cable shall be meggered after insulation is installed.
4. Heating cable shall be meggered at final commissioning prior to being energized.
5. Insulation resistance must exceed 1.000 megohms at 2,500 V dc.
6. All results must meet manufacturer's specification.

C. Install electric heating cables after piping has been tested and before insulation is installed.

D. Install electric heating cables in accordance with IEEE 515.1.

E. Install insulation over piping with electric heating cables.

F. Install warning labels on piping insulation where piping is equipped with electric heating cables.

G. Set field-adjustable switches and circuit-breaker trip ranges.

H. Set heat tracing control system at 40°F connect the pipe sensor and ambient sensors to the unit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Initial start-up and field testing (commissioning) of system shall be performed by factory technician in accordance with Owner's requirements.

B. Contractor to perform the following tests and inspections during installation:

1. Heating cable shall be meggered when received at Project site before installation.
2. Heating cable shall be meggered after installation, but before insulation is installed.
3. Heating cable shall be meggered after insulation is installed.
4. Insulation resistance must exceed 1,000 megohms at 2,500 V dc.
5. All results must meet manufacturer's specification.
6. Test cables for electrical continuity during installation.

7. Test insulation integrity before energizing.
 8. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- D. Cables will be considered defective if they do not pass tests and inspections in accordance with manufacturer's testing requirements.
- E. Prepare test and inspection reports.
- 3.5 PROTECTION
- A. Protect installed heating cables, including nonheating leads, from damage and moisture ingress during construction.
 - B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533

SECTION 230900- ATC SYSTEMS

PART 1 - GENERAL

1.1 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 230913.23 - Sensors and Transmitters
 - 1. Airflow stations
 - 2. Flow meters
 - 3. Flow switches
 - 4. Hydronic temp sensor wells and sockets
- B. Section 230913.33 - Control Valves
 - 1. Control valves

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. None

1.3 DESCRIPTION

- A. General: The existing building does not have a BAS. The new control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.
- B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.
- C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified in 23 09 93 – "Sequence of Operations for HVAC Controls" shall be BACnet objects.

1.4 APPROVED CONTROL SYSTEM MANUFACTURERS

- A. The following are approved control system suppliers.
 - 1. Delaware Valley Automation (Loytec) Basis of Design
 - 2. Johnson Controls Branch (Metasys) (Verasys not allowed)
 - 3. Trane (Tracer)
 - a. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.
 - 4. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
 - 5. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.5 QUALITY ASSURANCE

- A. Installer and Manufacturer Qualifications:
1. Installer shall have an established working relationship with Control System Manufacturer.
 2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.
 3. ATC / BAS / DDC must be the primary business of the installer. Mechanical contractors or equipment vendors whose primary business is not ATC/BAS/DDC are not permitted.

1.6 CODES AND STANDARDS

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to the receipt of bids of the following codes:
1. National Electric Code (NEC)
 2. International Building Code (IBC)
 - a. Section 719 Ducts and Air Transfer Openings
 - b. Section 907 Fire Alarm and Detection Systems
 - c. Section 909 Smoke Control Systems
 - d. Chapter 28 Mechanical
 3. International Mechanical Code (IMC)
 4. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems

1.7 SYSTEM PERFORMANCE

- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
1. Graphic Display: A graphic with 20 dynamic points shall display with current data within 10 sec.
 2. Graphic Refresh: A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
 3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
 4. Object Command: Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
 5. Alarm Response Time: An object that goes into alarm shall be annunciated at the workstation within 45 sec.
 6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
 7. Performance: Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
 8. Multiple Alarm Annunciation: Each workstation on the network shall receive alarms within 5 sec of other workstations.
 9. Reporting Accuracy: System shall report values with minimum end-to-end accuracy listed in Table 1.
 10. Control Stability and Accuracy: Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table-1 - Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (±1°F)
Outside Air	±1.0°C (±2°F)
Dew Point	±1.5°C (±3°F)
Water Temperature	±0.5°C (±1°F)
Delta-T	±0.15° (±0.25°F)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO ₂)	±50 ppm

Note 1: Accuracy applies to 10%–100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

Table 2 - Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0–1.5 kPa (0–6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.5°C (±3°F)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1–150 psi) 0–12.5 kPa (0–50 in. w.g.) differential

1.8 SUBMITTALS

- A. Product Data and Shop Drawings: Meet requirements of Section 013000 on Shop Drawings, Product Data, and Samples. In addition, the contractor shall provide shop drawings or other submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and three 11"x17" prints of each drawing. When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work.

Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. DDC System Hardware:
 - a. A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
 - b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
 - 1) Direct digital controllers (controller panels)
 - 2) Transducers and transmitters
 - 3) Sensors (including accuracy data)
 - 4) Actuators
 - 5) Valves
 - 6) Relays and switches
 - 7) Control panels
 - 8) Power supplies
 - 9) Batteries
 - 10) Operator interface equipment
 - 11) Wiring
 - c. Wiring diagrams and layouts for each control panel. Show termination numbers.
 - d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.
2. Central System Hardware and Software
 - a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and relevant technical.
 - b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
 - 1) Central Processing Unit (CPU) or web server
 - 2) Monitors
 - 3) Keyboards
 - 4) Power supplies
 - 5) Battery backups
 - 6) Interface equipment between CPU or server and control panels
 - 7) Operating System software
 - 8) Operator interface software
 - 9) Color graphic software
 - 10) Third-party software
 - c. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show interface wiring to control system.
 - d. Network riser diagrams of wiring between central control unit and control panels.
3. Controlled Systems:
 - a. Riser diagrams showing control network layout, communication protocol, and wire types.
 - b. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
 - c. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.

- d. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
 - e. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
 - f. A point list for each control system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.
 - g. Sequence of operation must be project and equipment specific. It is not satisfactory to copy HVAC sequence which by default will not list all specific inputs, outputs, and control logic, and must include all safety interlock and reset.
 4. Quantities of items submitted shall be reviewed but are the responsibility of the Contractor.
 5. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.
- B. Schedules:
1. Within one month of contract award, provide a schedule of the work indicating the following:
 - a. Intended sequence of work items
 - b. Start date of each work item
 - c. Duration of each work item
 - d. Planned delivery dates for ordered material and equipment and expected lead times
 - e. Milestones indicating possible restraints on work by other trades or situations
 2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.
- C. Project Record Documents. Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:
1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD compatible files on magnetic or optical media (file format: .DWG, .DXF, .VSD, or comparable) and as 11"x17" prints.
 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 230923 Article 3.17 (Control System Demonstration and Acceptance).
 3. Operation and Maintenance (O&M) Manual.
 4. As-built versions of submittal product data.
 5. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
 6. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
 7. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 8. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 9. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
 10. Graphic files, programs, and database on magnetic or optical media.
 11. List of recommended spare parts with part numbers and suppliers.
 12. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.

13. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
 14. Licenses, guarantees, and warranty documents for equipment and systems.
 15. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
- D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.9 WARRANTY

- A. Warrant work as follows:
1. Warrant labor and materials for specified control system free from defects for a period of 24 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
 2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
 3. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
 4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
 5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.10 OWNERSHIP OF PROPRIETARY MATERIAL

- A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
1. Graphics
 2. Record drawings
 3. Database
 4. Application programming code
 5. Documentation

1.11 DEFINITIONS

Term	Definition
BACnet Interoperability Building Blocks (BIBB)	A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.
BACnet/BACnet Standard	BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
Control Systems Server	A computer(s) that maintain(s) the systems configuration and programming database.
Controller	Intelligent stand-alone control device. Controller is a generic reference to building controllers, custom application controllers, and application specific controllers.
Direct Digital Control	Microprocessor-based control including Analog/Digital conversion and program logic.
Gateway	Bi-directional protocol translator connecting control systems that use different communication protocols.
Local Area Network	Computer or control system communications network limited to local building or campus.
Master-Slave/Token Passing	Data link protocol as defined by the BACnet standard.
Point-to-Point	Serial communication as defined in the BACnet standard.
Primary Controlling LAN	High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
Protocol Implementation Conformance Statement	A written document that identifies the particular options specified by BACnet that are implemented in a device.
Router	A device that connects two or more networks at the network layer.
Wiring	Raceway, fittings, wire, boxes and related items.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- B. Install new wiring and network devices as required to provide a complete and workable control network.
- C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

- D. Wireless encrypted mesh communication network is allowable providing that every device has a wired communication port available. Wireless network must be tested, Mesh Point and Mesh Path Statistics reports must be available to prove network function. A live Wireless Mesh Floorplan graphic must be available to easily troubleshoot and identify poor connections. If a device is found that does not meet the following minimum requirements it must be wired at the contractor's expense.
1. Mesh Point Statistics - Weak performance or bad reliability in a Mesh network can have several reasons. one of them is a badly integrated Mesh point in the Mesh network. Such a weak point is revealed by bad connection to other Mesh points. The statistics data provides information on mesh point IP, MAC address, received and transmitted data, the signal strength, authentication status and time of inactivity.
 - a. The most important values are the signal strength and the authentication status. The authentication status should always indicate successful authentication under normal operation and the signal strength should be no less than -70 dBm for an acceptable connection.
 2. Mesh Path Statistics – The Mesh path statistics report provides information on the Mesh paths to all Mesh points in the Mesh network. Each line of the report shows a Mesh path with the receiver Mesh point ID. Additionally, the Mesh point ID of the neighboring node is given for the respective path, to which packets are forwarded in order to reach the addressed receiver Mesh point. More statistics information is the Mesh path metric, the sequence number, the expiration period, the buffered packets, and the state of the Mesh path.
 - a. The most important figures are the Mesh path metric and the state of the Mesh path. The Mesh path metric reflects the path quality from the Mesh point to the receiver Mesh point. The smaller the path metric the better the connection quality to the receiver Mesh point. The smaller the path metric the better the connection quality to the receiver Mesh point. A value larger than 500, however, should not be reached. In this case the Mesh point whitelist should be optimized for this Mesh path. For normal operation, the Mesh path state should always read 'active', 'sn valid', or 'resolved'. This indicates an active and resolved Mesh path with a valid sequence number.
 3. Wireless Mesh Floorplan Graphic:
 - a. By using a floorplan in the Mesh graph the local layout of the building can be considered when configuring the Mesh network. The Mesh network visualization using a floorplan from the top view of the building. If Mesh network visualization over UDP has been activated, the current signal strength between the Mesh points is added to the view. The connections are colored depending on the signal strength. Green stands for a good connection over -50 dBm, orange stands for a medium connection of about -50 dBm to -70 dBm and red stands for a weak connection under -70 dBm. By looking at the color-coded connection it is fairly easy to identify weak connections and go forward to troubleshoot weak spots in the configuration.
- E. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
 2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 23 09 93. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- F. Workstations, Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from

an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.

- G. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

2.3 OPERATOR INTERFACE

- A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. The Operator Workstation or server shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L.

- B. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

- C. Hardware:

- 1. Workstation or web server. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The following hardware requirements also apply:
 - a. The hard disk shall have sufficient memory to store:
 - 1) All required operator workstation software.
 - 2) A DDC database at least twice the size of the delivered system database.
 - 3) One year of trend data based on the points specified to be trended at their specified trend intervals.
 - b. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.
 - c. Minimum hardware configuration shall include the following:
 - 1) Quad Core Processor
 - 2) 8 GB RAM
 - 3) 1 TB hard disk providing data at 3.0 Gb/sec
 - 4) 16x DVD+/-RW drive
 - 5) Serial, parallel, and network communication ports and cables as required for proper DDC system operation

- D. System Software:

- 1. Building management software with management and operating features as engineering and user interface. The scalable building management system combines all functions from installation and configuration of automation stations for HVAC and room automation, input and output modules, gateways, DALI constant light controllers, touch panels and infrastructure products that are installed in the Ethernet/IP network. In addition, it is the user interface for the visualization and operation of the facility. The building management software provides a consistent user interface during all project phases from installation to operation.
- 2. The building management system uses a client-server architecture and thereby consists of a building management server application and one or more client applications as a user interface. As a central component, the server manages and stores system and operating parameters, historic data, access rights, and device configurations (backup) in an SQL data base. Via SSL-encrypted web services (OPC XML-DA), it exchanges real time data within the Ethernet/IP network distributed autonomous automation stations for HVAC and room automation, input

3. and output modules, gateways, DALI constant light controllers, touch panels, and infrastructure products, independently of the underlying field bus technology (BACnet, KNX, DALI, M-Bus, Modbus, etc.).
4. The client application is the user interface of the building management system. The client can be installed locally together with the server or it can run on computers, distributed in the Ethernet/IP network. The use of SSL-encrypted web services for accessing the server allows a smooth and secure communication via firewalls and NAT routers and the use of Intranet and Internet to build a distributed building automation system. Moreover, this offers the user, independently of different communication technologies, a common view of information from the different communication systems.
5. All areas of the building management system are visualized and operated by installation schematics. Each schematic can consist of a large number of dynamic display elements which reflect the current status of the facilities in real time. It is also possible to directly integrate alarms, trend logs, schedules, web links, dynamic pages, and MP3 streams into the graphics. The configuration software to design the graphical representation of the installation with customized and dynamic schematics is built directly into the building management system. Dynamic information is shown in the form of numeric values, text, changing icons, bar graphs, trend logs, alarm and event lists, or schedule controls.
6. Workspaces can be arranged freely. Thereby, e.g. the dynamic schematics can be detached and shown in a separate window, respectively on a dedicated screen or it will be arranged in a window together with the alarm overview, the navigation tree, and data points in the watch view. The workspace arrangement can be done by the user and be stored as a perspective.
7. For monitoring the buildings technical equipment, a standard web browser can be natively used. There is no difference, whether a smartphone, tablet, or PC is used. In contrast to the building management client application, the web application is limited to operate and monitor a building.
8. Alarms from different sources must be visualized in a uniform manner. Thereby, neither the source, nor the communication protocol is of importance. Alarms can be acknowledged or disabled in the alarm view.
9. Alarms have to be acknowledged and sent, dependent on the weekday and time or free definable rules, to one or multiple recipients via e-mail or as a notification. If the alarm is not acknowledged within a configurable amount of time, an alternative action like an escalation can be triggered.
10. Apart from displaying and operating schedules and calendars of automation serves, also schedules and calendars of numerous automaton servers are grouped and structured hierarchically. The calendar functions have to match the common office applications regarding their handling, to provide an easy to use user interface for the user. If schedules and calendars are grouped on different hierarchy levels, the entries on the highest hierarchy level affect all subordinated entries. Entries on a lower hierarchy level affect only those below this level. Local changes on the device are shown on a superordinate level and can either be acknowledged or disabled. The corresponding configurations of schedules and calendars are calculated and loaded into the relevant devices where they are carried out decentralized.
11. Historic data about the temporal cycle of values and operating states (trending) and also alarms from installed automation stations for HVAC and room automation, input and output modules, gateways, DALI constant light controllers, and touch panels are recorded periodically or event-driven and are stored in an SQL data base. If there is no fixed IP connection between the building management system and the relevant devices, the devices will send trend data and alarms automated as an e-mail attachment to the building management server.
12. Users can create ad hoc trend logs in choosing a random data point and activating the trend recording via the context menu.
13. Trend data can either be presented in tabular form or as a trend curve. In addition, the application offers the possibility of exporting trend data via CSV files.

14. The reporting template can be created or adjusted by the user. No programming skills are required. Information can be linked through mathematical operations in any way, e.g. as numerical series, tables, or diagrammed (graph, bar, or pie diagram). The integration of illustrations or graphics is possible. Reports can be triggered on demand at any time or automatically, according to time periods set (daily, weekly, monthly, etc.). Reports can be generated in PDF, Excel, or Word format. They can be automatically distributed via e-mail.
15. All system events are logged in the event log, displayed together on the management station, and filtered according to freely selectable characteristics. The event data base records all alarm, system, user, and operating messages with time stamp, location, message text, username, and other important information like changes of a device configuration and system notifications. All system events and user interventions are documented.
16. A system-wide parameter view must allow, as configurable matrix, to clearly present, change, and save system and operating parameters throughout the entire system in a common view,
17. User administration determines the maximum user access rights. It is used to assign user access rights. The system must dispose of user groups that correspond these access rights and that can be assigned to individual users.
18. Programming of devices is carried out via an add-in, directly startable from the building management system (not included in the position). Thereby, programming has to be carried out in accordance with the IEC 61131-3 standard. Programming with the programming languages via functional blocks (FBS) or structured text (ST) has to be possible. Both programming languages can be mixed within a project. The IEC 61131-3 programming software allows the online testing of an application via the Ethernet/IP network. IEC 61131-3 applications can be changed without interrupting ongoing projects. In addition, the programming software provides comprehensive diagnostic and debugging functions and also commissioning and service functions (e.g. with force list). An early fault detection is generated already at creating a function block diagram and an integrated graphical offline simulation. Oscilloscope and logic analyzer functions allow a chronological representation of values. Moreover, watch pages for the visualization and changing of runtime data are available.
19. For an effective project processing, a comprehensive and tested HVAC library has to be part of the system.
20. A function for central storage and management of configuration files including recovery, display of online status and also firmware update of automation stations, input and output modules, gateways, DALI constant light controller, touch panels, and infrastructure products that are installed in the Ethernet/IP network is an integral part of the building management software. In the case of programmable devices also the user program is included. A backup feature is responsible for a regular backup of all relevant device configurations on the server. In case of a device exchange, the system takes over the recovery of firmware and device configuration.
21. Through the building management software, protocol independent data point connections between different devices can be configured using drag & drop. After the connection is established, the devices exchange the data peer to peer independently of the system.
22. Licensing has to be carried out via the total number of embedded devices. The number of users shall not be used.
23. Alarm transmission rules: unrestricted
24. Perspectives: unrestricted
25. Web clients: unrestricted
26. Automated reports: unrestricted
27. Data bases: SQLite (included), Microsoft SQL server or MySQL
28. Communication: OPC XML-DA, BACnet/IP, HTTP, HTTPS, SSL
29. Applicable graphic formats: GIF, JPG, BMP, TIF, PNG, SVG
30. Licensing: 10 via Ethernet/IP directly embedded automation servers, gateways, DALI controller, touch panels, and infrastructure products.

2.4 CONTROLLERS

- A. Terminal equipment controllers for VAV, FCU, and UV shall be of the same model for easy and consistent service and district stocking. Basis of design LIOB-585.
- B. The I/O Controllers are IP-enabled, compact, programmable automation stations for BACnet/ IP networks with physical inputs and outputs and integrated graphical visualization.
- C. The I/O Controllers are equipped with two Ethernet ports including a built-in Ethernet switch. This allows for building a daisy chained line topology of up to 20 devices. Dual Ethernet port devices also allow the setup of a redundant Ethernet installation (ring topology), which increases reliability. The redundant Ethernet topology is enabled by the Rapid Spanning Tree Protocol (RSTP), which is supported by most managed switches
- D. Technology data points are automatically exposed as OPC tags for higher level OPC client applications or building management system via the integrated OPC server providing SSL encrypted web services (OPC XML-DA) or UA Secure Conversation (OPC UA). The I/ O Controllers further allow data exchange over global connections (network-wide data exchange), offer AST™ functions (Alarming, Scheduling, and Trending), store custom graphic pages for visualization, and can be seamlessly integrated in the Building Management System. I/ O Controllers implement the BACnet Building Controller (B-BC) profile and are BTL certified.
- E. The automation station features a jog dial and a graphical display (128x64) with backlight. This allows both local configuration and monitoring of the correct function and also local override. The six relay outputs can be overridden via 3-way switches on the front panel of the device.
- F. Programming is done with the IEC 61 499 and IEC 61 131-3 based graphical programming system.
- G. The automation station manages user-specific graphical pages with dynamic content for the visualization of information. The visualization of dynamic graphical pages is carried out by (HTML5 PC Application) or (HTML5 in Web browser) on one or more PCs or mobile devices. The automation server can also be integrated in the Building Management System. For the dynamic visualization of information, no additional browser plug-in is required. Web services (OPC XML-DA) are used to access the data. Per Automation Server, multiple graphical applications can exist in parallel. The automation server can be accessed over an IP connection by several users simultaneously.
- H. The automation station features scheduling, alarming, and trending. Time synchronization is done through a BACnet Time-Master or an NTP server.
- I. An event-driven e-mail notification, as the result of a predefined action, informs about the operating status. The e-mail text can be freely chosen. The placement of dynamic values in the text is possible. Stored trend data (CSV file) can be forwarded as attachment.
- J. Binary, analog, and multi-state objects (inputs and outputs) can be created as BACnet server objects or can be accessed via BACnet client functions (Write Property, Read Property, COV Subscription). The BACnet client configuration is done via the provided Configuration Software (network scan or EDE import).
- K. Static and dynamic network variables (NVs) are supported likewise user defined NVs (UNVTs) and configuration parameters (SCPTs, UCPTs). NVs can be linked in the network via “binding” or they are available as “external data points”.

- L. The automation station supports remote packet capturing and troubleshooting using Wireshark. In addition, recording of BACnet communication via BACnet/IP port for network diagnosis is supported.
- M. A I/O module can be integrated via direct connection to other modules. The I/O module extends the automation station with additional physical I/Os (inputs, outputs).
- N. An integrated web server provides access to configuration parameters and statistical information via a standard web browser. Additionally, data points, schedules, and calendars that have been created during device configuration can be accessed via the web server. Current operating conditions can be queried and parameters such as set points and switching times can be set by means of the web server. The configuration can also be done via the provided configuration software.
- O. The automation server is equipped with two Ethernet ports. It can either be configured to use the internal switch to interconnect the two ports or every port is configured to work in a separate IP network.
- P. When the Ethernet ports are configured for two separate IP networks, one port can be connected for instance to a WAN (Wide Area Network) with enabled network security (HTTPS) while the second port can be configured to be connected to an insecure network (LAN) where the standard building automation protocols like BACnet or Modbus TCP are present. These devices also feature firewall functionality of course to isolate particular protocols or services between the ports.
- Q. The automation server features two 100Base-T Ethernet ports with integrated Ethernet switch. Up to 20 automation servers with dual Ethernet can be operated in an Ethernet ring, if the Ethernet ring is connected with an Ethernet switch featuring RSTP function (Rapid Spanning Tree Protocol) on both ends (not included in the position).
- R. The built-in SNMP server (Simple Network Management Protocol) provides network management information of a device that can be used by customary IT tools. Via a configurable SNMP agent, status information and statistics with standard MIBs (Management Information Bases), system registers, and all OPC-exposed data points can be read and monitored, and also alarms can be sent.
- S. The device is equipped with a three colored LED that shows the current device status. The LED informs about pending errors and inputs or outputs in manual mode. Moreover, the network status is indicated.
- T. Installation: DIN rail mounting following DIN 43880, top hat rail EN 50022
- U. Operating conditions: 0 °C to 50 °C, 10 – 90 % RH, non-condensing, degree of protection: IP40, IP20 (terminals)
- V. Power supply: 24 V DC / 24 V AC \pm 10 % via L-POW, or with an external power supply

2.5 INPUT AND OUTPUT INTERFACE

- A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.
- B. UI – Universal Input:
 - 1. UIs are universal inputs for four different input types. They have an input voltage range of 0 V to 10 V, and can withstand up to 30 V. The UIs correspond to class 1 with a relative accuracy of \pm 1 % (of measured value) between 1 V and 10 V, and an absolute accuracy

of ± 10 mV between 0 V and 1 V. The ADC resolution is 16 bits. Galvanically isolated sensors resp. switches must be connected. Universal inputs can be configured as:

- C. Binary Input (Digital Input)
 - 1. Input impedance > 20 k Ω , sampling period 10 ms.
 - 2. In voltage mode, the threshold values are < 0.8 V for low level and > 2 V for high level.
 - 3. In resistance mode, the threshold values are < 1.9 k Ω for low level and > 6.7 k Ω for high level. Between the threshold values, the resulting level of the UI is not defined.
- D. Voltage Metering 0-10 V: Input Impedance > 20 k Ω , sampling period < 1 s.
- E. Current loop 4-20 Ma: Input Impedance > 20 k Ω , sampling period < 1 s. An internal shunt of 249 Ω is available for some universal inputs. Otherwise, an external resistor of 249 Ω must be used as a shunt.
- F. Resistance Measurement:
 - 1. Input Impedance 10 k Ω , sampling period < 1 s. Resistors in the range of 1 k Ω to 100 k Ω can be measured. For popular temperature sensors (e.g. Pt1000, NTC10K, NTC1K8, Ni1000) fixed internal translation tables are provided. For all other temperature sensors, translation tables can be defined in the configuration tool and used on the device.
 - 2. The average sampling period p of analog inputs depends on the number of active (non-disabled) universal inputs n that are configured in analog mode. The formula for p is:
$$p = n \cdot 125 \text{ ms}$$
 - 3. This means if e.g. only two UIs are configured as analog inputs, a new sample is taken every 250 ms (on average) for each of the two inputs. The UIs configured as digital inputs are unaffected (sampling period always 10 ms) by this formula.
- G. DI – Digital Input, Counter Input (S0-Pulse): DIs are fast binary inputs, which can also be used as counter inputs (S0). They follow the S0 specification for electric meters and have a sampling rate of 10 ms. They change state at a load of 195 Ω between the DI terminal and GND. Galvanically iso- lated sensors resp. switches must be connected.
- H. AO – Analog Output: AOs are analog outputs with a signal range of 0 to 10 V (up to 12 V), a resolution of 10 bits, and a maximum output current of 10 mA (20 mA @ 12 V), short circuit proof (2 outputs at a time). The accuracy over the whole range is ± 100 mV.
- I. DO – Digital Output: The following digital outputs are available:
 - 1. Relay 6 A Output: Switching capacity 6 A, 250 V AC resp. 30 V DC. Max in-rush current 6 A, max. 600 W (resistive) @ 250 V AC.
 - 2. Relay 10 A Output: Switching capacity 10 A, 250 V AC resp. 30 V DC. Max in-rush current 10 A, max. 1600 W (resistive) @ 250 V AC.
 - 3. Relay 16 A Output: Switching capacity 16 A, 250 V AC resp. 30 V DC. Max in-rush current 80 A, max. 2000 W (resistive) @ 250 V AC.
 - 4. TRIAC Output: Switching capacity 0.5 A, 24 to 230 V AC. External relays must not be connected.
- J. PRESS – Pressure Sensor: These inputs represent differential pressure sensors. They are equipped with two 3/16" (4.8 mm) hose connectors.
- K. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system

2.6 POWER SUPPLIES AND LINE FILTERING

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA listed.
- B. Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
1. Dielectric strength of 1000 V minimum
 2. Response time of 10 nanoseconds or less
 3. Transverse mode noise attenuation of 65 dB or greater
 4. Common mode noise attenuation of 150 dB or greater at 40–100 Hz

2.7 AUXILIARY CONTROL DEVICES

- A. Motorized Control Dampers:
1. Type. Control dampers shall be the parallel or opposed-blade type as specified below or as scheduled on drawings.
 - a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
 - b. Other modulating dampers shall be opposed blade.
 - c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.
 2. Frame. Damper frames shall be 2.38 mm (13-ga) galvanized steel channel or 3.175 mm (1/8") extruded aluminum with reinforced corner bracing.
 3. Blades. Damper blades shall not exceed 20 cm (8") in width or 125 cm (48") in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16-ga).
 4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
 5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s·m² (10 cfm per ft²) at 1000 Pa (4" w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).
 6. Sections. Individual damper sections shall not exceed 125 cm × 150 cm (48" × 60"). Each section shall have at least one damper actuator.
 7. Modulating dampers shall provide a linear flow characteristic where possible.
 8. Linkages. Dampers shall have exposed linkages.
 9. Electric Damper and Valve Actuators.
 10. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
 11. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
 12. Signal and Range. Proportional actuators shall accept a 0–10 Vdc or a 0–20 mA control signal and shall have a 2–10 Vdc or 4–20 mA operating range. (Floating motor actuators

may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)

13. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
 14. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60"-lb) torque capacity shall have a manual crank.
- B. Control Valves:
1. Control valves shall be two-way or three-way type for two-position or modulating service as shown.
 2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a. Water Valves:
 - 1) Two-way: 150% of total system (pump) head.
 - 2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - b. Steam Valves: 150% of operating (inlet) pressure.
 3. Water Valves:
 - a. Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - b. Sizing Criteria:
 - 1) Two-position service: Line size.
 - 2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - 3) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 35 kPa (5 psi) maximum.
 - 4) Valves ½ in. through 2" shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless-steel ball.
 - 5) Valves 2-1/2" and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
 - c. Water valves shall fail normally open or closed, as scheduled on plans, or as follows:
 - 1) Water zone valves—normally open preferred.
 - 2) Heating coils in air handlers—normally open.
 - 3) Chilled water control valves—normally closed.
 - 4) Other applications—as scheduled or as required by sequences of operation.
 4. Steam Valves:
 - a. Body and trim materials shall be in accordance with manufacturer's recommendations for design conditions and service with linear ports for modulating service.
 - b. Sizing Criteria:
 - 1) Two-position service: pressure drop 10% to 20% of inlet psig.
 - 2) Modulating service: 100 kPa (15-psig) or less; pressure drop 80% of inlet psig.
 - 3) Modulating service: 101 to 350 kPa (16 to 50-psig); pressure drop 50% of inlet psig.
 - 4) Modulating service: over 350 kPa (50-psig); pressure drop as scheduled on plans.
- C. Binary Temperature Devices:
1. Low-Voltage Space Thermostats.: Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C–30°C (55°F–85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

2. Line-Voltage Space Thermostats: Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 13°C–30°C (55°F–85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
 3. Low-Limit Thermostats: Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20') long. Element shall sense temperature in each 30 cm (1') section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.
- D. Temperature Sensors:
1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
 2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5') in length per 1 m²(10 ft²) of duct cross-section.
 3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
 4. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.
 5. Differential Sensors. Provide matched sensors for differential temperature measurement.
- E. Humidity Sensors:
1. Duct and room sensors shall have a sensing range of 20%–80%.
 2. Duct sensors shall have a sampling chamber.
 3. Outdoor air humidity sensors shall have a sensing range of 20%–95% RH and shall be suitable for ambient conditions of -40°C–75°C (-40°F–170°F).
 4. Humidity sensors shall not drift more than 1% of full scale annually.
- F. Flow Switches:
1. Flow-proving switches shall be paddle (water service only) or differential pressure type (air or water service) as shown. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).
 2. Paddle switches shall have adjustable sensitivity and NEMA 1 enclosure unless otherwise specified.
 3. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.
- G. Relays:
1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
 2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.
- H. Override Timers: Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0–6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.
- I. Current Transmitters:
1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4–20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500-ohm maximum burden.

2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirement and shall be UL/CSA recognized.
 3. Unit shall be split-core type for clamp-on installation on existing wiring.
- J. Current Transformers:
1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
 2. Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full-scale output.
 3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.
- K. Voltage Transmitters:
1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4–20 mA output with zero and span adjustment.
 2. Adjustable full-scale unit ranges shall be 100–130 Vac, 200–250 Vac, 250–330 Vac, and 400–600 Vac. Unit accuracy shall be $\pm 1\%$ full-scale at 500-ohm maximum burden.
 3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirement and shall be UL/CSA recognized at 600 Vac rating.
- L. Voltage Transformers:
1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
 2. Transformers shall be suitable for ambient temperatures of 4°C–55°C (40°F–130°F) and shall provide $\pm 0.5\%$ accuracy at 24 Vac and 5 VA load.
 3. Windings (except for terminals) shall be completely enclosed with metal or plastic.
- M. Power Monitors:
1. Selectable rate pulse output for kWh reading, 4–20 mA output for kW reading, N.O. alarm contact, and ability to operate with 5.0-amp current inputs or 0–0.33-volt inputs.
 2. 1.0% full-scale true RMS power accuracy, +0.5 Hz, voltage input range 120–600 V, and auto range select.
 3. Under voltage/phase monitor circuitry.
 4. NEMA 1 enclosure.
 5. Current transformers having a 0.5% FS accuracy, 600 VAC isolation voltage with 0–0.33 V output. If 0–5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.
- N. Hydronic Flowmeters:
1. Insertion-Type Turbine Meter
 - a. Dual counter-rotating axial turbine elements, each with its own rotational sensing system, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Single turbine for piping 2 inches and smaller. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag.
 - b. Insertion type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown.
 - c. Sensing method shall be impedance sensing (non-magnetic and non-photoelectric)
 - d. Volumetric accuracy
 - 1) $\pm 0.5\%$ of reading at calibrated velocity
 - 2) $\pm 1\%$ of reading from 3 to 30 ft/s (10:1 range)
 - 3) $\pm 2\%$ of reading from 0.4 to 20 ft/s (50:1 range)
 - e. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% of flow rate and traceable to the National Institute of Standards and Technology (NIST).
 - f. Maximum operating pressure of 400 psi and maximum operating temperature of 200°F continuous (220°F peak).

- g. All wetted metal parts shall be constructed of 316 stainless steel.
 - h. Analog outputs shall consist of non-interactive zero and span adjustments, a DC linearity of 0.1% of span, voltage output of 0-10 Vdc, and current output of 4-20 mA.
2. Magnetic Flow-Tube Type Flowmeter.
- a. Sensor shall be a magnetic flowmeter, which utilizes Faraday's Law to measure volumetric fluid flow through a pipe. The flowmeter shall consist of two elements, the sensor, and the electronics. The sensor shall generate a measuring signal proportional to the flow velocity in the pipe. The electronics shall convert this EMF into a standard current output.
 - b. Electronic replacement shall not affect meter accuracy (electronic units are not matched with specific sensors).
 - c. Four-wire, externally powered, magnetic type flow transmitter with adjustable span and zero, integrally mounted to flow tube. Output signal shall be a digital pulse proportional to the flow rate (to provide maximum accuracy and to handle abrupt changes in flow). Standard 4-20 mA or 0-10 Vdc outputs may be used provided accuracy is as specified.
 - d. Flow Tube:
 - 1) ANSI class 150-psig steel
 - 2) ANSI flanges
 - 3) Protected with PTFE, PFA, or ETFE liner rated for 245°F minimum fluid temperature
 - e. Electrode and grounding material
 - 1) 316L Stainless steel or Hastelloy C
 - 2) Electrodes shall be fused to ceramic liner and not require o-rings.
 - f. Electrical Enclosure: NEMA 4, 7
 - g. Approvals:
 - 1) UL or CSA
 - 2) NSF Drinking Water approval for domestic water applications
 - h. Performance
 - 1) Accuracy shall be $\pm 0.5\%$ of actual reading from 3 to 30 ft/s flow velocities, and 0.015 ft/s from 0.04 to 3 ft/s.
 - 2) Stability: 0.1% of rate over six months.
 - 3) Meter repeatability shall be $\pm 0.1\%$ of rate at velocities > 3 ft/s.
3. Magnetic Insertion-Type Flowmeter
- a. Magnetic Faraday point velocity measuring device.
 - b. Insertion type complete with hot-tap isolation valves to enable sensor removal without water supply system shutdown.
 - c. 4-20 mA transmitter proportional to flow or velocity.
 - d. Accuracy: larger of 1% of reading and 0.2 ft/s.
 - e. Flow range: 0.2 to 20 ft/s, bidirectional.
 - f. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% of flow rate and traceable to the National Institute of Standards and Technology (NIST).
4. Vortex Shedding Flowmeter
- a. Output: 4-20 mA, 0-10 Vdc, 0-5 Vdc.
 - b. Maximum Fluid Temperature: 800°F (427 °C).
 - c. Wetted Parts: Stainless Steel.
 - d. Housing: NEMA 4X.
 - e. Turndown: 25:1 minimum.
 - f. Accuracy: 0.5% of calibrated span for liquids, 1% of calibrated span for steam and gases.
 - g. Body: Wafer style or ANSI flanged to match piping specification.
5. Transit-Time Ultrasonic Flowmeter
- a. Clamp-On transit-time ultrasonic flowmeter
 - b. Wide-Beam transducer technology
 - c. 4-20 mA transmitter proportional to flow or velocity.

- d. Accuracy: 0.5% of reading in range 1 to 30 ft/s, 0.001 ft/s sensitivity.
- O. Thermal Energy Meters. Shall be reused where applicable.
1. Matched RTD, solid state, or thermistor temperature sensors with a differential temperature accuracy of $\pm 0.15^{\circ}\text{F}$.
 2. Flow meter: See "Hydronic Flowmeters" section.
 3. Unit accuracy of $\pm 1\%$ factory calibrated, traceable to NIST with certification.
 4. NEMA 1 enclosure.
 5. Panel mounted display.
 6. UL listed.
 7. Isolated 4–20 ma signals for energy rate and supply and return temperatures and flow.
- P. Air Flow Measuring Stations:
1. General:
 - a. Provide one AMD with temperature output and airflow alarming capability where indicated on the plans, schedules and/or control diagrams to determine the average airflow rate and temperature of each fan at each measurement location.
 - b. Each AMD shall be provided with a microprocessor-based transmitter and one or more sensor probes capable of independently processing up to 4 independently wired sensor nodes contained in one or more probe assemblies per measurement location.
 - 1) Devices that have electronic signal processing components on or in the sensor probe are not acceptable.
 - c. Airflow measurement shall be field configurable to determine the average Actual or Standard mass airflow rate.
 - 1) Actual airflow rate calculations shall have the capability of being corrected by the transmitter for altitudes other than sea level.
 - d. Temperature measurement shall be field configurable to provide either the velocity-weighted average temperature as the default, or simple arithmetic average temperature.
 2. Sensor Probes:
 - a. Sensor probes shall consist of one sensor node mounted on a 304 stainless steel block with two adjustable zinc plated steel rods connected to 304 stainless steel pivoting mounting feet.
 - b. Sensor node internal wiring connections shall be sealed and protected from the elements and suitable for direct exposure to water.
 - c. Each sensor probe shall be provided with an integral, FEP jacket, plenum rated CMP/CL2P, UL/cUL Listed cable rated for exposures from -67°F to 392°F (-55°C to 200°C) and continuous and direct UV exposure.
 - 1) Plenum rated PVC jacket cables are not acceptable.
 - d. Sensor node airflow and temperature calibration data shall be stored in a serial memory chip in the cable connecting plug and not require matching or adjustments to the transmitter.
 - e. Each sensor node shall be provided with two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy with sensor housings constructed of glass-filled polypropylene. Upon request, the manufacture shall provide a written independent laboratory test result of 100% survival rate in a 30-day saltwater and acid vapor test.
 - 1) Devices that use epoxy or glass encapsulated chip thermistors are not acceptable.
 - f. Each thermistor shall be individually calibrated at a minimum of 3 temperatures to NIST-traceable temperature standards.
 - g. Each sensing node shall have an airflow accuracy of $\pm 2\%$ of reading over a calibrated range of 0 to 10,000 FPM (50.8 m/s).

- h. Each sensor node shall be individually calibrated at 16 measurement points to airflow standards directly calibrated at NIST to the NIST Laser Doppler Anemometer (LDA) primary velocity standard.
 - 1) Upon request the manufacture shall submit for AMD approval a copy of the NIST report of calibration used for the reference standard used.
 - a) Devices claiming NIST traceability to third party laboratories and not directly to NIST are not acceptable
 - i. Each sensing node shall have a temperature accuracy of $\pm 0.15^{\circ}$ F (0.08° C) over an operating range of -20° F to 160° F (-28.9° C to 71.1° C) and humidity range of 0 to 100% RH.
 - j. The number of independent sensor nodes provided for SWSI and DWDI fans shall be 2 probes x 1 sensor node/per probe in each fan inlet
3. Transmitter:
- a. A remotely located microprocessor-based transmitter shall be provided for each measurement location.
 - b. All printed circuit board interconnects, edge fingers, and test points shall be gold plated.
 - c. All printed circuit boards shall be electroless nickel immersion gold (ENIG) plated.
 - d. All integrated circuitry shall be temperature rated as 'industrial-grade'. Submissions containing 'commercial-grade' integrated circuitry are not acceptable.
 - e. The transmitter shall be capable of determining the average airflow rate and temperature of the sensor nodes.
 - 1) Separate integration buffers shall be provided for display airflow output, and airflow signal output (analog and network).
 - f. The transmitter shall be capable of providing a low and/or high airflow alarm output with user-defined set point and % of set point tolerance. Alarm shall be capable of being manually or automatically reset and low-limit cutoff value may be selected to disable the alarm. An alarm delay function shall also be field defined.
 - g. The transmitter shall be capable of identifying an AMD malfunction via the system status alarm and ignore any sensor node that is in a fault condition.
 - h. The transmitter shall be capable of field configuration, diagnostics and include Field Output Adjustment software, all using an on-board pushbutton interface and the LCD display. Field Output Adjustment Wizard shall allow for a one or two point field adjustment to factory calibration for installations that require adjustment.
 - i. The transmitter shall be provided with a 16-character, alpha-numeric, LCD display.
 - 1) The airflow rate, temperature, high and/or low airflow set point alarm and system status alarm shall be visible on the display.
 - j. The transmitter shall be provided with communications [select one of the following prior to order entry]
 - 1) Two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated, and over-current protected analog output signals (AO1=airflow, AO2=temperature or alarm), or
 - 2) One isolated RS-485 (field selectable BACnet MS/TP or Modbus RTU) network connection.
 - k. Analog signal capability shall include two output terminals: the first (AO1), shall provide the total airflow rate; while the second output (AO2) shall be field configurable to provide one of the following:
 - 1) temperature
 - 2) low and/or high user-defined airflow set point alarm; or
 - 3) system status alarm
 - l. Network RS-485 (field selectable BACnet MS/TP or Modbus RTU) network communications shall provide: the average airflow rate, average temperature, low and/or high airflow set point alarm, system status alarm, individual sensor node airflow rates and individual sensor node temperatures.
 - m. The transmitter shall have an on-off power switch. Isolation transformers shall not be required.

- n. The transmitter shall be powered by 24-VAC (22.8 to 26.4 under load) @11 V-A maximum and use a power supply that is over-current and over-voltage protected.
 - o. The transmitter shall use a “watchdog” timer circuit to ensure automatic reset after power disruption, transients, and brownouts.
 - p. Each transmitter shall have an operating range of -20° F to 120° F (-28.9° C to 48.9° C) and humidity range of 5 to 95% RH.
4. Listings and Certifications:
- a. The AMD shall be UL/cUL 873 Listed as an assembly.
 - 1) Devices claiming compliance with the UL Listing based on individual UL component listing are not acceptable.
 - b. All network-capable AMD models supplied with RS-485 interface and BACnet protocol shall be BTL Listed.
5. The AMD shall be tested for compliance with the EMC Directive’s requirements and be certified to carry the CE Mark for European Union Shipments
- Q. Current Switches. Shall be reused where applicable.
- 1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.
- R. Pressure Transducers. Shall be reused where applicable.
- 1. Transducers shall have linear output signal and field-adjustable zero and span.
 - 2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
 - 3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 4–20 mA output, suitable mounting provisions, and block and bleed valves.
 - 4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300psi.) Transducer shall have 4–20 mA output, suitable mounting provisions, and 5-valve manifold.
- S. Differential Pressure Switches. Shall be reused where applicable: Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.
- T. Pressure-Electric (PE) Switches. Shall be reused where applicable.
- 1. Shall be metal or neoprene diaphragm actuated, operating pressure rated for 0–175 kPa (0–25-psig), with calibrated scale minimum setpoint range of 14–125 kPa (2–18-psig) minimum, UL listed.
 - 2. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application. Electrically rated for pilot duty service (125 VA minimum) and/or for motor control.
 - 3. Switches shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.
 - 4. Each pneumatic signal line to PE switches shall have permanent indicating gauge.
- U. Local Control Panels: Shall be reused where applicable.
- 1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
 - 2. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.8 WIRING AND RACEWAYS

- A. General. Provide all wiring in conduit or EMT. Conduit in mechanical room must be rigid. Plenum wiring in ceilings is not acceptable.
- B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.
- C. All communications wiring will be in conduit: All conduit and wire required for a complete BAS system will be provided by this contractor.
- D. All I/O wiring will be in conduit: All conduit and wire required for a complete BAS system will be provided by this contractor.

PART 3 - SEQUENCE OF OPERATIONS

3.1 CONTROL OF HOT WATER PUMPS

- A. Starter for each pump shall be Hand/Off/Auto Type. When starter is in Auto Position, pump shall be controlled by DDC System.
- B. there are (2) secondary hot water pumps. One pump is to run under variable speed control and the second pump is stand-by. Pumps shall be sequenced to equalize run time.
- C. Each boiler (total of 3) has its own associated circulating pump which shall be energized whenever its associated boiler is operating.

Point Name	Hardware Points				Software Points						Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	
Hot Water Pump 1 Status			x						x		x
Hot Water Pump 2 Status			x						x		x
Hot Water Pump 1 Start/Stop				x					x		x
Hot Water Pump 2 Start/Stop				x					x		x
Outside Air Temp					x						x
Hot Water Pump 1 Failure										x	
Hot Water Pump 1 Running in Hand										x	
Hot Water Pump 1 Runtime Exceeded										x	
Hot Water Pump 2 Failure										x	

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Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Hot Water Pump 2 Running in Hand											x	
Hot Water Pump 2 Runtime Exceeded											x	
Totals	0	0	2	2	1	0	0	0	0	4	6	5

Total Hardware (4) Total Software (11)

Hot Water Circulation Loop:

Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Hot Water Differential Pressure	x									x		x
Hot Water Return Temp	x									x		x
Hot Water Supply Temp	x									x		x
Hot Water Pump 1 VFD Speed		x								x		x
Hot Water Pump 2 VFD Speed		x								x		x
Hot Water Pump 1 Status			x							x		x
Hot Water Pump 1 VFD Fault			x								x	x
Hot Water Pump 2 Status			x							x		x
Hot Water Pump 2 VFD Fault			x								x	x
Hot Water Pump 1 Start/Stop				x						x		x
Hot Water Pump 2 Start/Stop				x						x		x
Hot Water Differential Pressure Setpoint					x							x
Outside Air Temp					x							x
High Hot Water Differential Pressure											x	
High Hot Water Supply Temp											x	
Hot Water Pump 1 Failure											x	
Hot Water Pump 1 Running in Hand											x	
Hot Water Pump 1 Runtime Exceeded											x	
Hot Water Pump 2 Failure											x	

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Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Hot Water Pump 2 Running in Hand											x	
Hot Water Pump 2 Runtime Exceeded											x	
Low Hot Water Differential Pressure											x	
Low Hot Water Supply Temp											x	
Totals	3	2	4	2	2	0	0	0	9	12	13	
Total Hardware (11)						Total Software (23)						

3.2 CONTROL OF VARIABLE SPEED HOT & CHILLED WATER PUMPS (HOT & CHILLED WATER SECONDARY PUMPS)

- A. Provide the following to control variable speed pumping systems:
 1. Differential pressure transmitters at the ends of the pipe runs. 3 for heating water system and 3 for chilled water system. 6 in total. See plans for locations.
 2. Receiver/Controller
 3. All interconnecting wiring and programming.
 4. Interface DDC System with pump system drives.
- B. Speed of pumps shall be varied as required to maintain minimum required pressure at end of system. Points shall be monitored and adjustable thru the computer.

3.3 CONTROL OF BOILERS

- A. Boilers shall be controlled to maintain required supply water temperature. Temperature shall be adjustable thru the computer. ATC Damper for Combustion Air Louver shall be in open position whenever Boiler(s) or Water Heaters are firing.
- B. Provide lead/lag control so that lag boilers are energized in stages upon fall of hot water boiler supply temperature in lead boiler (adjustable). Alternate operation of boiler burners will be through DDC system. Energize two (min) boiler/burners below outside temperature of 30°F (adjustable).
- C. Primary pump for each boiler shall run continuously when any boiler is enabled.
- D. Boilers shall utilize Smart Touch Control System for sequencing and control of hot water discharge temperature.
- E. Hot Water Reset Control shall be as follows:

<u>Outside Air Temperature</u>	<u>Hot Water Supply Temperature</u>
0°	130°F
50°F and above	100°F

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Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Main Hot Water Return Temp	x									x		x
Main Hot Water Supply Flow	x									x		x
Main Hot Water Supply Temp	x									x		x
Outside Air Temp					x							x
Boiler 1 Failure											x	x
Boiler 2 Failure											x	x
Boiler 3 Failure											x	x
High Main Hot Water Return Temp											x	
High Main Hot Water Supply Temp											x	
Low Main Hot Water Return Temp											x	
Low Main Hot Water Supply Temp											x	
Totals	3	0	0	0	1	0	0	0	0	3	7	7

Total Hardware (3)

Total Software (11)

3.4 CONTROL OF CHILLER

- A. Control of chillers shall be by means of connection to DDC System. Chillers shall only be able to run when chilled water flow is proven by flow switches.
- B. Chiller and chilled water pumps shall be controlled through panel-mounted cooling master on-off switch and also through DDC System so that chillers/pump run when master switch is in the on position and any ATC Zone is in the occupied mode. If all ATC zones are in the unoccupied mode, then pumps and chiller shall be de-energized even with the master switch in the on position. When the master switch is in the off position, pumps and chiller shall be disabled.
- C. Provide time delay so that chilled water pump operation is continuous for 1 minute (adjustable) after chiller is de-energized.
- D. DDC System shall enable chillers in sequence to maintain 45°F discharge water temperature (adjustable). Chillers shall operate under self-contained controls. When chiller is operating (1) primary chilled water pump shall operate.

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Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Chilled Water Return Temp	x									x		x
Chilled Water Supply Temp	x									x		x
Chilled Water Pump Status			x							x		x
Chiller Status			x							x		x
Emergency Shutdown			x							x	x	x
Chilled Water Pump Start/Stop				x								x
Chiller Enable				x								x
Outside Air Temp					x							x
Chilled Water Pump Failure											x	
Chilled Water Pump Running in Hand											x	
Chilled Water Pump Runtime Exceeded											x	
Chiller Failure											x	
Chiller Running in Hand											x	
Chiller Runtime Exceeded											x	
High Chilled Water Supply Temp											x	
Low Chilled Water Supply Temp											x	
Totals	2	0	3	2	1	0	0	0	0	5	9	8

Total Hardware (7)

Total Software (15)

3.5 CONTROL OF CHILLED WATER SYSTEM

- A. Control of Chilled Water System shall be by means of connection to BACnet IP open protocol DDC System. Chiller shall only be able to run when chilled water flow is proven by flow switches.
- B. Chiller and Chilled water pumps shall be controlled through DDC System so that chiller/pumps run when required based on manual selection or system status. If all ATC zones are in the unoccupied mode, then pumps and chiller shall be de-energized even with master switch in the on position. When master switch is in the off position, pumps and chiller shall be disabled.
- C. Provide time delay so that chilled water pump operation is continuous for (1) minute (adjustable) after chiller is de-energized.
- D. ATC Contractor shall furnish and install the following controls for the chiller including wiring to chiller control panel. Controls shall be purchased from the chiller manufacturer or shall be compatible with chiller:
 - 1. Entering Evaporator Water Temperature Sensor
 - 2. Leaving Evaporator Water Temperature Sensor

3. Evaporator Differential Pressure Switch (to sense flow)
 4. Ambient temperature sensor
- E. In addition, ATC Contractor shall run 120V control voltage wiring and 24V control wiring from chiller starter to chiller as required.
- F. ATC Contractor shall also connect control wiring from chilled water pump starters to chiller.

3.6 CONTROL OF FAN COILS

- A. General: The units shall be indexed to the occupied/unoccupied/warm-up positions from the DDC System. Duct smoke detectors (units with a flow of 2000 CFM or greater) mounted in discharge air duct shall, upon sensing alarm conditions, completely shut down the unit supply fan, close outside air damper and relief damper (where applicable) and open return air damper.
- B. Warm-Up: The unit fan shall run continuously. The outside air damper and associated relief air damper (where applicable) shall remain closed and the unit shall operate on full return air. The room thermostat shall modulate a 2-way hot water ATC valve to maintain room temperature.
- C. Occupied: The unit fan shall run continuously. A room thermostat shall, on a fall in space temperature, modulate the outside air damper to its minimum position and then modulate the control valve open to the full flow hot water coil position. Low limit thermostat The unit shall maintain a minimum discharge air temperature as required (Heating Mode Only). The room thermostat shall, on a rise in space temperature, modulate the ATC hot water valve closed. and then modulate the outside air damper and relief air damper open (where applicable), while closing the return air damper. On a further rise in space temperature, and if chilled water is available as sensed by an aquastat installed in the chilled water pipe, the outside air damper shall be closed to the minimum position and indicated by the central plant water controller, the 2-way chilled water valve shall be modulated open.
- D. Unoccupied: The unit outside air damper and associated relief air damper (where applicable) shall be closed with the control valve full open to permit full airflow over the heating coil. The room thermostat shall cycle the fan to maintain the reduced night setting. Cooling shall be locked out.
- E. Room humidistat shall, on a rise of space humidity above 60% (adjustable) modulate chilled water valve open and modulate open the hot water reheat valve as required to maintain desired space temperature and humidity.
- F. Points List:
1. Heating Coil Control Valve Position (AO)
 2. Cooling Coil Control Valve Position (AO)
 3. Reheat Coil Control Valve Position (AO)
 4. Discharge Air Temperature (AI)
 5. Return Air Smoke Detector (Normal/Alarm) (BI)
 6. Dirty Filter (Normal/Alarm) (BI)
 7. Fan Status (BO)
 8. Fan Command (BI)
 9. Zone Temperature/RH/CO2 (AO)

3.7 VAV PACKAGED ROOFTOP AIR HANDLING SYSTEMS WITH TOTAL ENERGY RECOVERY WHEEL

- A. General: The units shall be indexed to the occupied/unoccupied/warm-up modes from the DDC System. Freeze detection thermostat shall de-energize unit fans, close outdoor air dampers and

open hot water coil ATC Valve upon sensing a coil discharge temperature below its setting. Duct smoke detectors mounted in supply and return air ducts shall, upon sensing alarm conditions, shut down unit fans and close outdoor air dampers. A current sensing switch on supply fan and exhaust fan shall alarm the DDC System whenever the fan fails. A differential pressure switch across units' filter bank shall display filter pressure drop and alarm the DDC System when filter pressure exceeds a high limit setpoint. On a rise in discharge static above 4" w.c. (adjustable) on leaving side of supply fan, high static limit shall de-energize supply fan and alarm DDC System.

- B. Occupied Mode: When the AH is in the occupied mode, the supply fan and exhaust fan shall operate continuously, the variable-frequency drive shall modulate the capacity of the supply fan to maintain the duct static pressure setpoint (adjustable) as measured by a static pressure sensor located approximately 1/3 down supply air duct. The variable frequency drive shall modulate the capacity of the exhaust fan based on local building static pressure setpoint and the cooling valve and heating valve shall modulate, total-energy recovery wheel shall be on, and outdoor air dampers shall open to a minimum position. The outside air by-pass damper and exhaust air by-pass damper shall be closed. The recirculation damper shall modulate with the outside air damper. The discharge air temperature setpoint shall be reset based on the cooling requirements (if any) of any of the associated spaces served by this unit. The outdoor airflow, as measured at the air handling unit outdoor air intake, shall be maintained at a value equal to or greater than the minimum required outdoor airflow setpoint as described below. See below for economizer mode operation.
1. For fan-powered VAV boxes, fan shall operate continuously. Room sensor shall modulate VAV box inlet damper and hot water reheat coil to maintain setpoint.
 2. For non-fan-powered VAV boxes, room sensor shall modulate VAV box inlet damper and hot water coil to maintain setpoint.
- C. Unoccupied Mode; When the AH is in the unoccupied mode, the supply fan, exhaust fan and the total-energy recovery wheel shall be OFF, the outdoor air damper(s) and cooling valve shall be closed, recirculation damper and the heating valve shall be fully open. The outside air and exhaust air by-pass damper shall be closed. Fan powered VAV box fans shall be off. Inlet dampers for fan-powered VAV boxes and non-fan-powered VAV box fans shall be open to full position.
1. A representative room sensor in the area served by this unit shall, on a fall in space temperature below unoccupied setpoint, energize main rooftop supply fan and any fans for fan-powered VAV boxes associated with this unit and main hot water ATC valve shall modulate as required. Return air shall bypass total energy recovery wheel.
- D. Morning Warm-Up Mode (WMU): When the AH is in the morning warm-up mode, the supply fan shall operate continuously, the variable-frequency drive shall modulate the capacity of the supply fan to maintain the duct static pressure setpoint the exhaust fan shall be off, the outdoor air dampers and cooling valve shall be closed, the total energy recovery wheel shall be off, the recirculation air damper shall be fully open, the outside air and exhaust air by-pass dampers shall be closed, and the air handler heating valve shall modulate to maintain the MWU discharge air temperature setpoint which will be reset based on return air temperature. All VAV terminal units shall disable local heat and operate in their VAV heating mode until the MWU criteria is satisfied and the AH returns to the occupied or unoccupied mode. Fans for fan powered VAV boxes shall be energized.
- E. Supply Fan Control: The supply fan will operate continuously whenever the AH is in either the occupied mode or the morning warm-up mode. The supply fan shall be cycled whenever the AHU is in the unoccupied mode and the fans shall be off whenever the stop/auto interlock is open, the mixed air low limit is tripped.
- F. Exhaust Fan Control: The exhaust fan shall operate continuously at 90% of the outdoor airflow whenever the AH is in the occupied mode. During the occupied mode when the local building static pressure controller for this unit senses an increase over the setpoint, the exhaust fan shall

adjust speed as required. The exhaust fan shall be off whenever the supply fan is off and during unoccupied mode and warm-up mode. See below for economizer mode.

- G. Variable Frequency Drive Control: When the supply fan and exhaust fan is on, the variable-frequency drive(s) will slowly ramp up (adjustable) and modulate to maintain the proper discharge duct static pressure setpoint and local building static pressure setpoint.
- H. Economizer Control: When the outdoor air enthalpy reading is acceptable the outdoor air dampers, bypass damper(s), recirculation air damper(s), etc. shall modulate the airflow between the minimum required outdoor airflow setpoint and the full-open position to maintain the discharge air temperature setpoint. The total energy wheel will be off. All air shall bypass wheel.
- I. Total Energy Recovery Wheel Control: During the occupied mode, control of the total-energy recovery wheel shall be defined by the following modes of operation:
 - 1. Cooling-Full Recovery: When the outdoor air enthalpy is higher than the return air enthalpy, the total-energy recovery wheel shall be on and both the supply side and exhaust side bypass dampers shall be closed.
 - 2. Economizing: When the outdoor air enthalpy is less than the return air enthalpy, the total-energy recovery wheel shall be off, both the supply side and exhaust side bypass dampers shall be open, and the outdoor air damper shall modulate between the minimum required outdoor airflow setpoint and the full-open position to maintain the discharge air temperature setpoint. When the outdoor air dampers reach fully opened position, the cooling valve shall be enabled and modulate to maintain the discharge air temperature setpoint. The recirculation damper shall modulate with outside air damper.
- J. Building Automation System Interface: The Building Automation System (BAS) shall send the AHU a discharge air temperature setpoint and a minimum required outdoor airflow setpoint. The BAS shall also send start-up, occupied, unoccupied, and morning warm-up commands.
- K. VAV Control: Each VAV unit (both fan-powered and non-fan powered) served by the Air Handling Unit shall communicate the airflow (CFM) delivered to the space. The microprocessor serving the Air Handling Unit shall calculate the required total outdoor air quantity for each space to maintain the ventilation requirements. As the supply air requirement to satisfy the space condition varies, the microprocessor shall calculate the varying quantity of outdoor air required to maintain the minimum outdoor air requirement for each space. This requirement, or set point, shall, through the minimum outdoor air monitoring station, vary the outdoor air percentage to maintain the requirements of ASHRAE Standard 62. This calculation is the responsibility of the Building Automated Systems Contractor (BAS) to be accurately implemented and to be documented as a proven software feature that does not require the control software to be custom written for this project. It is the responsibility of this BAS Contractor to provide and install the minimum outdoor air monitoring device or devices. It is also the BAS Contractors responsibility to guarantee the airflow monitoring device to be reliable throughout the range of airflow to within $\pm 5\%$ of full range.
 - 1. The transducer used to calculate the airflow at the Air Monitoring Stations shall be selected so that the control range of the device is no higher than 150% of the calculated differential pressure of the air monitoring device.
 - 2. The transducer used on the air monitoring stations shall have the ability to be field calibrated. Software calibration of this transducer is not acceptable.
 - 3. The VAV terminal units shall be individually controlled by a dedicated Direct Digital Control (DDC) Variable Air Volume (VAV) controller per VAV Terminal Unit.
 - 4. To assure proper operation and control, the contractor as part of this bid shall recalibrate the transducers six (6) months after acceptance of the DDC System to correct any deviations as a result of transducer drift.
 - a. Submit a copy of the recalibration report to the Engineer and Owner.
 - 5. The system outdoor air quantity shall be determined and controlled by using ASHRAE Equation 6.1 and shall comply with the International Mechanical Code (2015) Section 403.3.2.

- a. $Y = X / (1+X - Z)$
 - b. Y = Corrected Outdoor Airflow Fraction
 - c. X = Uncorrected Outdoor Airflow Fraction
 - d. Z = Highest Space Ventilation Fraction
6. Calibration of the VAV Unit Transducer
- a. The BAS Software program for the VAV Controllers shall include a feature used to calibrate the differential pressure sensor used to measure airflow.
 - b. The calibration must be performed during the unoccupied mode, with the air handling unit "OFF".
 - c. Calibration is performed by driving the VAV Unit and damper actuator fully closed. With the VAV Unit damper fully closed, new analog input offset values are calculated for the differential pressure sensor and stored in the VAV Unit Controllers memory.
 - d. Calibration shall be performed on a programmed based schedule and can only be performed in the unoccupied mode.
 - e. Calibration shall be performed no less than on a weekly schedule.
- L. For those units with CO2 sensors, outside air damper shall be move to minimum position. When carbon dioxide sensor reaches threshold limit, outside air damper shall modulate open as required. Economizer cycle shall override this control. Sensor shall be located in return air duct.
- M. Points List:
- 1. Supply Air Volume (CFM) of Air Handling Unit (AI)
 - 2. ASHRAE 62-89 Required Percentage of Outdoor Air
 - 3. Total Outdoor Air Required for Air Handling Unit (Setpoint)
 - 4. Actual Outdoor Air Delivered (AI)
 - 5. Outdoor Air Volume (CFM) Setpoint
 - 6. Supply Duct Static Pressure (AI)
 - 7. Supply Leaving Air Temperature (AI)
 - 8. Return Air Temperature (AI)
 - 9. Mixed Air Temperature (AI)
 - 10. Preheat Discharge Air Temperature (AI)
 - 11. Discharge Air Temperature-Wheel outlet (AI)
 - 12. Entering Air Temperature B Wheel Inlet (AI)
 - 13. Heating Coil Control Valve Position (AO)
 - 14. Return Air, Smoke Detector (Normal/Alarm) (BI)
 - 15. Freezestat (Normal/Alarm) (BI)
 - 16. Dirty Filter (Normal/Alarm) (BI)
 - 17. Supply and Exhaust Fan (On/Off), Alarm (BO, BI)
 - 18. Exhaust Wheel Motor (On/Off), Alarm (BO, BI)
 - 19. Outdoor Air Damper (2) (AO)
 - 20. Outdoor Air Bypass Damper (AO)
 - 21. Recirculation Damper (AO)
 - 22. Exhaust Bypass Damper (AO)
 - 23. Local Building Static Pressure (AI)
 - 24. CO2 Level
 - 25. Reheat Coil (AO)
- N. Provide Air Monitoring Station on outdoor air inlet.
- 3.8 CONTROL OF ROOF TOP AIR HANDLERS
- A. General: The units shall be indexed to the occupied/unoccupied/warm-up positions from the DDC System. Freeze detection thermostat shall de-energize the unit fan and close outside air damper upon sensing a coil discharge temperature below its setting. Duct smoke detectors (units with a flow of 2000 CFM or greater) mounted in discharge air duct shall, upon sensing alarm conditions,

completely shut down the unit supply fan, close outside air damper and relief damper (where applicable) and open return air damper.

- B. Warm-Up: The unit fan shall run continuously. The outside air damper and associated relief air damper (where applicable) shall remain closed and the unit shall operate on full return air. The room thermostat shall modulate a 2-way 3-way hot water ATC valve to maintain room temperature.
- C. Occupied: The unit fan shall run continuously. A room thermostat shall, on a fall in space temperature, modulate the outside air damper to its minimum position and then modulate the control valve open to the full flow hot water coil position. Low limit thermostat shall maintain a minimum discharge air temperature as required (Heating Mode Only). The room thermostat shall, on a rise in space temperature, modulate the ATC hot water valve closed and then modulate the outside air damper and relief air damper open (where applicable), while closing the return air damper. On a further rise in space temperature, and if chilled water is available as sensed by an aquastat installed in the chilled water pipe, the outside air damper shall be closed to the minimum position and the 2-way chilled water valve shall be modulated open.
- D. Unoccupied: The unit outside air damper and associated relief air damper (where applicable) shall be closed with the control valve full open to permit full airflow over the heating coil. The room thermostat shall cycle the fan to maintain the reduced night setting. Cooling shall be locked out.
- E. Room humidistat shall, on a rise of space humidity above 60% (adjustable) modulate chilled water valve open and either integral hot water reheat valve or associated HWC hot water valve open as required to maintain desired space temperature and humidity.
- F. For those units with CO2 sensors, outside air damper shall be move to minimum position. When carbon dioxide sensor reaches threshold limit, outside air damper shall modulate open as required. Economizer cycle shall override this control. Sensor shall be located in return air duct.
- G. Points List:
 - 1. Heating Coil Control Valve Position (AO)
 - 2. Cooling Coil Control Valve Position (AO)
 - 3. Discharge Air Temperature (AI)
 - 4. Outdoor Air Damper (AO)
 - 5. Return Air Damper (AO)
 - 6. Relief Air Damper (when applicable) (AO)
 - 7. Freezestat (Normal/Alarm) (BI)
 - 8. Return Air Smoke Detector (Normal/Alarm) (BI)
 - 9. Unit Status (BI)
 - 10. Unit On-Off (BO)
 - 11. CO2 Levels
 - 12. Supply Air Volume (CFM) of Air Handling Unit (AI)
 - 13. ASHRAE 62-89 Required Percentage of Outdoor Air
 - 14. Total Outdoor Air Required for Air Handling Unit (Setpoint)
 - 15. Actual Outdoor Air Delivered (AI)
 - 16. Outdoor Air Volume (CFM) Setpoint
 - 17. Supply Duct Static Pressure (AI) (VAV Units only)
 - 18. Supply Leaving Air Temperature (AI)
 - 19. Return Air Temperature (AI)
 - 20. Mixed Air Temperature (AI)
 - 21. Cooling Coil Discharge Air Temperature (AI)
 - 22. Dirty Filter (Normal/Alarm) (BI)
 - 23. Supply Alarm (BO, BI)
 - 24. Local Building Static Pressure (AI)
 - 25. Space Humidity Sensor

H. Provide overflow sensor in drain pan which shall annunciate alarm upon high level condition.

3.9 CONTROL OF EXHAUST FANS

- A. Control Type 1: These fans shall be tied into DDC time clock for that respective zone. Fan shall be energized only during the occupied cycle.
- B. Control Type 2: These fans shall run continuously.
- C. Control Type 3: These fans shall be controlled by means of tie-in with wall light switch. Provide time delay (by EC) so that fan operates for 10 minutes (adjustable) after light switch is turned off.
- D. Control Type 4: This fan shall be tied into kitchen hood control panel provided by others.
- E. Provide the following points:
 - 1. Airflow (BI)
 - 2. Off/On (BO)
 - 3. Alarms – Airflow
 - 4. Programs – Time schedule Start/stop

3.10 VAV BOXES – FAN POWERED

- A. Each VAV box shall have a direct digital controller. Multiple VAV boxes controlled by single controller shall not be acceptable. Service technician shall be able to view, change and program all points associated with VAV box from portable service tool plugged into space sensor or a computer.
- B. During the occupied mode, fan shall be energized to run continuously. Primary air control damper shall modulate to maintain space temperature. On a call for heat, air control damper shall go to minimum position and reheat coil valve shall modulate to maintain space temperature setpoint. Occupied heating setpoint shall be 70°F (adjustable) and occupied cooling setpoint shall be 74°F (adjustable).
- C. System operator shall be capable of reading primary air CFM at each VAV box from central operator workstation through air monitoring device.
- D. For dehumidification mode (occupied and unoccupied), on a rise in RH above 60% (adjustable), the VAV box inlet damper shall modulate open, VAV box fan shall be on and HW coil shall reheat air to maintain room temperature setpoint.
- E. For VAV boxes with CO2 sensors, inlet damper to VAV box shall be closed if space CO2 sensor is satisfied and if no cooling is required in space. Maximum turndown for any RTU shall be 30%.

Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Airflow	x									x		x
Discharge Air Temp	x									x		x

RHAWNURST ELEMENTARY SCHOOL
SDP CONTRACTS NO. B-070C GC, B-071C MC, B-072C PC & B-073C EC OF 2019/20

Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Zone Carbon Dioxide PPM	x									x		x
Zone Setpoint Adjust	x											x
Zone Temp	x									x		x
Reheating Valve		x								x		x
Zone Damper		x								x		x
Zone Override			x							x		x
Fan Start/Stop				x								x
Airflow Setpoint					x					x		x
Cooling Setpoint					x					x		x
Environmental Index					x					x		
Heating Setpoint					x					x		x
Percent of Time Satisfied					x					x		
Zone Carbon Dioxide PPM Setpoint					x					x		x
Heating Mode						x				x		
Schedule									x			
High Discharge Air Temp											x	
High Zone Carbon Dioxide Concentration											x	
High Zone Temp											x	
Low Discharge Air Temp											x	
Low Zone Temp											x	
Totals	5	2	1	1	6	1	0	1	14	5	13	

Total Hardware (9)

Total Software (27)

3.11 VAV BOXES – NON-FAN POWERED

- A. Each VAV box shall have a direct digital controller. Multiple VAV boxes controlled by single controller shall not be acceptable. Service technician shall be able to view, change and program all points associated with VAV box from portable service tool plugged into space sensor or at computer.
- B. During the occupied mode, primary air control damper shall modulate to maintain space temperature. On a call for heat, air control damper shall go to heat position and reheat coil valve shall modulate to maintain space temperature setpoint.

- C. System operator shall be capable of reading primary air CFM at each VAV box from central operator workstation through air monitoring device.
- D. For dehumidification mode (occupied and unoccupied), on a rise of RH above 60% (adjustable), the VAV box inlet damper shall open and the HW coil shall reheat air to maintain room setpoint.

Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Airflow	x									x		x
Zone Setpoint Adjust	x											x
Zone Temp	x									x		x
Zone Damper		x								x		x
Zone Override			x							x		x
Airflow Setpoint					x					x		x
Cooling Setpoint					x					x		x
Heating Setpoint					x					x		x
Heating Mode						x				x		
Schedule								x				
High Zone Temp											x	
Low Zone Temp											x	
Totals	3	1	1	0	3	1	0	1	8	2	8	

Total Hardware (5)

Total Software (15)

3.12 CONTROL OF HOT WATER UNIT HEATERS

- A. Single temperature electric space thermostat shall cycle the unit heater fan on and open 2-way electric hot water valve whenever hot water is circulating through the unit heater circuit as sensed by a strap-on aquastat.
- B. The thermostat shall be connected to DDC System.

Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Zone Setpoint Adjust	x											x
Zone Temp	x									x		x
Heating Valve		x								x		x

RHAWNHURST ELEMENTARY SCHOOL
SDP CONTRACTS NO. B-070C GC, B-071C MC, B-072C PC & B-073C EC OF 2019/20

Point Name	Hardware Points				Software Points				
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend
Water Supply Flow	x								x
Pump Failure					x				
Pump On/Off			x	x					
Totals	3	0	0	0	1	0	0	0	3

Total Hardware (4)

Total Software (3)

3.15 CONTROL OF DUCTLESS SPLIT SYSTEM UNITS (AC/CU)

- A. General: The units shall be controlled by wall mounted thermostat provided with the unit. Provide a room temperature sensor connected to the DDC System.

Point Name	Hardware Points				Software Points						Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	
Room Temperature Monitoring	x								x	x	x
Totals	1	0	0	0	0	0	0	0	1	1	1

Total Hardware (1)

Total Software (2)

3.16 MONITORING OF MAKEUP AIR UNIT (MAU-1)

- A. General: The units shall be controlled by kitchen hood control panel and shall be monitored through the BAS.
- B. Provide the following points to be monitored:
1. Airflow (AO)
 2. Fan Status On/Off (BO)
 3. Fan Speed (AO)
 4. Alarm – Low flow
 5. Alarm – High/Low LAT

3.17 CONTROL OF THERMOSTATIC MIXING VALVE

- A. General: The units controller shall be connected to the BAS via BacNet interface.

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Point Name	Hardware Points				Software Points			
	AI	AO	BI	BO	AV	BV	Loop	Sched
Hot Water Return Temp		x						
Hot Water Outlet Temp		x						
Hot Water Inlet Temp		x						
Cold Water Inlet Temp		x						
Hot water Outlet Setpoint	x							
Power failure			x		x			
Temp High/Low Alarm	x				x			
Totals	3	0	0	0	1	0	0	0

Total Hardware (7)

Total Software (2)

3.18 CONTROL OF DOMESTIC WATER HEATERS

- A. General: The systems controller shall connect to the BAS via BacNet interface.

Point Name	Hardware Points				Software Points						Show On Graphic
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	
Hot Water Return Temp	x								x		x
Hot Water Supply Temp	x	x							x		x
Hot Water Storage Temp	x								x		x
Boiler 1 Failure										x	x
Boiler 2 Failure										x	x
Boiler 3 Failure										x	x
Boiler Pump 1 Status				x							
Boiler Pump 2 Status				x							
Boiler Pump 3 Status				x							
Boiler 1 Fire rate		x									
Boiler 2 Fire rate		x									
Boiler 3 Fire rate		x									
Low Water Flow										x	
Low Main Hot Water Return Temp										x	
Low Main Hot Water Supply Temp										x	

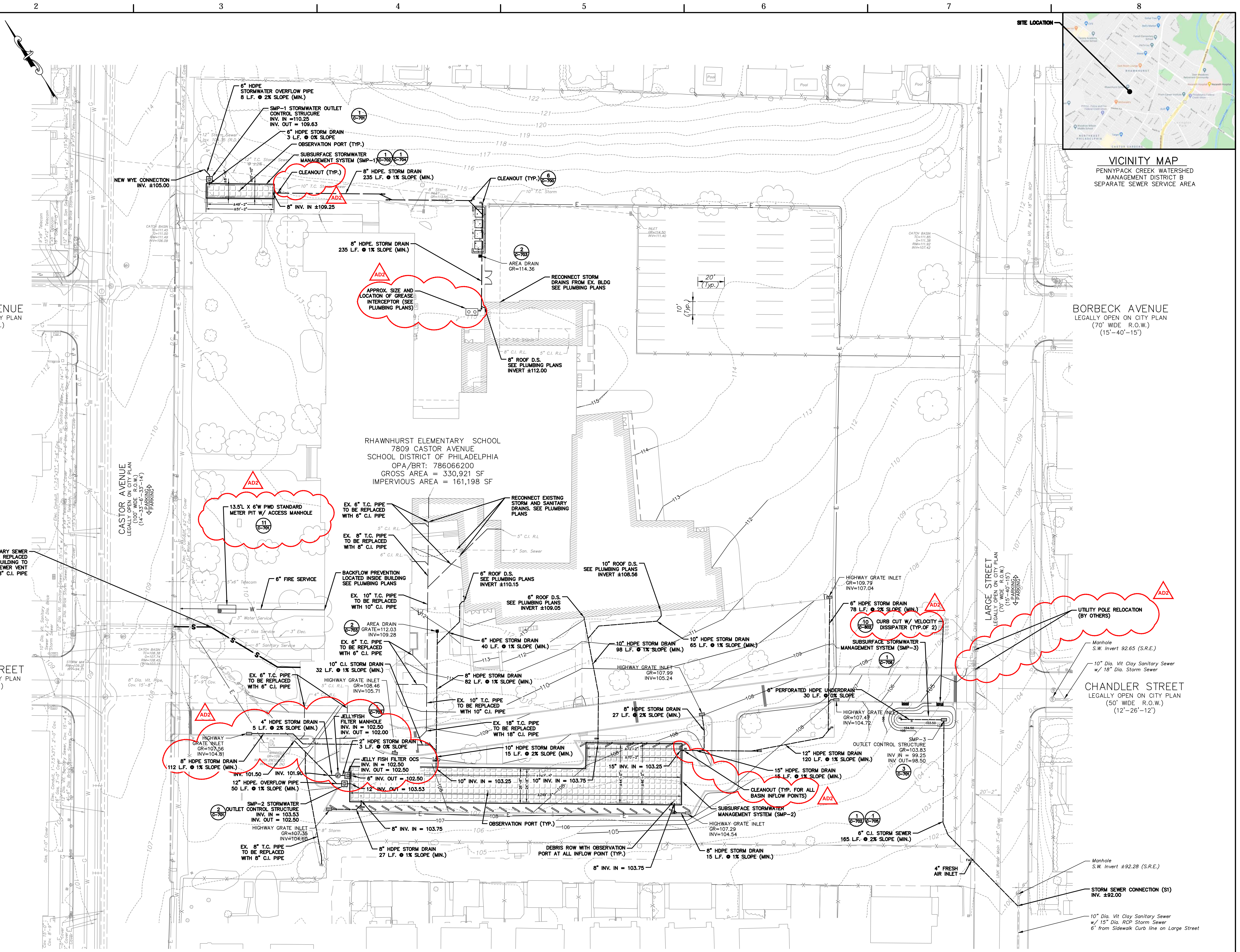
RHAWNURST ELEMENTARY SCHOOL
SDP CONTRACTS NO. B-070C GC, B-071C MC, B-072C PC & B-073C EC OF 2019/20

Point Name	Hardware Points				Software Points						Show On Graphic	
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm		
Totals	3	4	0	3	1	0	0	0	3	7	7	
Total Hardware (10)					Total Software (10)							

END OF SECTION 230900

PROPOSED LEGEND

---	PROPERTY LINE
- - - -	EXISTING CONTOUR
- - - -	PROPOSED CONTOUR
- - - -	STORM SEWER
- - - -	SANITARY SEWER
- - - -	WATER SERVICE
- - - -	ORNAMENTAL FENCE (4'H)
- - - -	LIMIT OF DISTURBANCE (LOD) & DEP. SITE BOUNDARY
□	AREA DRAIN
□	INLET
□	STORM DRAIN CLEAN OUT
□	MILL & OVERLAY PAVING
□	NEW ASPHALT PAVING (DCIA)
□	CONCRETE PAVING
□	GRASS AREA
□	LANDSCAPING AREA



BORBECK AVENUE
LEGALLY OPEN ON CITY PLAN
(70' WIDE R.O.W.)
(15'-40'-15')

CHANDLER STREET
LEGALLY OPEN ON CITY PLAN
(50' WIDE R.O.W.)
(12'-26'-12')

VICINITY MAP
PENNYPAK CREEK WATERSHED
MANAGEMENT DISTRICT B
SEPARATE SEWER SERVICE AREA

THE SCHOOL DISTRICT OF PHILADELPHIA
OFFICE OF CAPITAL PROGRAMS
440 NORTH BROAD STREET
PHILADELPHIA, PA 19130 - 4015
(215) 400 - 4730 | (215) 400 - 4731 (fax)
www.philasd.org

SEAL:
FRANK ANTHONY FRECA
REGISTERED PROFESSIONAL ENGINEER
NO. P258809
PENNSYLVANIA

Frank A. Freca
FRANK ANTHONY FRECA, PE
STATE AND LICENSE NO. P258809

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Bryan Mikkenen, AIA
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Attn: Brittany Pavayko

FOOD SERVICE
McFarland, Kähler
1130 Perry Highway, Suite 115
Pittsburgh, PA 15237
Phone: 412-999-7659
Email: kkaehler-mka@comcast.net
Attn: Ken Kähler

3/2/2021

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1	9/19/2021

NO. DATE REVISION

SCHOOL & LOCATION
RHAWNURST ELEMENTARY SCHOOL
7809 CASTOR AVENUE
PHILADELPHIA PA 19152

PROJECT TITLE
ADDITIONS & RENOVATIONS

DRAWING TITLE
UTILITY PLAN

LOCATION NO.	FILE NO.
DRAWN BY KSE	CHECKED BY KSE
B-070	OF 2019 / 20
B-071	OF 2019 / 20
B-072	OF 2019 / 20
B-073	OF 2019 / 20
DRAWING NO.	
C-500	

- CONSTRUCTION NOTES:**
- UNDERGROUND UTILITIES AS SHOWN ARE TAKEN FROM FIELD EVIDENCE AND PLANS AS PROVIDED BY THE VARIOUS UTILITY AUTHORITIES (PA ONE CALL SERIAL NO. 20200023262 AND 20200023268). THE ACCURACY REGARDING UTILITY LOCATION AND/OR DEPTH CANNOT BE GUARANTEED AND ADDITIONAL UNDERGROUND UTILITIES NOT DEPICTED ON THE PLAN MAY EXIST. BEFORE EXCAVATIONS ARE BEGUN, THE PENNSYLVANIA ONE CALL SYSTEM AT 1-800-242-1776 SHALL BE CONTACTED AT LEAST 3-10 DAYS PRIOR TO COMMENCEMENT OF ANY DEMOLITION OR EXCAVATION ACTIVITIES IN ACCORDANCE WITH ALL APPLICABLE LAWS, RULES AND REGULATIONS.
 - CONTRACTOR SHALL PROVIDE PROTECTION OF EXISTING UTILITIES THROUGHOUT THE DURATION OF THE PROJECT CONSTRUCTION.
 - DEVELOPER / OWNER WILL COMPLY WITH ALL PHILADELPHIA REGULATIONS PERTAINING TO PROPER ABANDONMENT AND/ OR REUSE OF WATER SERVICE LINES AND SEWER LATERALS. PROOF OF ABANDONMENT AND/ OR WATER DISCONTINUANCE MUST BE PROVIDED UPON REQUEST.
 - ALL EXISTING SERVICE UTILITIES SHALL BE CUT AND CAPPED AT LIMITS OF PROPOSED BUILDING.
 - CONTRACTOR TO COMPLETE SEWER CONNECTIONS IN ACCORDANCE WITH THE LATEST VERSION OF THE PHILADELPHIA WATER DEPARTMENT SEWER CONNECTION AND REPAIR MANUAL.

PWD WATER UTILITY CONNECTIONS

I.D.	TYPE	SIZE	MATERIAL
(W1)	FIRE SERVICE	6"	DUCTILE IRON

PWD SEWER UTILITY CONNECTIONS

I.D.	TYPE	SIZE	MATERIAL	CONNECTION TYPE
(S1)	STORM SEWER CONNECTION	6"	CAST IRON	SADDLE CONNECTION

PROTECT YOURSELF

ACT 187
IT IS THE CONTRACTOR'S RESPONSIBILITY TO COMPLY WITH THE PENNSYLVANIA ACT 187 AND TO CONTACT THE "ONE CALL SYSTEM" THREE (3) WORKING DAYS (UNLESS OTHERWISE NOTED) PRIOR TO START OF CONSTRUCTION.
PENNSYLVANIA ONE CALL: 1-800-242-1776

PHILADELPHIA WATER DEPARTMENT 1101 MARKET STREET, 2ND FLOOR PHILADELPHIA, PENNSYLVANIA 19107 (215) 685-6270	VERIZON 900 RACE STREET PHILADELPHIA, PENNSYLVANIA 19107 (215) 351-8947
PHILADELPHIA GAS WORKS 800 W. MONTGOMERY AVENUE, 3RD FLOOR PHILADELPHIA, PENNSYLVANIA 19122 (215) 684-6796	COMCAST 1351 S. COLUMBUS BOULEVARD PHILADELPHIA, PENNSYLVANIA 19147 (215) 952-4935

PECO-CONSTRUCTION DEPARTMENT
2301 MARKET STREET
PHILADELPHIA, PENNSYLVANIA 19103
(215) 731-3264

CALL BEFORE YOU DIG
PENNSYLVANIA LAW REQUIRES 3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE & 10 WORKING DAYS IN DESIGN STAGE
Pennsylvania One Call System, Inc.
1-800-242-1776

SITE LOCATION:
7809 CASTOR AVENUE
PHILADELPHIA, PA 19152

PROPERTY OWNER:
SCHOOL DISTRICT OF PHILADELPHIA
440 N. BROAD STREET
PHILADELPHIA PA 19130

SCALE: 1" = 30'-0"

EXISTING LEGEND

- PROPERTY LINES
- CONTOUR LINE
- GAS LINE
- POTABLE WATER
- SEPARATE SEWER SYSTEM
- SANITARY SEWER
- STORM DRAIN
- ELECTRIC CONDUIT
- ELECTRIC OVERHEAD LINE
- FENCE
- UNKNOWN MANHOLE
- TELEPHONE MANHOLE
- SANITARY MANHOLE
- STORM MANHOLE
- STORM/SANITARY MANHOLE
- ELECTRIC MANHOLE
- WATER MANHOLE
- WATER VALVE
- GAS VALVE
- UNKNOWN VALVE
- SEWER VENT
- FIRE HYDRANT
- UTILITY POLE/STREET LIGHT
- LIGHT POLE
- SIGN
- TRAFFIC SIGNAL
- TREE

EROSION & SEDIMENT CONTROL LEGEND

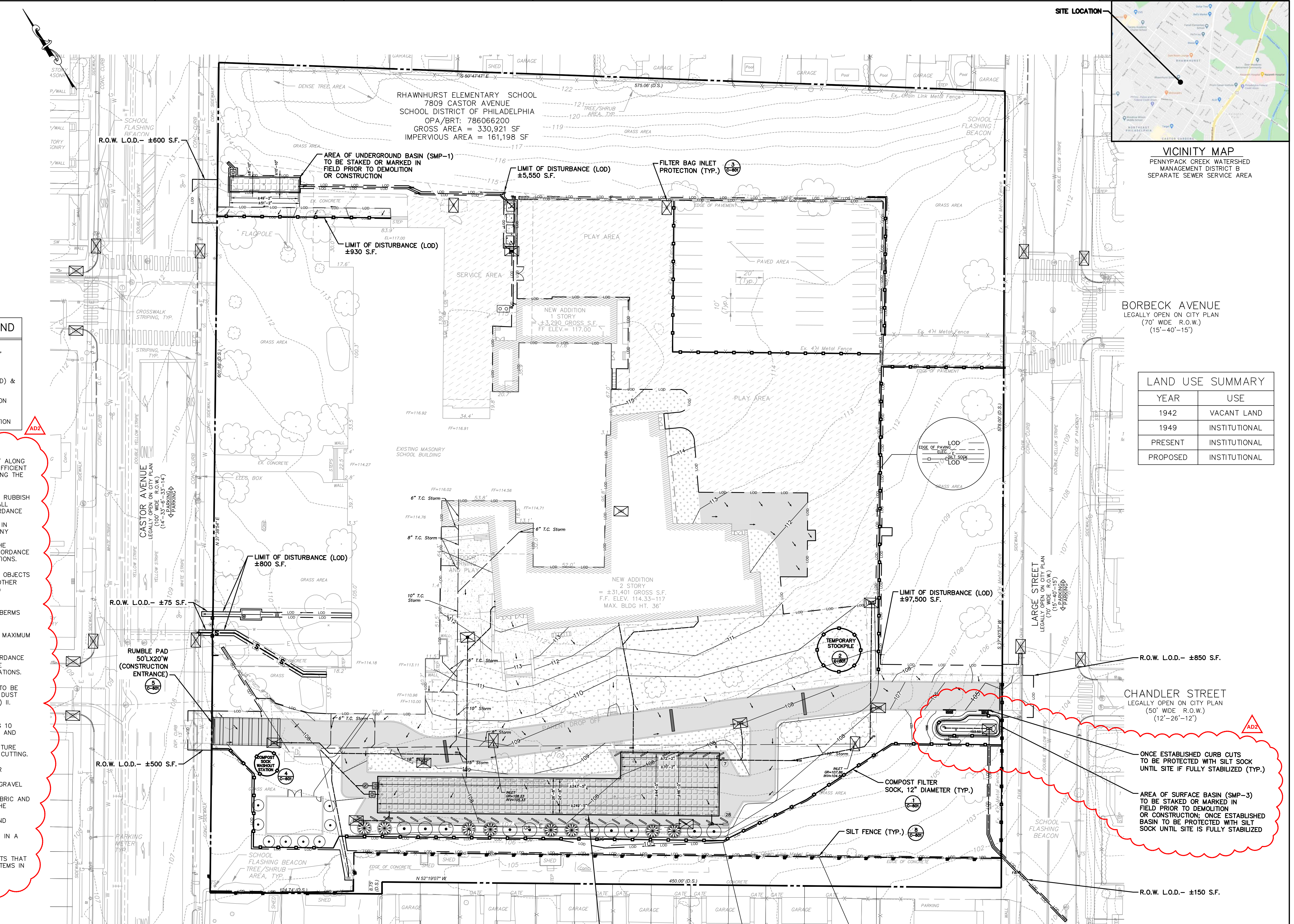
- COMPOST FILTER SOCK, 12" DIAMETER
- SILT FENCE
- LIMIT OF DISTURBANCE (LOD) & DEP SITE BOUNDARY
- RUMBLE PAD (CONSTRUCTION ENTRANCE)
- FILTER BAG INLET PROTECTION

EROSION AND SEDIMENT CONTROL (E&SC) NOTES:

- EXISTING CONCRETE AND BITUMINOUS PAVING TO BE SAW-CUT ALONG LIMIT OF DISTURBANCE LINE WITH A CLEAN CUT LINE TO A SUFFICIENT DEPTH TO ALLOW THE REMOVAL OF PAVING WITHOUT DISTURBING THE EXISTING PAVING THAT IS TO REMAIN.
- THE CONTRACTOR SHALL REMOVE FROM THE SITE ALL DEBRIS, RUBBISH AND OTHER MATERIALS RESULTING FROM DEMOLITION AND SHALL SAFELY AND LEGALLY DISPOSE OF ALL THESE ITEMS IN ACCORDANCE WITH APPLICABLE LOCAL, FEDERAL, STATE AND REGULATORY AUTHORITY HAVING JURISDICTION. RECYCLING MUST BE DONE IN ACCORDANCE WITH APPLICABLE REGULATIONS. BURNING OF ANY DEMOLISHED MATERIALS ON-SITE SHALL NOT BE PERMITTED. RECYCLING OF DEMOLITION DEBRIS SHALL BE APPROVED BY THE OWNER. ALL EXISTING FILL TO BE REMOVED FROM SITE IN ACCORDANCE WITH THE PA DEP MANAGEMENT OF FILL POLICY AND REGULATIONS.
- COMPOST FILTER SOCK ON PAVING TO BE WEIGHTED DOWN BY OBJECTS OF CONSIDERABLE MASS (SAND BAGS, CONCRETE BLOCK OR OTHER SUITABLE MATERIAL). COMPOST FILTER SOCK TO BE INSTALLED DOWNSTREAM OF ALL EARTH MOVING ACTIVITIES.
- INLET PROTECTION IN ROADWAYS NOT TO INCLUDE STONE OR BERMS FOR ROADWAY MAINTENANCE PURPOSES.
- MAXIMUM HEIGHT FOR STOCKPILE AREAS TO BE 20 FEET. THE MAXIMUM SIDE SLOPE FOR STOCKPILE AREAS NOT TO EXCEED 2:1.
- RUMBLE PAD CONSTRUCTION ENTRANCE TO BE SIZED IN ACCORDANCE WITH PA DEP MINIMUM REQUIREMENTS OF 50' X 20' W AND BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
- CONSTRUCTION, DEMOLITION AND EARTHWORK DUST CONTROL TO BE COMPLETED IN ACCORDANCE WITH THE CITY OF PHILADELPHIA DUST CONTROL REQUIREMENTS (AIR MANAGEMENT REGULATION (AMR) II, SECTION IX.) AND TO INCLUDE BUT NOT LIMITED TO:
 - NOTIFY OCCUPANTS OF NEARBY PROPERTIES, IN WRITING 10 DAYS BEFORE ENGAGING IN EARTHWORK, CONSTRUCTION AND DEMOLITION ACTIVITIES.
 - USE OF VACUUM OR SIMILAR SUCTION SYSTEMS TO CAPTURE DUST KICKED UP BY POWER TOOLS WHEN GRINDING OR CUTTING.
 - APPLICATION OF WATER OR APPROVED DUST CONTROL SUPPRESSANT DURING EXCAVATION, DEMOLITION AND/OR CONSTRUCTION TO SUPPRESS DUST FORMATION.
 - COVERING AND WETTING OF STOCKPILES EARTH, SAND, GRAVEL AND OTHER SIMILAR CONSTRUCTION MATERIALS.
 - ALL PERIMETER FENCING MUST HAVE DUST CONTROL FABRIC AND MUST MEASURE A MINIMUM OF 5 FT IN HEIGHT FROM THE BOTTOM OF FENCING.
 - 10 MILE PER HOUR SPEED LIMIT FOR ALL EQUIPMENT AND TRUCKS TRAVELING WITHIN THE WORK SITE.
 - WETTING AND SWEEPING OF ROADWAYS / ACCESS ROAD IN A WORK SITE TO PREVENT DUST FORMATION.
- PERMANENT INLET PROTECTION TO BE INSTALLED ON ALL INLETS THAT DRAIN TO THE UNDERGROUND STORM WATER MANAGEMENT SYSTEMS IN ACCORDANCE WITH THE SPECIFICATIONS.

GENERAL NOTES:

- THE TOPOGRAPHIC AND PHYSICAL FEATURES SHOWN ON THIS PLAN WERE OBTAINED THROUGH A COMBINATION OF AERIAL PHOTOGRAPHY PREPARED BY AXIS GEOSPATIAL ON 4/25/2020 AND FIELD EDITED BY GEOTREK ENVIRONMENTAL & SURVEYING, LLC ON 3/16/2020, 4/10/2020 & 4/14/2020.
- HORIZONTAL DATUM IS THE NAD83 PENNSYLVANIA STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, NORTH AMERICAN DATUM OF 1983, (PA83-SF, NAD 83). VERTICAL DATUM IS THE CITY OF PHILADELPHIA VERTICAL DATUM, FINISHED FLOOR OF EL. 117.00 WAS UTILIZED AS THE BENCHMARK TAKEN FROM EXISTING SITE PLANS.
- MERIDIANS AND BEARINGS ARE REFERENCED TO CITY PLAN NO. 318 DATED NOVEMBER 20TH, 2002 AND CITY PLAN NO. 320 DATED AUGUST 11TH, 2003. LOT BEARINGS AND DISTANCES ARE SHOWN IN PHILADELPHIA DISTRICT STANDARD. ALL OTHER DIMENSIONS ARE SHOWN IN U.S. SURVEY FEET.
- UNDERGROUND UTILITIES AS SHOWN ARE TAKEN FROM FIELD EVIDENCE AND PLANS AS PROVIDED BY THE VARIOUS UTILITY AUTHORITIES (PA ONE CALL SERIAL NO. 20200023262 AND 20200023268). THE ACCURACY REGARDING UTILITY LOCATION AND/OR DEPTH CANNOT BE GUARANTEED AND ADDITIONAL UNDERGROUND UTILITIES NOT DEPICTED ON THE PLAN MAY EXIST. BEFORE EXCAVATIONS ARE BEGUN, THE PENNSYLVANIA ONE CALL SYSTEM AT 1-800-242-1776 SHALL BE CONTACTED AT LEAST 3-10 DAYS PRIOR TO COMMENCEMENT OF ANY DEMOLITION OR EXCAVATION ACTIVITIES IN ACCORDANCE WITH ALL APPLICABLE LAWS, RULES AND REGULATIONS.
- SITE LIES WITHIN THE MAPPED LIMITS OF FLOOD ZONE X, AS SHOWN ON THE FEMA FLOOD INSURANCE RATE PAY COMMUNITY-PANEL NO 42075701096, DATED 01/17/2007 FOR THE CITY OF PHILADELPHIA.
- PROJECT SITE IS NOT LOCATED IN A SPECIAL FLOOD HAZARD ZONE AND THERE ARE NOT WETLANDS ON SITE. THERE ARE NO WATER COURSES OR BODIES OF WATER LOCATED WITHIN 100 FEET OF THE PROPERTY.



MAINTENANCE NOTES:

- INLET PROTECTION DEVICES AND BARRIERS SHALL BE REPAIRED OR REPLACED IF THEY SHOW SIGNS OF UNDERMINING, OR DETERIORATION.
- ALL SEEDED AREAS SHALL BE CHECKED REGULARLY TO SEE THAT A GOOD STAND IS MAINTAINED. AREAS SHOULD BE FERTILIZED, WATERED, AND RESEEDED AS NEEDED.
- COMPOST FILTER SOCKS SHALL BE REPAIRED TO THEIR ORIGINAL CONDITIONS IF DAMAGED. SEDIMENT SHALL BE REMOVED WHEN IT REACHES ONE-HALF THE HEIGHT OF THE EXPOSED COMPOST FILTER SOCK.
- THE CONSTRUCTION ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOW OF MUD ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING OF THE CONSTRUCTION ENTRANCE AS CONDITIONS DEMAND.
- BMPs ARE TO BE INSPECTED ON A WEEKLY BASIS AND AFTER STORMWATER EVENTS. INSPECTIONS ARE TO BE LOGGED, DATED AND KEPT ON-SITE AT ALL TIMES.

LIMIT OF DISTURBANCE (LOD) SUMMARY

ON-SITE	105,000 S.F.	2.41 ACRES
PUBLIC R.O.W.	2,300 S.F.	0.05 ACRES
TOTAL	107,300 S.F.	2.46 ACRES

ACT 187

IT IS THE CONTRACTOR'S RESPONSIBILITY TO COMPLY WITH THE PENNSYLVANIA ACT 187 AND TO CONTACT THE "ONE CALL SYSTEM" THREE (3) WORKING DAYS (UNLESS OTHERWISE NOTED) PRIOR TO START OF CONSTRUCTION.

PENNSYLVANIA ONE CALL: 1-800-242-1776

PHILADELPHIA WATER DEPARTMENT 1101 MARKET STREET, 2ND FLOOR PHILADELPHIA, PENNSYLVANIA (215) 685-6270	VERIZON 900 RACE STREET PHILADELPHIA, PENNSYLVANIA 19107 (215) 351-8947
PHILADELPHIA GAS WORKS 800 W. MONTGOMERY AVENUE, 3RD FLOOR PHILADELPHIA, PENNSYLVANIA 19122 (215) 684-6796	COMCAST 1351 S. COLUMBUS BOULEVARD PHILADELPHIA, PENNSYLVANIA 19147 (215) 952-4935

PECO-CONSTRUCTION DEPARTMENT
2301 MARKET STREET
PHILADELPHIA, PENNSYLVANIA 19103
(215) 731-3264

WHAT YOU DON'T KNOW CAN HURT YOU.
CALL BEFORE YOU DIG!
PENNSYLVANIA LAW REQUIRES 3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE & 10 WORKING DAYS IN DESIGN STAGE
Pennsylvania One Call System, Inc.
1-800-242-1776

THE SCHOOL DISTRICT OF PHILADELPHIA
OFFICE OF CAPITAL PROGRAMS
440 NORTH BROAD STREET
PHILADELPHIA, PA 19130 - 4015
(215) 400 - 4730 | (215) 400 - 4731 (fax)
www.phildad.org

SEAL:
FRANK ANTHONY FRECA
REGISTERED PROFESSIONAL ENGINEER
NO. P25880R
PENNSYLVANIA

FRANK ANTHONY FRECA, PE
STATE AND LICENSE NO. P25880R

VICINITY MAP

PENNSYLVANIA CREEK WATERSHED MANAGEMENT DISTRICT B SEPARATE SEWER SERVICE AREA

BORBECK AVENUE

LEGALLY OPEN ON CITY PLAN (70' WIDE R.O.W.) (15'-40'-15')

CHANDLER STREET

LEGALLY OPEN ON CITY PLAN (50' WIDE R.O.W.) (12'-26'-12')

LAND USE SUMMARY

YEAR	USE
1942	VACANT LAND
1949	INSTITUTIONAL
PRESENT	INSTITUTIONAL
PROPOSED	INSTITUTIONAL

ARCHITECT

CRABTREE, BOHRBAUGH & ASSOCIATES
401 E. Winding Hill Road
Mechanicsburg, PA 17055
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Email: kkaehler-mka@comcast.net
Attn: Ken Kähler

3/2/2021

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NO. DATE REVISION

SCHOOL & LOCATION

RHAWNURST ELEMENTARY SCHOOL
7809 CASTOR AVENUE, PHILADELPHIA PA 19152

PROJECT TITLE
ADDITIONS & RENOVATIONS

DRAWING TITLE
EROSION AND SEDIMENT CONTROL PLAN

DRAWN BY	CHECKED BY	DATE	OF	NO.
KSE	KSE	B-070	OF	2019 / 20
		B-071	OF	2019 / 20
		B-072	OF	2019 / 20
		B-073	OF	2019 / 20

DRAWING NO.
C-600

STANDARD EROSION AND SEDIMENT CONTROL NOTES:

1. AN INDUSTRIAL WASTE PERMIT WILL BE REQUIRED SHOULD PUMPING TO CITY-OWNED INFRASTRUCTURE BECOME NECESSARY DURING CONSTRUCTION. ALL PUMPING WORK AREAS SHALL BE DONE ACCORDING TO THE PROCEDURE DESCRIBED IN THIS PLAN, OVER UNDISTURBED VEGETATED AREAS.
2. INLET PROTECTION SHOULD BE PROVIDED FOR ALL INLETS OWNED BY PWD THAT ARE LOCATED WITHIN ONE BLOCK OF THE PROJECT SITE.
3. PWD IS NOT RESPONSIBLE FOR ANY CLEANING OR REPAIRS NEEDED ON CITY-OWNED INFRASTRUCTURE DUE TO ANY EROSION AND SEDIMENT CONTROL PRACTICES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT ALL EROSION AND SEDIMENT CONTROL PRACTICES ARE FUNCTIONING IN ACCORDANCE WITH THE APPROVED PLANS.
4. INSPECTION AND MAINTENANCE OF ALL EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES SHALL OCCUR ON A WEEKLY BASIS, BEFORE ANY ANTICIPATED PRECIPITATION EVENTS, AND AFTER ALL PRECIPITATION EVENTS.
5. THE MAXIMUM HEIGHT FOR STOCKPILE AREAS SHALL BE 20 FEET. THE MAXIMUM SIDE SLOPE FOR STOCKPILE AREAS SHALL NOT EXCEED 2:1.
6. THE ROCK CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED ON-SITE. A STOCKPILE SHALL BE MAINTAINED ON-SITE FOR THIS PURPOSE. AT THE END OF EACH CONSTRUCTION DAY, ALL SEDIMENT DEPOSITED ON PAVED ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE. IN NO CASE SHALL THE SEDIMENT BE WASHED, SHOVELED, OR THROWN INTO ANY ROADSIDE DITCH, STORM SEWER, OR SURFACE WATER.
7. FILTER FABRIC FENCE SHALL BE INSTALLED AT LEVEL GRADE. BOTH ENDS OF EACH FENCE SECTION SHOULD BE EXTENDED AT LEAST 8 FEET UPSLOPE AT 45 DEGREES TO THE MAIN BARRIER ALIGNMENT. SUPPORT STAKES SHALL BE SPACED AT A MAXIMUM OF 8 FEET. SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH 1/2 THE ABOVE GROUND HEIGHT OF THE FILTER FENCE.
8. ANY FENCE SECTION WHICH HAS BEEN UNDERMINED OR TOPPED MUST BE IMMEDIATELY REPLACED WITH A ROCK FILTER OUTLET. SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE HEIGHT OF THE OUTLET.
9. EROSION CONTROL BLANKETING SHALL BE INSTALLED ON ALL SLOPES 3H:1V OR STEEPER WITHIN 50 FEET OF A SURFACE WATER AND ON ALL OTHER DISTURBED AREAS SPECIFIED ON THE PLAN MAPS AND/OR DETAIL SHEETS.
10. IMMEDIATELY UPON DISCOVERING UNFORESSEEN CIRCUMSTANCES POSING THE POTENTIAL FOR EROSION AND SEDIMENT POLLUTION, THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT POLLUTION AND NOTIFY PWD AND PA DEP.
11. UNTIL THE SITE IS STABILIZED, ALL E&S BMP'S SHALL BE MAINTAINED PROPERLY. MAINTENANCE SHALL INCLUDE INSPECTIONS OF ALL E&S BMP'S PRIOR TO ANY ANTICIPATED STORM EVENT, AFTER EACH RUNOFF EVENT AND ON A WEEKLY BASIS. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN UP, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING, AND RENETTING, MUST BE PERFORMED IMMEDIATELY. IF THE E&S BMP'S FAIL TO PERFORM AS EXPECTED, REPLACEMENT BMP'S, OR MODIFICATIONS OF THOSE INSTALLED, WILL BE REQUIRED.
12. ALL EARTH DISTURBANCES, INCLUDING CLEARING AND GRUBBING, AS WELL AS CUTS AND FILLS, SHALL BE DONE IN ACCORDANCE WITH THE APPROVED E&S PLAN. A COPY OF THE APPROVED DRAWINGS MUST BE AVAILABLE AT THE PROJECT SITE AT ALL TIMES. PWD WILL BE NOTIFIED OF ANY CHANGES TO THE APPROVED PLAN PRIOR TO IMPLEMENTATION OF THOSE CHANGES. PWD MAY REQUIRE A WRITTEN SUBMITTAL OF THOSE CHANGES FOR REVIEW AND APPROVAL AT ITS DISCRETION.
13. AT LEAST THREE (3) DAYS PRIOR TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, OR EXPANDING INTO AN AREA PREVIOUSLY UNDER THE PENNSYLVANIA ONE CALL SYSTEM INC. SHALL BE NOTIFIED AT 1-800-242-1776 FOR THE LOCATION OF EXISTING UNDERGROUND UTILITIES.
14. ALL EARTH DISTURBANCE ACTIVITIES SHALL PROCEED IN ACCORDANCE WITH THE SCIENCE PROVIDED ON THE PLAN DRAWINGS. DEVIATION FROM THAT SEQUENCE MUST BE APPROVED IN WRITING BY PWD AND THE PA DEP PRIOR TO IMPLEMENTATION.
15. AREAS TO BE FILLED ARE TO BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL TO REMOVE TREES, VEGETATION, ROOTS, AND OTHER OBJECTIONABLE MATERIAL.
16. CLEARING, GRUBBING, AND TOPSOIL STRIPPING SHALL BE LIMITED TO THOSE AREAS DESCRIBED IN EACH STAGE OF THE CONSTRUCTION SEQUENCE. GENERAL SITE CLEARING, GRUBBING, AND TOPSOIL STRIPPING MAY NOT COME IN ANY STAGE OF THE PROJECT UNTIL THE E&S BMP'S SPECIFIED BY THE BMP'S SEQUENCE FOR THAT STAGE HAVE BEEN INSTALLED AND ARE FUNCTIONING AS DESCRIBED IN THIS E&S PLAN.
17. AT NO TIME SHALL CONSTRUCTION VEHICLES BE ALLOWED TO ENTER AREAS OUTSIDE THE LIMIT OF DISTURBANCE BOUNDARIES SHOWN ON THE PLAN MAPS. THESE AREAS MUST BE CLEARLY MARKED AND FENCED OFF BEFORE CLEARING AND GRUBBING OPERATIONS BEGIN.
18. A LOG SHOWING DATES THAT E&S BMP'S WERE INSPECTED AS WELL AS ANY DEFICIENCIES FOUND AND THE DATE THEY WERE CORRECTED SHALL BE MAINTAINED ON THE SITE AND BE AVAILABLE TO PWD AT THE TIME OF INSPECTION.
19. ALL SEDIMENT REMOVED FROM BMP'S SHALL BE DISPOSED OF IN THE FOLLOWING MANNER: REMOVAL AND DISPOSAL TO BE AT AN OFF-SITE LOCATION IN

ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

20. AREAS WHICH ARE TO BE TOPSOILED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF THREE TO FIVE INCHES - SIX TO TWELVE INCHES ON COMPACTED SOILS - PRIOR TO PLACEMENT OF TOPSOIL. AREAS TO BE VEGETATED SHALL HAVE A MINIMUM FOUR INCHES OF TOPSOIL IN PLACE PRIOR TO SEEDING AND MULCHING. FILL OUTLOSSES SHALL HAVE A MINIMUM OF TWO INCHES OF TOPSOIL.
21. ALL FILLS SHALL BE COMPACTED AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, SUBSIDENCE, OR OTHER RELATED PROBLEMS. FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES, AND CONDUITS, ETC. SHALL BE COMPACTED IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES.
22. ALL EARTHEN FILLS SHALL BE PLACED IN COMPACTED LAYERS NOT TO EXCEED NINE INCHES IN THICKNESS.
23. FILL MATERIALS SHALL BE FREE OF FROZEN PARTICLES, BRUSH, ROOTS, SOIL, OR OTHER FOREIGN OR OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
24. FROZEN MATERIALS OR SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS SHALL NOT BE INCORPORATED INTO FILLS.
25. FILL SHALL NOT BE PLACED ON SATURATED OR FROZEN SURFACES.
26. SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION SHALL BE HANDLED IN ACCORDANCE WITH THE STANDARD AND SPECIFICATION FOR SUBSURFACE DRAIN OR OTHER APPROVED METHOD.
27. ALL GRADED AREAS SHALL BE PERMANENTLY STABILIZED IMMEDIATELY UPON REACHING FINISHED GRADE. CUT SLOPES IN COMPLETED BEDROCK AND ROCK FILL NEED NOT BE VEGETATED. SEEDING AREAS WITHIN 50 FEET OF A SURFACE WATER, OR AS OTHERWISE SHOWN ON THE PLAN DRAWINGS, SHALL BE BLANKETED ACCORDING TO THE STANDARDS OF THIS PLAN.
28. IMMEDIATELY AFTER EARTH DISTURBANCE ACTIVITIES CEASE IN ANY AREA OR SUB-AREA OF THE PROJECT, THE OPERATOR SHALL STABILIZE ALL DISTURBED AREAS. DURING NON-GERMINATING MONTHS, MULCH OR PROTECTIVE BLANKETING SHALL BE APPLIED AS DESCRIBED IN THE PLAN. AREAS NOT AT FINISHED GRADE, WHICH WILL BE REACTIVATED WITHIN ONE YEAR, MAY BE STABILIZED IN ACCORDANCE WITH THE TEMPORARY STABILIZATION SPECIFICATIONS. THOSE AREAS WHICH WILL NOT BE REACTIVATED WITHIN ONE YEAR SHALL BE STABILIZED IN ACCORDANCE WITH THE PERMANENT STABILIZATION SPECIFICATIONS.
29. PERMANENT STABILIZATION IS DEFINED AS A MINIMUM UNIFORM, PERENNIAL 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED EROSION. CUT, AND FILL SLOPES SHALL BE CAPABLE OF RESISTING FAILURE DUE TO SLUMPING, SLIDING, OR OTHER MOVEMENTS.
30. E&S BMP'S SHALL REMAIN FUNCTIONAL AS SUCH UNTIL ALL AREAS TRIBUTARY TO THEM ARE PERMANENTLY STABILIZED OR UNTIL THEY ARE REPLACED BY ANOTHER BMP'S APPROVED BY PWD AND PA DEP.
31. AFTER FINAL SITE STABILIZATION HAS BEEN ACHIEVED, TEMPORARY E&S BMP'S MUST BE REMOVED OR CONVERTED TO PERMANENT POST-CONSTRUCTION STORMWATER MANAGEMENT PRACTICES. AREAS DISTURBED DURING REMOVAL OR CONVERSION OF THE E&S BMP'S SHALL BE STABILIZED IMMEDIATELY. IN ORDER TO ENSURE RAPID REVEGETATION OF DISTURBED AREAS, SUCH REMOVAL/CONVERSIONS ARE TO BE DONE ONLY DURING THE GERMINATING SEASON.
32. SEDIMENT BASINS AND/OR TRAPS SHALL BE KEPT FREE OF ALL CONSTRUCTION WASTE, WASH WATER, AND OTHER DEBRIS HAVING POTENTIAL TO CLOG THE BASIN/TRAP OUTLET STRUCTURES AND/OR POLLUTE THE SURFACE WATERS. (WHEN APPLICABLE)
33. DURING CONSTRUCTION, THE SELECTED CONTRACTOR IS EXPECTED TO FOLLOW THE PCSPM APPROVED BY PWD (WHERE APPLICABLE). NO CHANGE OR DEVIATION FROM THE APPROVED PCSPM IS PERMITTED WITHOUT PRIOR APPROVAL FROM PWD.
34. ALL WORK ASSOCIATED WITH PWD WATER CONVEYANCE AND SEWER INFRASTRUCTURE SHALL BE DONE IN ACCORDANCE WITH THE CITY OF PHILADELPHIA WATER DEPARTMENT "WATER MAIN STANDARD DETAILS AND CORROSION CONTROL SPECIFICATIONS", 1985 EDITION, AND "STANDARD DETAILS AND STANDARD SPECIFICATIONS FOR SEWERS", 1985 EDITION.
35. CONTACT PWD WATER TRANSPORT RECORDS (1101 MARKET STREET, 2ND FLOOR, PHONE: 215-685-6271) FOR ADDITIONAL APPROVALS AND PERMITS REQUIRED FOR ALL WATER SERVICES, METERS, AND CONNECTIONS TO THE EXISTING AND/OR PROPOSED PWD FACILITIES.
36. ALL BUILDING MATERIALS AND WASTES SHALL BE REMOVED FROM THE SITE AND RECYCLED OR DISPOSED OF IN ACCORDANCE WITH THE PADEP'S SOLID WASTE MANAGEMENT REGULATIONS AT 25 PA CODE 280.1 ET SEQ., 271.1 AND 287.1 ET SEQ. NO BUILDING MATERIALS OR WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURNED, BURIED, DUMPED, OR DISCHARGED AT THE SITE.

SITE STABILIZATION METHODS (TEMPORARY & PERMANENT STABILIZATION)

1. STRAW MULCH MUST BE APPLIED AT 3.0 TONS PER ACRE.
2. MULCH WITH MULCH CONTROL NETTING OR EROSION CONTROL BLANKETS MUST BE INSTALLED ON ALL SLOPES GREATER THAN 3:1.
3. STRAW MULCH SHALL BE APPLIED IN LONG STRANDS, NOT CHOPPED OR FINELY

BROKEN.

- TEMPORARY SEEDING**
1. THE FOLLOWING SURFACES OF THE SITE SHALL BE TEMPORARILY SEEDED AND MULCHED:
 - A. THE SURFACE OF TOPSOIL STOCKPILES.
 - B. THE SURFACE OF EXPOSED EARTH AREAS THAT WILL BE EXPOSED WITHOUT CONSTRUCTION ACTIVITY THEREON.
 2. SEEDING SHALL OCCUR IMMEDIATELY AFTER ESTABLISHMENT OF THE TOPSOIL STOCKPILES OR ROUGH GRADED AREAS. THE FOLLOWING SHALL BE PLANTED:
 - A. 40 LBS./ACRE ANNUAL RYE GRASS - COMMON, 100% P.L.S.
 3. PREPARE AREAS TO BE SEEDED AS FOLLOWS:
 - A. REPAIR ALL DEBRIS, INCLUDING LARGE STONES, APPLY LIME AT A RATE OF 3 TONS PER ACRE AND FERTILIZER AT THE RATE OF 50-50-50 PER ACRE AND WORK INTO SOIL.
 - B. SOW SEED AT THE INDICATED RATE. DIVIDE SEED INTO TWO EQUAL LOTS, SOW ONE LOT IN ONE DIRECTION, SOW SECOND LOT AT RIGHT ANGLE TO FIRST. RAKE SEED AREA SLIGHTLY. ROLL SURFACE LIGHTLY TO FIRM SOIL AROUND SEED.
 4. PLACE CLEAN DRY STRAW OR HAY MULCH WITHIN 48 HOURS AFTER SEEDING. PLACE AT THE RATE OF 3 TONS PER ACRE.
 5. SEEDING DATES SHALL BE BETWEEN MARCH 1 AND NOVEMBER 15.
- TEMPORARY MULCHING**
1. MULCH PROPOSED LANDSCAPE AREAS OR TOPSOIL STOCKPILES IF EARTHWORK IS COMPLETED OUTSIDE OF THE RECOMMENDED PLANTING SEASONS FOR TEMPORARY SEEDING OR DUE TO UNFAVORABLE WEATHER CONDITIONS.
 2. MULCH SHALL BE APPLIED IMMEDIATELY FOLLOWING THE ESTABLISHMENT OF THE TOPSOIL STOCKPILE OR ROUGH GRADING.
 3. MULCH WITH SUITABLE FIBROUS GROUND, SHREDDED AGED HARDWOOD, PINE WOOD BARK OR STRAW, UNIFORM AND CONTINUOUSLY TO A LOOSE DEPTH OF 3 INCHES MINIMUM. ANCHOR AS REQUIRED.
 4. PROPERLY MAINTAIN MULCHED AREAS UNTIL PERMANENT STABILIZATION MEASURES ARE COMPLETE. REAPPLY MULCH MATERIALS WHICH BECOME DISLOADED AS INITIAL OR MATURED RATES AS NECESSARY. IF A SLOPE FAILURE OCCURS WHICH REQUIRES REDRESSING, EXCAVATION, OR THE ESTABLISHMENT OF A NEW SLOPE, REPLACE MULCH AS NECESSARY.
- PERMANENT SEEDING**
1. PERMANENT SEEDING SHALL OCCUR IMMEDIATELY AFTER THE FINAL GRADING IS COMPLETED. THE FOLLOWING SEED SHALL BE PLACED UNLESS OTHERWISE SPECIFIED ON THE PLANS OR DIRECTED IN THE FIELD.
 - A. 40% PENNLANAW FINE FESCUE
 - B. 60% RED TOP
 2. 20% CHAMPION PERENNIAL RYE GRASS QUANTITIES ARE OF PURE LIVE SEED (P.L.S.) SPREAD AT A RATE OF 63 LBS. PER ACRE.
 3. REMOVE ALL DEBRIS, INCLUDING LARGE STONES, TILL SOIL TO A DEPTH OF FOUR INCHES TO SIX INCHES. APPLY LIME AT A RATE OF 4 TONS PER ACRE. APPLY COMMERCIAL 10-20-20 FERTILIZER AT A RATE OF 930 LBS. PER ACRE. WORK FERTILIZER INTO TOP INCH OF SOIL.
 4. DIVIDE SEED INTO TWO EQUAL LOTS. SOW ONE LOT IN ONE DIRECTION, SOW SECOND LOT AT RIGHT ANGLE TO FIRST LOT. RAKE SEED AREA SLIGHTLY. ROLL SURFACE LIGHTLY TO FIRM SOIL AROUND SEED.
 5. MULCH SEEDED AREAS WITH STRAW OR HAY AT THE RATE OF 3 TONS PER ACRE. ANCHOR MULCH. COMPLY WITH THE REQUIREMENTS OF SECTION 805 - MULCHING, PENNDOT PUBLICATION 408. ANCHOR MULCH AS SPECIFIED.
 6. MULCHING SHALL BE DONE AT THE MINIMUM RATE OF 3 TONS PER ACRE WITH SALT HAY, HAY OR STRAW MULCHES. PLACE MULCH IMMEDIATELY AFTER SEEDING OR WITHIN 48 HOURS AFTER SEEDING IS COMPLETED. PROPERLY MAINTAIN MULCHED AREAS UNTIL THE ENTIRE PROJECT HAS BEEN COMPLETED. PROMPTLY REAPPLY MULCH MATERIALS WHICH BECOME DISLOADED OR LOST DUE TO WIND, RAIN, OR OTHER CAUSES AT INITIAL RATES OR AS DIRECTED.
 7. LIQUID MULCH BINDERS MAY BE USED TO ANCHOR SALT HAY, HAY OR STRAW MULCHES.
 - A. APPLICATIONS SHOULD BE HEAVIER AT EDGES WHERE WIND CATCHES THE MULCH IN VALLEYS AND AT CRESTS OF BANKS. REMAINDER OF AREAS SHOULD BE UNIFORM IN APPEARANCE.
 - B. USE ONE OF THE FOLLOWING: EMULSIFIED ASPHALT, CLASS E-1 OR E-6, APPLY 31 GALLONS PER 1,000 SQUARE YARDS ON SLOPES LESS THAN 8 FEET HIGH. ON SLOPES 8 FEET HIGH OR MORE, USE 58 GALLONS PER 1,000 SQUARE YARDS. CUTBACK ASPHALT, CLASS RC-250, APPLY 31 GALLONS PER 1,000 SQUARE YARDS ON FLAT AREAS AND ON SLOPES LESS THAN 8 FEET HIGH. ON SLOPES 8 FEET HIGH OR MORE, USE 58 GALLONS PER 1,000 SQUARE YARDS. NON-ASPHALTIC EMULSION - NATURAL VEGETABLE GUM BLENDED WITH GELLING AND HARDENING AGENTS (TERRA TACK, AR) AS MANUFACTURED BY GRASS GROWERS COMPANY OR EQUAL. APPLY 25 LBS. PER 1,000 SQUARE YARDS.

MAINTENANCE PROGRAM

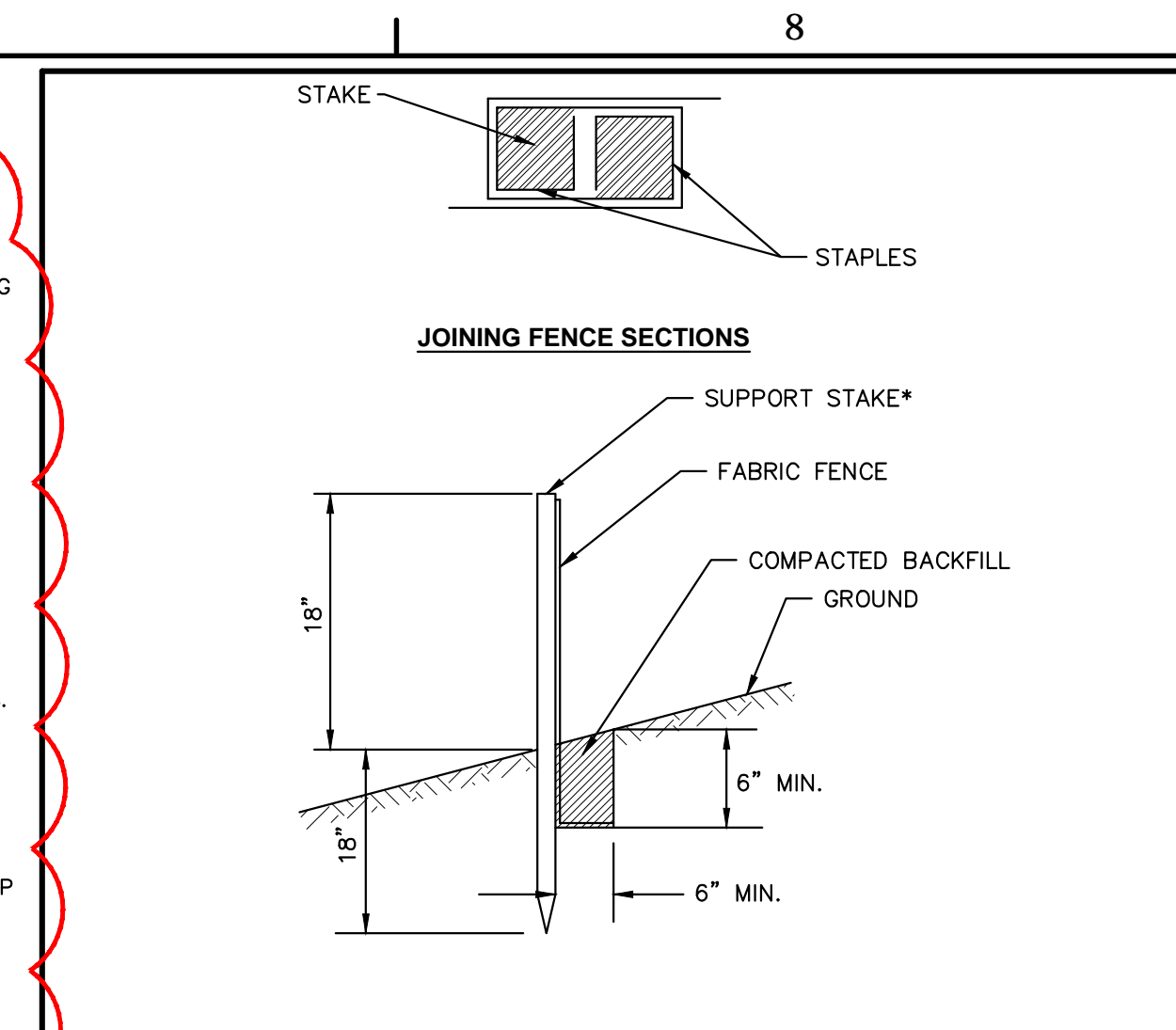
1. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE PROPER CONSTRUCTION STABILIZATION, AND MAINTENANCE OF ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES AND RELATED ITEMS INCLUDED WITHIN THIS PLAN. THE CONTRACTOR WILL ALSO BE RESPONSIBLE FOR THE PROPER CONSTRUCTION AND STABILIZATION OF PERMANENT CONTROL MEASURES AND RELATED ITEMS INCLUDED WITHIN THIS PLAN.
2. THE OWNER WILL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL PERMANENT CONTROL MEASURES.
3. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENT BMP'S MUST BE MAINTAINED PROPERLY. MAINTENANCE MUST INCLUDE INSPECTIONS OF ALL

- EROSION AND SEDIMENT CONTROL BMP'S AFTER EACH RUNOFF EVENT AND ON A WEEKLY BASIS. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK INCLUDING CLEAN UP, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING, AND RENETTING, MUST BE DONE IMMEDIATELY. IF EROSION AND SEDIMENT CONTROL BMP'S FAIL TO PERFORM AS EXPECTED, REPLACEMENT BMP'S, OR MODIFICATIONS TO THOSE INSTALLED WILL BE REQUIRED.**
1. AREA FOR PROPOSED SUBSURFACE SMP'S MUST BE PHYSICALLY MARKED IN FIELD BEFORE ANY SITE WORK BEGINS TO AVOID SOIL DISTURBANCE AND COMPACTION DURING CONSTRUCTION.
 2. COMPLETE SITE GRADING AND STABILIZATION OF ALL DISTURBED SOIL.
 3. EXCAVATE SUBSURFACE SMP AREAS TO PROPOSED DEPTHS, MANUALLY GRADE AND SCARIFY THE EXISTING SUBGRADE. THE BOTTOM OF THE SMP MUST BE AT A LEVEL ABOVE EXISTING SUBGRADE MUST NOT BE COMPACTED OR SUBJECT TO EXCESS CONSTRUCTION EQUIPMENT.
 4. COMPLETE INFILTRATION TESTING IN ACCORDANCE WITH THE PHILADELPHIA WATER DEPARTMENT (PWD) REQUIREMENTS FOR EXPLORATORY TEST PITS AND DOUBLE-RING INFILTROMETER TESTING AS OUTLINED CHAPTER 3.3 OF THE PWD STORMWATER MANAGEMENT GUIDANCE MANUAL V3.2 OR LATEST VERSION.
 5. PLACE GEOTEXTILE, LEVELING SAND AND STONE AGGREGATE BEDDING IMMEDIATELY AFTER APPROVAL OF SUBGRADE PREPARATION AND IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS.
 6. INSTALL STORMWATER TANKS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. 7. INSTALL ALL AGGREGATE IN LIFTS OF SIX TO EIGHT INCHES. ALL AGGREGATE MUST REMAIN FREE OF SEDIMENT.
 8. CONFIRM AND DOCUMENT ALL INVERT ELEVATIONS AND DIMENSIONS FOR ALL LAYERS AND STRUCTURES.
 9. BACKFILL TO FINISHED GRADE. ENSURE BACKFILL IS PROPERLY COMPACTED IN ACCORDANCE WITH THE SPECIFICATIONS. ENSURE BACKFILL DOES NOT DISRUPT THE SMP SYSTEM.
 10. COMPLETE SURFACE GRADING AND INSTALL FINISHED SURFACE.
- SURFACE INFILTRATION SMP SEQUENCE OF CONSTRUCTION**
1. REGISTERED PROFESSIONAL SHALL BE PRESENT ON SITE DURING THESE STAGES TO OVERSEE THE DOCUMENTATION OF ELEVATIONS AND MEASUREMENTS AS FOUND IN THE PWD CONSTRUCTION CERTIFICATION PACKAGE.
 1. AREA FOR BIOINFILTRATION SHALL BE CLEARLY MARKED BEFORE ANY SITE WORK BEGINS TO AVOID SOIL DISTURBANCE AND COMPACTION DURING CONSTRUCTION.
 2. COMPLETE SITE ELEVATION GRADING AND STABILIZE THE SOIL DISTURBED WITHIN THE LIMITS OF DISTURBANCE. DO NOT FINALIZE BIOINFILTRATION EXCAVATION AND CONSTRUCTION UNTIL THE DRAINAGE AREA IS FULLY STABILIZED.
 3. COMPLETE DOUBLE RING INFILTROMETER TESTING IN ACCORDANCE WITH PWD REQUIREMENTS AS OUTLINED IN CHAPTER 3.3 OF THE PWD STORMWATER MANAGEMENT GUIDANCE MANUAL V3.2 OR LATEST VERSION PRIOR TO BASIN CONSTRUCTION AND CONFIRM PROPOSED SYSTEM TYPE AND ORIFICE SIZE/SEALED CAP WITH THE DESIGN ENGINEER. DO NOT PROCEED WITH BASIN CONSTRUCTION UNTIL WRITTEN AUTHORIZATION HAS BEEN GRANTED BY THE ENGINEER.
 4. CONTRACTOR TO FOLLOW AND COMPLETE PWD'S SMP CONSTRUCTION CERTIFICATION PACKAGE FORM FOR BIOINFILTRATION/BIORETENTION BASINS. SEE PWD STORMWATER MANAGEMENT GUIDANCE MANUAL.
 5. EXCAVATE BIOINFILTRATION AREA TO PROPOSED INVERT DEPTH AND SCARIFY THE EXISTING SOIL SURFACES. DO NOT COMPACT IN-SITU SOILS. HEAVY EQUIPMENT SHALL NOT BE USED WITHIN THE BIOINFILTRATION BASIN. EQUIPMENT SHALL BE KEPT OUT OF THE EXCAVATED AREA TO THE MAXIMUM EXTENT POSSIBLE.
 6. INSTALL OUTLET CONTROL STRUCTURE. PLACE FILTER FABRIC, THEN PLACE THE CLEAN WASHED STONE, AND SET THE UNDERDRAIN ACCORDING TO THE PLANS.
 7. BACKFILL THE EXCAVATED AREA AS SOON AS THE SUBGRADE PREPARATION IS COMPLETE TO AVOID ACCUMULATION OF DEBRIS. PLACE BIOINFILTRATION SOIL IN 12-18 INCHES LIFTS AND TAMP LIGHTLY. SLOTTED OVERLAPPING MIGHT BE NECESSARY TO ACCOUNT FOR SETTLEMENT. PRE-SOAK SOIL AT LEAST ONE DAY PRIOR TO FINAL GRADING AND LANDSCAPING TO ALLOW FOR SETTLEMENT.
 8. AFTER ALLOWING FOR SETTLEMENT, COMPLETE FINAL GRADING WITHIN ABOUT 2 INCHES OF THE PROPOSED DESIGN ELEVATIONS, LEAVING SPACE FOR TOP DRESSING OF MULCH OR MULCH/COMPOST BLEND IF REQUIRED BY THE SCHOOL DISTRICT OF PHILADELPHIA.
 9. SEED AND PLANT VEGETATION AS INDICATED ON THE PLANS AND SPECIFICATIONS.
 10. GRADE AND MULCH TO FINAL ELEVATIONS.
 11. INSTALL OUTLET PROTECTION AS SPECIFIED ON THE PLANS.
 12. WATER VEGETATION AT THE END OF EACH DAY FOR TWO WEEKS AFTER PLANTING IS COMPLETED.

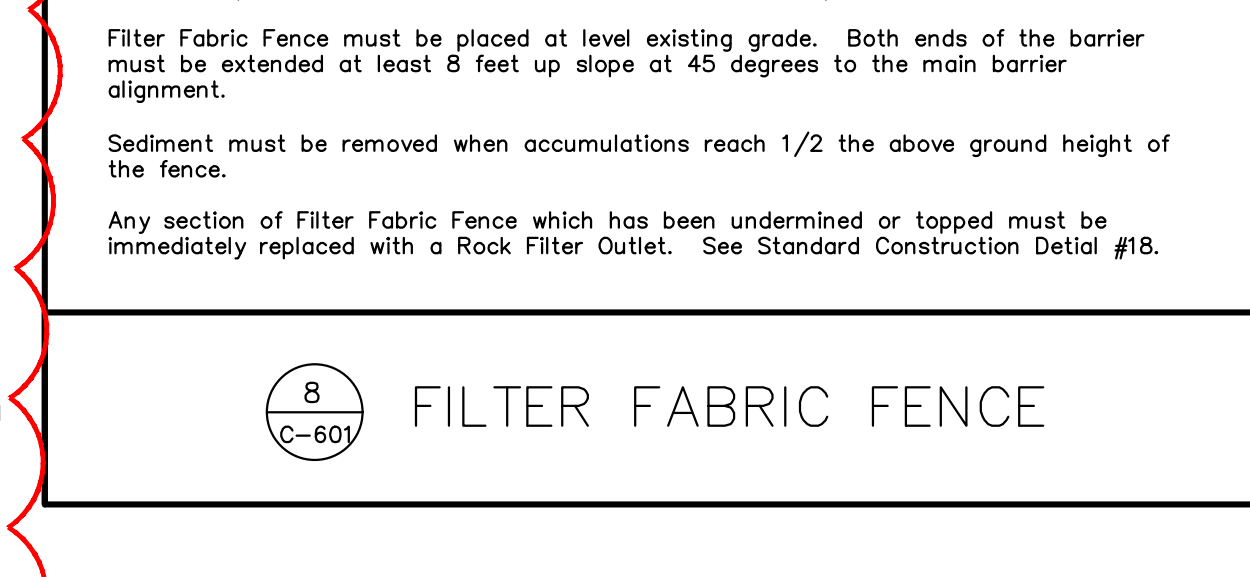
CONSTRUCTION SEQUENCE:

1. AT LEAST 7 DAYS PRIOR TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, THE OPERATOR SHALL NOTIFY ALL CONTRACTORS INVOLVED IN EARTH MOVING ACTIVITIES, THE LANDOWNER, ALL APPLICABLE CITY OFFICIALS, THE EROSION AND SEDIMENT CONTROL PREPARER, AND REPRESENTATIVE OF THE CITY OF PHILADELPHIA EROSION AND SEDIMENT CONTROL OFFICE TO AN ON-SITE MEETING. INCLUDE A REPRESENTATIVE FROM PWD'S EROSION AND SEDIMENT CONTROL INSPECTION GROUP BY CONTACTING THE INSPECTIONS COORDINATOR OF PWD (OFFICE 215-685-6387).
2. AT LEAST 3 DAYS BEFORE STARTING ANY EARTH DISTURBANCE ACTIVITIES, ALL CONTRACTORS INVOLVED IN THOSE ACTIVITIES SHALL NOTIFY PENNSYLVANIA ONE CALL SYSTEM INCORPORATED AT 1-800-242-1776 FOR BURIED UTILITY LOCATIONS.
3. CONSTRUCTION FENCE TO BE INSTALLED WHERE NEEDED TO PROTECT THE PUBLIC FROM LAND DISTURBANCE ACTIVITIES AND TO MAINTAIN PEDESTRIAN ACCESS.
4. INSTALL COMPOST FILTER SOCK DOWNHILL FROM ALL EARTH MOVING ACTIVITIES. THROUGH ONE SITE AREAS ARE PAVED, COMPOST FILTER SOCK OR OTHER EROSION CONTROL PRACTICES SHALL BE INSTALLED AROUND THE PERIMETER OF THE SITE AND AS SHOWN ON THE PLAN.
5. INSTALL SILT FENCE ALONG THE ENTIRE SOUTHERN FENCE LINE ALONG THE RESIDENTIAL PROPERTIES.
6. INSTALL INLET PROTECTION AS SHOWN ON THE PLAN. EXISTING INLETS SHALL BE PROTECTED THROUGHOUT THE DURATION OF THE CONSTRUCTION.
7. INSTALL CONSTRUCTION ENTRANCE AS SHOWN AND IN ACCORDANCE WITH THE CONSTRUCTION ENTRANCE DETAIL.
8. CONTRACTOR SHALL PROVIDE PROTECTION OF ANY EXISTING UTILITIES, SURFACE FEATURES AND PAVEMENTS THAT ARE TO REMAIN THROUGHOUT THE DURATION OF PROJECT CONSTRUCTION.
9. CLEAR SITE WITHIN LIMIT OF DISTURBANCE AREA, DEMOLISH EXISTING PAVING, CURBING AND FENCING AS REQUIRED. SAWCUT PAVED AREAS AS NEEDED TO MINIMIZE EARTH DISTURBANCE. EXCAVATE TRENCHES FOR PROPOSED SEWER AND STORM CONNECTIONS. DEMOLISHED MATERIAL SHALL BE REMOVED FROM THE SITE AND DISCARDED IN ACCORDANCE WITH APPLICABLE CITY, STATE AND FEDERAL REGULATIONS.
11. INSTALL NEW SEWERS AS SHOWN ON THE PLANS.
12. ROUGH GRADE SUBWAYS TO REQUIRED DEPTHS.
13. DEMOLISH EXISTING INLETS AND PIPING.
14. INSTALL STORMWATER MANAGEMENT SYSTEMS (SEE SMP S.O.C. ON C-600).
15. CONSTRUCT NEW BUILDING ADDITION.
16. AS SOON AS SLOPES, CHANNEL DITCHES AND OTHER DISTURBED AREAS REACH FINAL GRADE, THEY MUST BE STABILIZED. CESSATION OF ACTIVITY FOR FOUR (4) DAYS OR LONGER REQUIRES TEMPORARY STABILIZATION.
17. CONSTRUCT REMAINING FULL DEPTH VEMENT.
18. TOPSOIL AND SEED GRADED AREAS, INSTALL PLANTS AND TREES.
19. SWEEP PAVED AREAS DAILY TO PREVENT TRACKING OF SOIL OFF-SITE.
20. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT INSPECTIONS COORDINATOR OF PWD (OFFICE: 215-685-6387) FOR A FINAL INSPECTION PRIOR TO REMOVAL OF THE E&S BMP'S.
21. REMOVE SOIL EROSION MEASURES AFTER SITE HAS BEEN INSPECTED AND STABILIZED.
22. INSTALL PERMANENT INLET PROTECTION AT ALL INLETS

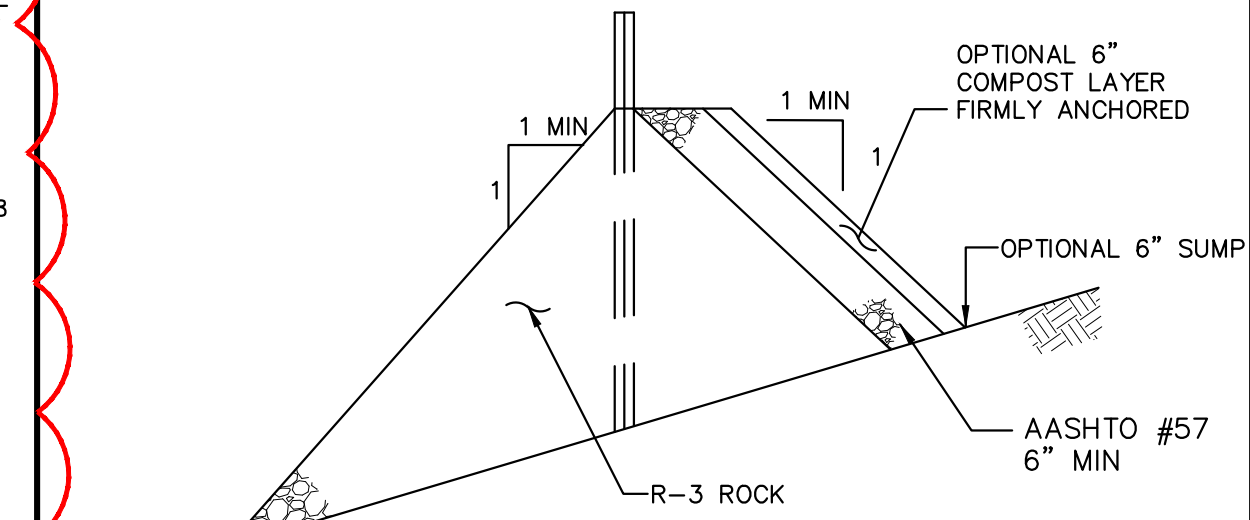
- SUBSURFACE INFILTRATION/RETENTION SMP CONSTRUCTION SEQUENCE:**
- A REGISTERED PROFESSIONAL SHALL BE PRESENT ON SITE DURING THESE STAGES TO OVERSEE THE DOCUMENTATION OF ELEVATIONS AND MEASUREMENTS AS FOUND IN THE PWD CONSTRUCTION CERTIFICATION PACKAGE.
1. AREA FOR PROPOSED SUBSURFACE SMP'S MUST BE PHYSICALLY MARKED IN FIELD BEFORE ANY SITE WORK BEGINS TO AVOID SOIL DISTURBANCE AND COMPACTION DURING CONSTRUCTION.
 2. COMPLETE SITE GRADING AND STABILIZATION OF ALL DISTURBED SOIL.
 3. EXCAVATE SUBSURFACE SMP AREAS TO PROPOSED DEPTHS, MANUALLY GRADE AND SCARIFY THE EXISTING SUBGRADE. THE BOTTOM OF THE SMP MUST BE AT A LEVEL ABOVE EXISTING SUBGRADE MUST NOT BE COMPACTED OR SUBJECT TO EXCESS CONSTRUCTION EQUIPMENT.
 4. COMPLETE INFILTRATION TESTING IN ACCORDANCE WITH THE PHILADELPHIA WATER DEPARTMENT (PWD) REQUIREMENTS FOR EXPLORATORY TEST PITS AND DOUBLE-RING INFILTROMETER TESTING AS OUTLINED CHAPTER 3.3 OF THE PWD STORMWATER MANAGEMENT GUIDANCE MANUAL V3.2 OR LATEST VERSION.
 5. PLACE GEOTEXTILE, LEVELING SAND AND STONE AGGREGATE BEDDING IMMEDIATELY AFTER APPROVAL OF SUBGRADE PREPARATION AND IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS.
 6. INSTALL STORMWATER TANKS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. 7. INSTALL ALL AGGREGATE IN LIFTS OF SIX TO EIGHT INCHES. ALL AGGREGATE MUST REMAIN FREE OF SEDIMENT.
 8. CONFIRM AND DOCUMENT ALL INVERT ELEVATIONS AND DIMENSIONS FOR ALL LAYERS AND STRUCTURES.
 9. BACKFILL TO FINISHED GRADE. ENSURE BACKFILL IS PROPERLY COMPACTED IN ACCORDANCE WITH THE SPECIFICATIONS. ENSURE BACKFILL DOES NOT DISRUPT THE SMP SYSTEM.
 10. COMPLETE SURFACE GRADING AND INSTALL FINISHED SURFACE.
- SURFACE INFILTRATION SMP SEQUENCE OF CONSTRUCTION**
1. REGISTERED PROFESSIONAL SHALL BE PRESENT ON SITE DURING THESE STAGES TO OVERSEE THE DOCUMENTATION OF ELEVATIONS AND MEASUREMENTS AS FOUND IN THE PWD CONSTRUCTION CERTIFICATION PACKAGE.
 1. AREA FOR BIOINFILTRATION SHALL BE CLEARLY MARKED BEFORE ANY SITE WORK BEGINS TO AVOID SOIL DISTURBANCE AND COMPACTION DURING CONSTRUCTION.
 2. COMPLETE SITE ELEVATION GRADING AND STABILIZE THE SOIL DISTURBED WITHIN THE LIMITS OF DISTURBANCE. DO NOT FINALIZE BIOINFILTRATION EXCAVATION AND CONSTRUCTION UNTIL THE DRAINAGE AREA IS FULLY STABILIZED.
 3. COMPLETE DOUBLE RING INFILTROMETER TESTING IN ACCORDANCE WITH PWD REQUIREMENTS AS OUTLINED IN CHAPTER 3.3 OF THE PWD STORMWATER MANAGEMENT GUIDANCE MANUAL V3.2 OR LATEST VERSION PRIOR TO BASIN CONSTRUCTION AND CONFIRM PROPOSED SYSTEM TYPE AND ORIFICE SIZE/SEALED CAP WITH THE DESIGN ENGINEER. DO NOT PROCEED WITH BASIN CONSTRUCTION UNTIL WRITTEN AUTHORIZATION HAS BEEN GRANTED BY THE ENGINEER.
 4. CONTRACTOR TO FOLLOW AND COMPLETE PWD'S SMP CONSTRUCTION CERTIFICATION PACKAGE FORM FOR BIOINFILTRATION/BIORETENTION BASINS. SEE PWD STORMWATER MANAGEMENT GUIDANCE MANUAL.
 5. EXCAVATE BIOINFILTRATION AREA TO PROPOSED INVERT DEPTH AND SCARIFY THE EXISTING SOIL SURFACES. DO NOT COMPACT IN-SITU SOILS. HEAVY EQUIPMENT SHALL NOT BE USED WITHIN THE BIOINFILTRATION BASIN. EQUIPMENT SHALL BE KEPT OUT OF THE EXCAVATED AREA TO THE MAXIMUM EXTENT POSSIBLE.
 6. INSTALL OUTLET CONTROL STRUCTURE. PLACE FILTER FABRIC, THEN PLACE THE CLEAN WASHED STONE, AND SET THE UNDERDRAIN ACCORDING TO THE PLANS.
 7. BACKFILL THE EXCAVATED AREA AS SOON AS THE SUBGRADE PREPARATION IS COMPLETE TO AVOID ACCUMULATION OF DEBRIS. PLACE BIOINFILTRATION SOIL IN 12-18 INCHES LIFTS AND TAMP LIGHTLY. SLOTTED OVERLAPPING MIGHT BE NECESSARY TO ACCOUNT FOR SETTLEMENT. PRE-SOAK SOIL AT LEAST ONE DAY PRIOR TO FINAL GRADING AND LANDSCAPING TO ALLOW FOR SETTLEMENT.
 8. AFTER ALLOWING FOR SETTLEMENT, COMPLETE FINAL GRADING WITHIN ABOUT 2 INCHES OF THE PROPOSED DESIGN ELEVATIONS, LEAVING SPACE FOR TOP DRESSING OF MULCH OR MULCH/COMPOST BLEND IF REQUIRED BY THE SCHOOL DISTRICT OF PHILADELPHIA.
 9. SEED AND PLANT VEGETATION AS INDICATED ON THE PLANS AND SPECIFICATIONS.
 10. GRADE AND MULCH TO FINAL ELEVATIONS.
 11. INSTALL OUTLET PROTECTION AS SPECIFIED ON THE PLANS.
 12. WATER VEGETATION AT THE END OF EACH DAY FOR TWO WEEKS AFTER PLANTING IS COMPLETED.



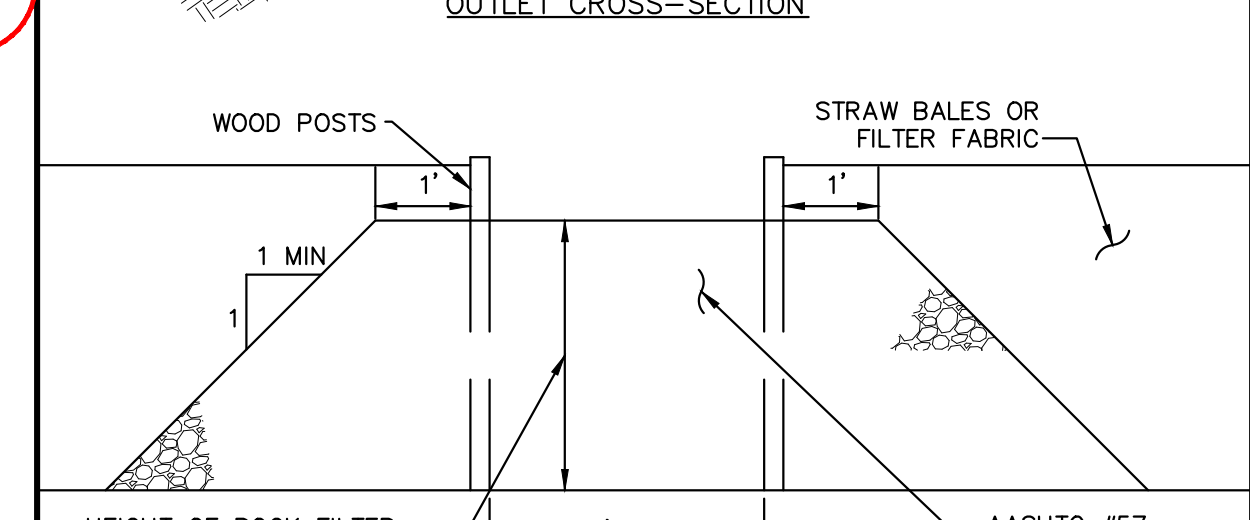
8 C-601 FILTER FABRIC FENCE



8 C-601 OUTLET CROSS-SECTION



6 C-601 PUMPED WATER FILTER BAG



7 C-601 ROCK FILTER OUTLET

Notes:

1. A rock filter outlet shall be installed where failure of a silt fence or straw barrier has occurred due to concentrated flow. Anchored composite filter layer shall be used on upslope face in HQ and EV watersheds.
2. Sediment must be removed when accumulations reach 1/3 the height of the outlet.

TABLE 4.1 Composite Sock Fabric Minimum Specifications

Material Type	3 mil HDPE			5 mil HDPE			Multi-Filament Polypropylene (MFPP)			Heavy Duty Multi-Filament Polypropylene (HDMFPP)		
	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable	Photo-degradable	Photo-degradable	Photo-degradable	Photo-degradable
Sock Diameters	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"	12", 18"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"
Strength	26 psi	26 psi	26 psi	44 psi	44 psi	202 psi						
Stability %	23%	23%	100%	100%	100%	100%						
Functional Longevity	6 months	9 months	6 months	1 year	1 year	2 years						

TABLE 4.2 Composite Standards

Organic Matter Content	80% - 100% (dry weight basis)
Organic Fraction	Fibrous and degraded
pH	5.5 - 8.0
Moisture Content	89% - 95%
Particle Size	60% pass through 1" screen
Soluble Salt Concentration	5.0 g/100g (maximum)

TABLE 11.1

Depth (ft)	Per 1,000 Square Feet	Per Acre
1	0.2	268
2	0.4	536
3	0.6	804
4	0.8	1072
5	1.0	1340
6	1.2	1608
7	1.4	1876
8	1.6	2144
9	1.8	2412
10	2.0	2680

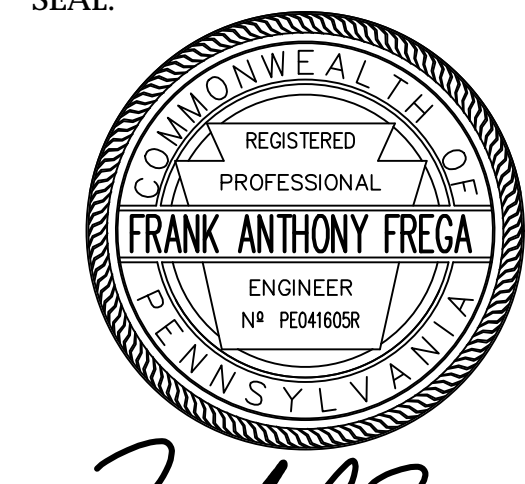
TABLE 11.2

Depth (ft)	Per 1,000 Square Feet	Per Acre
1	0.2	268
2	0.4	536
3	0.6	804
4	0.8	1072
5	1.0	1340
6	1.2	1608
7	1.4	1876
8	1.6	2144
9	1.8	2412
10	2.0	2680

TABLE 11.3

Depth (ft)	Per 1,000 Square Feet	Per Acre
1	0.2	268
2	0.4	536
3	0.6	804
4	0.8	1072
5	1.0	1340
6	1.2	1608
7	1	

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3/2/2021

NO.	DATE	REVISION
10		
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1	3/19/2021	ADDENDUM #2 (ADD)

SCHOOL & LOCATION

RHAWNHRST ELEMENTARY SCHOOL

7809 CASTOR AVENUE
PHILADELPHIA PA 19152

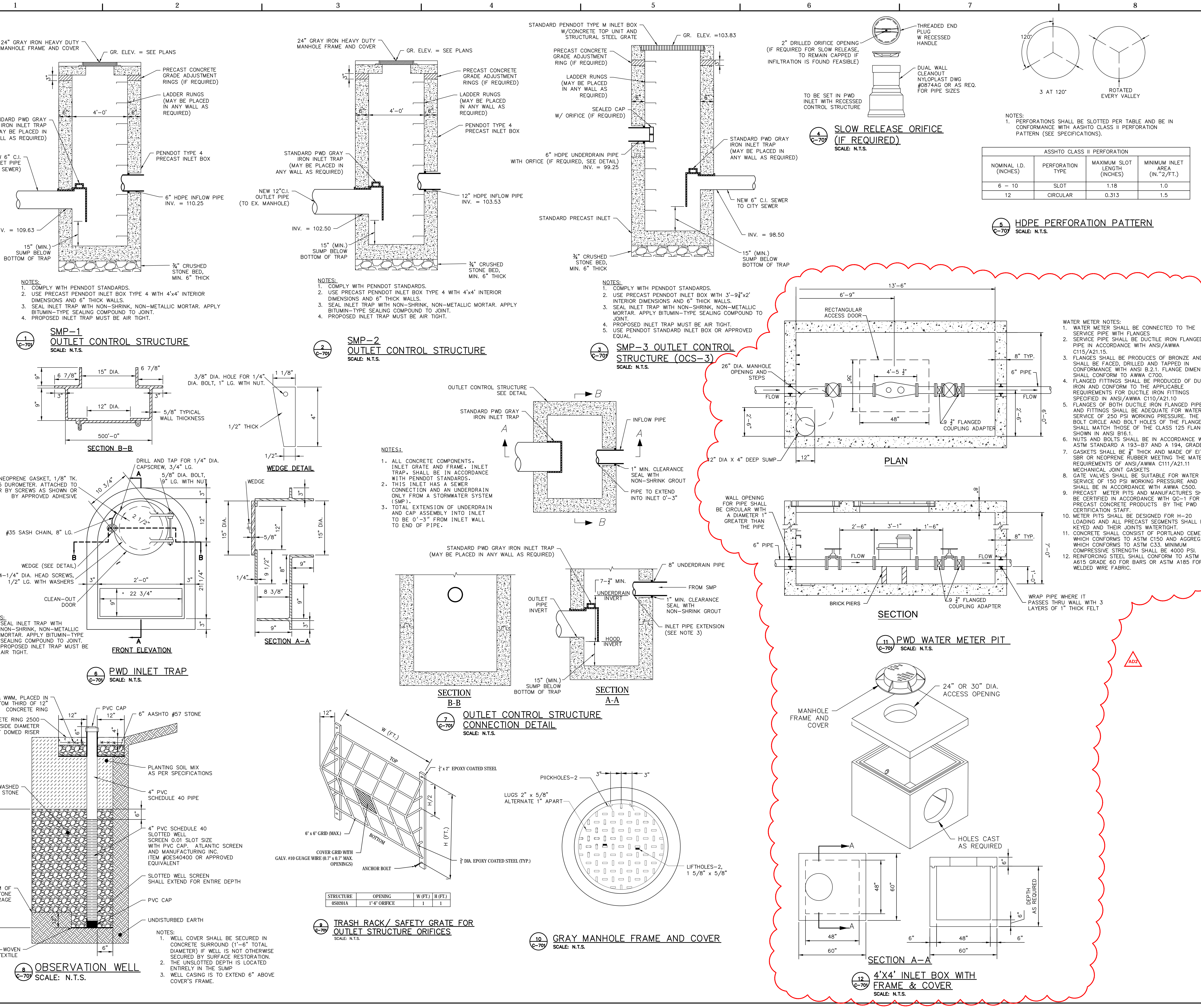
PROJECT TITLE

ADDITIONS & RENOVATIONS

DRAWING TITLE

UTILITY DETAILS (2)

LOCATION NO.	FILE NO.
DRAWN BY KSE	CHECKED BY KSE
B-070	OF 2019 / 20
B-071	OF 2019 / 20
B-072	OF 2019 / 20
B-073	OF 2019 / 20
DRAWING NO.	
C-701	



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NO.	DATE	REVISION
1	3/19/2021	ADDENDUM #2 (ADD)

SCHOOL & LOCATION

RHAWNURST ELEMENTARY SCHOOL

7809 CASTOR AVENUE,
PHILADELPHIA PA 19152

PROJECT TITLE

ADDITIONS & RENOVATIONS

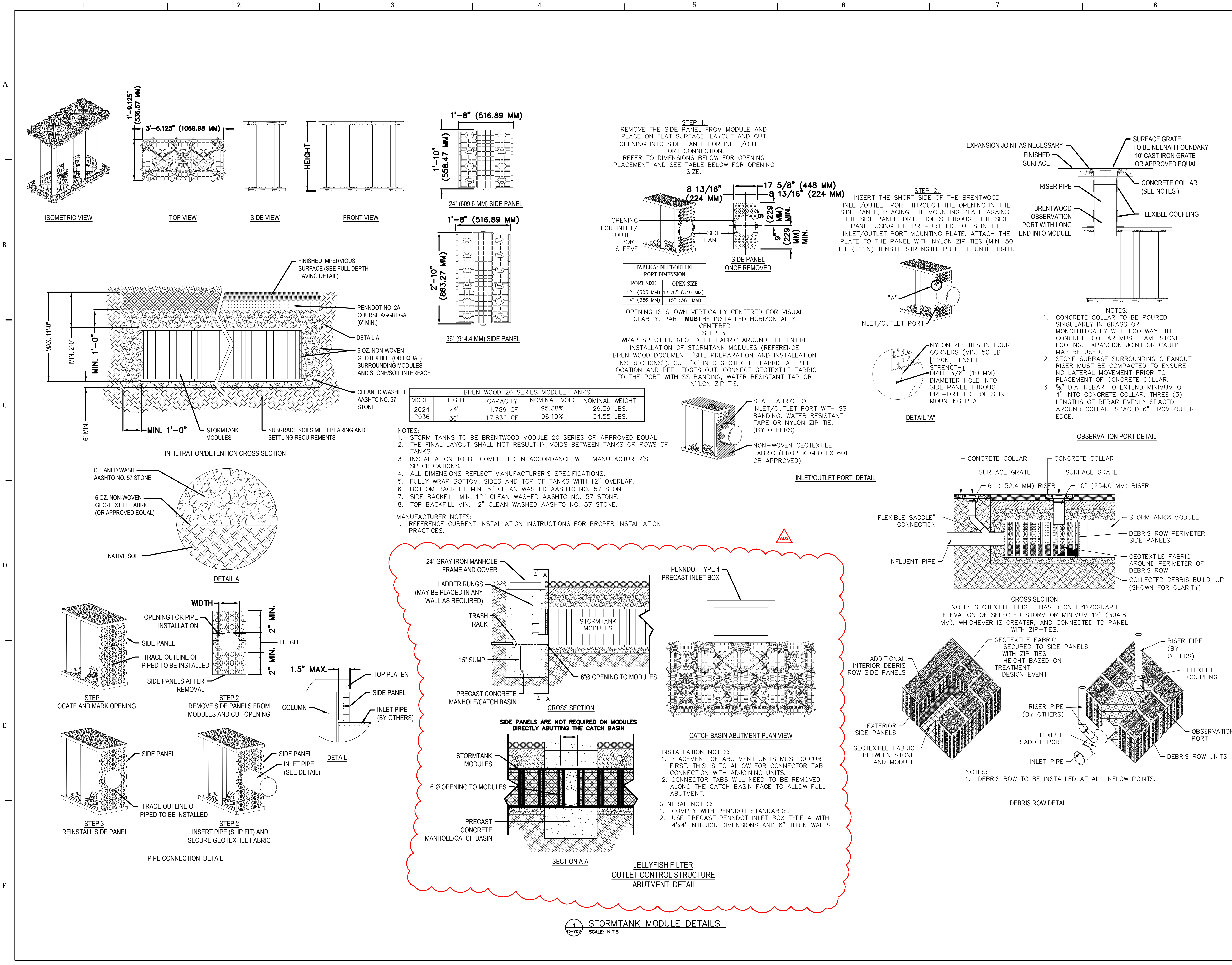
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UTILITY DETAILS (3)

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DRAWN BY KSE	CHECKED BY KSE
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B-071	OF 2019 / 20
B-072	OF 2019 / 20
B-073	OF 2019 / 20

DRAWING NO.

C-702



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3/2/2021

NO.	DATE	REVISION
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1	3/19/2021	ADDENDUM #2 (ADD)

SCHOOL & LOCATION

**RHAWNURST
ELEMENTARY SCHOOL**

7809 CASTOR AVENUE,
PHILADELPHIA PA 19152

PROJECT TITLE

**ADDITIONS &
RENOVATIONS**

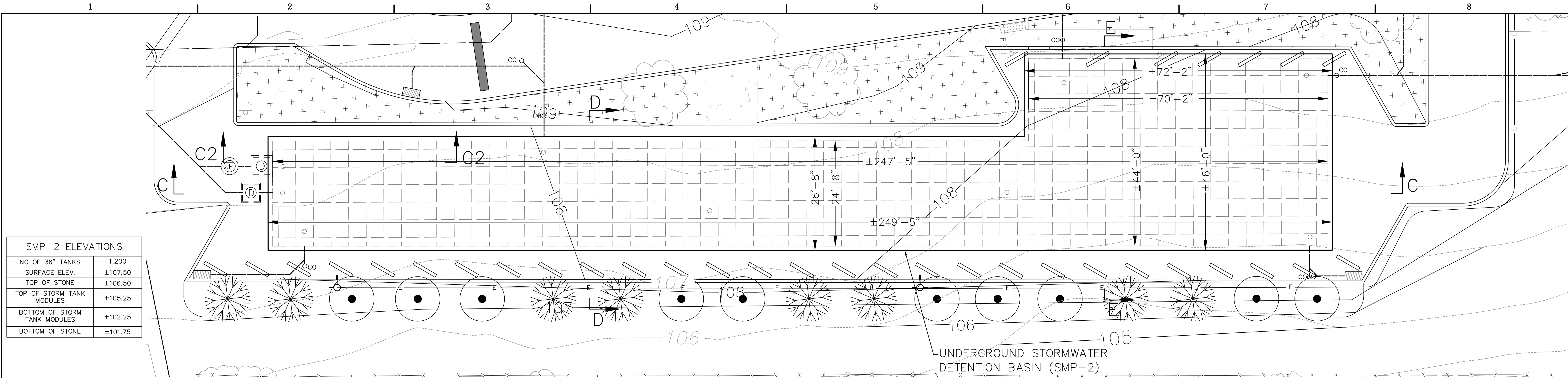
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**STORMWATER MANAGEMENT
SMP-2 SECTIONS**

LOCATION NO.	FILE NO.
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B-071	OF 2019 / 20
B-072	OF 2019 / 20
B-073	OF 2019 / 20

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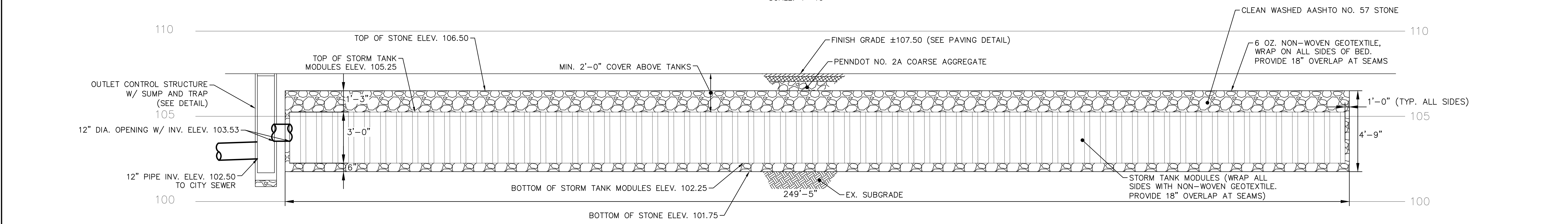
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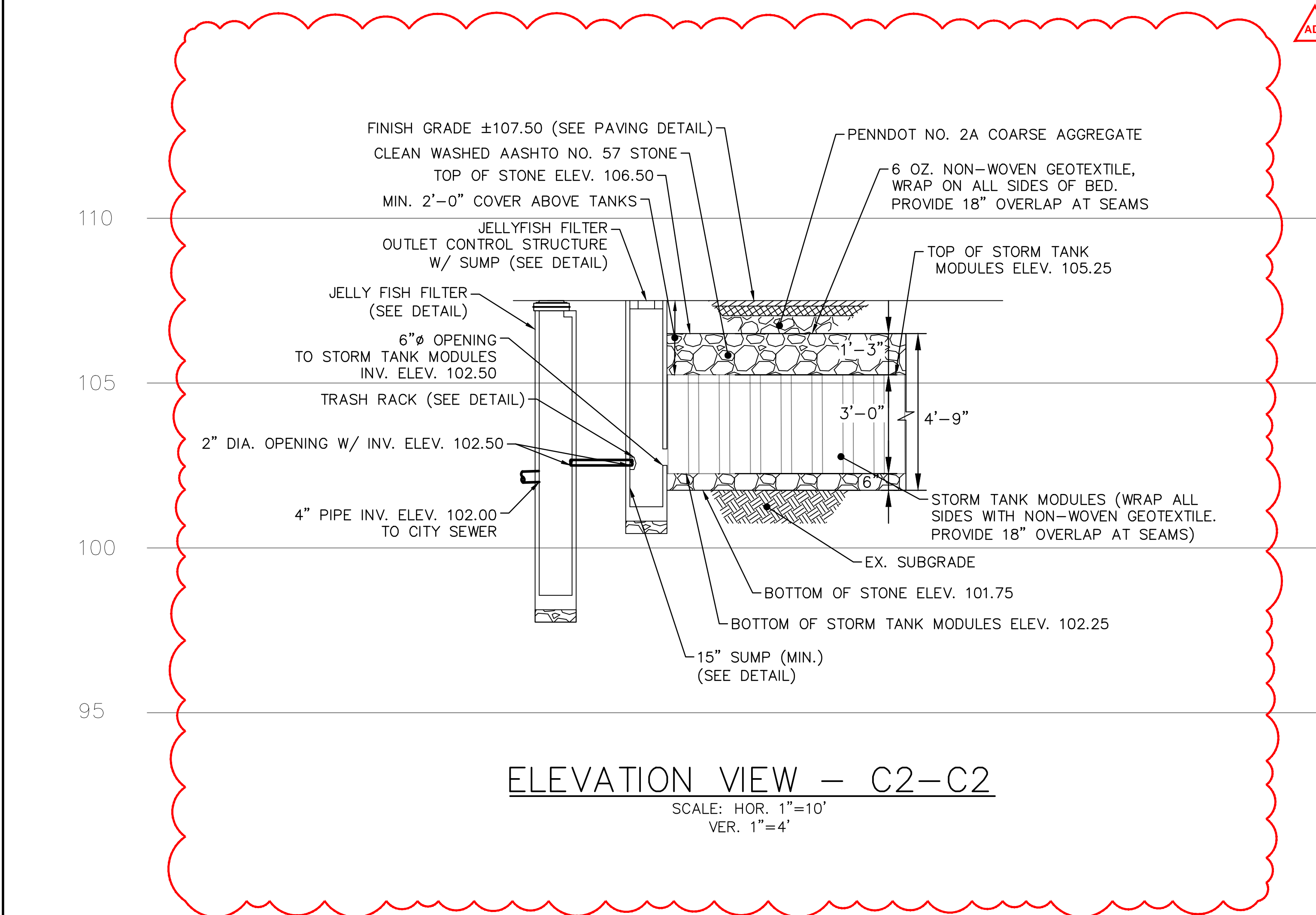
SMP-2 ELEVATIONS

NO OF 36" TANKS	1,200
SURFACE ELEV.	±107.50
TOP OF STONE	±106.50
TOP OF STORM TANK MODULES	±105.25
BOTTOM OF STORM TANK MODULES	±102.25
BOTTOM OF STONE	±101.75

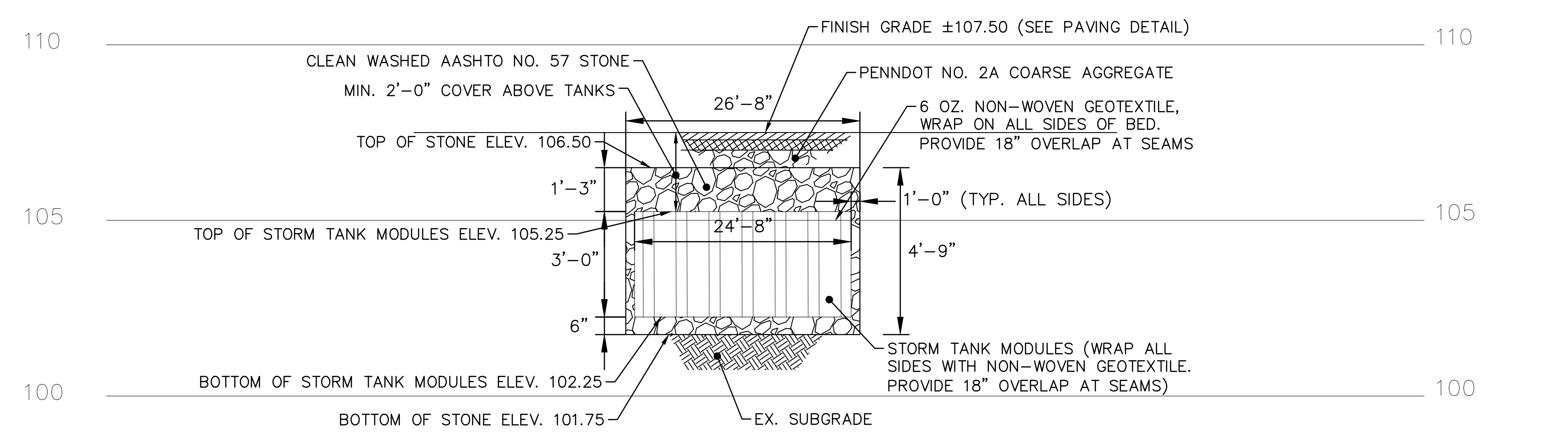
PLAN VIEW
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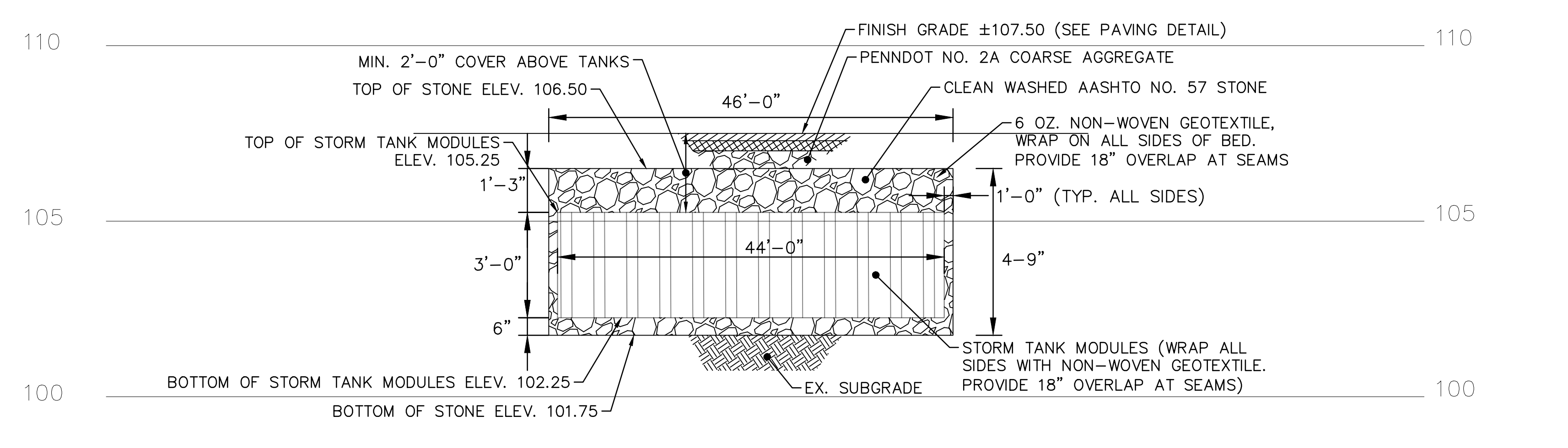
ELEVATION VIEW - C-C
SCALE: HOR. 1"=10'
VER. 1"=4'



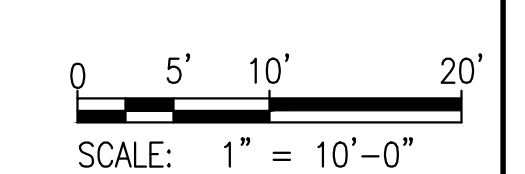
ELEVATION VIEW - C2-C2
SCALE: HOR. 1"=10'
VER. 1"=4'

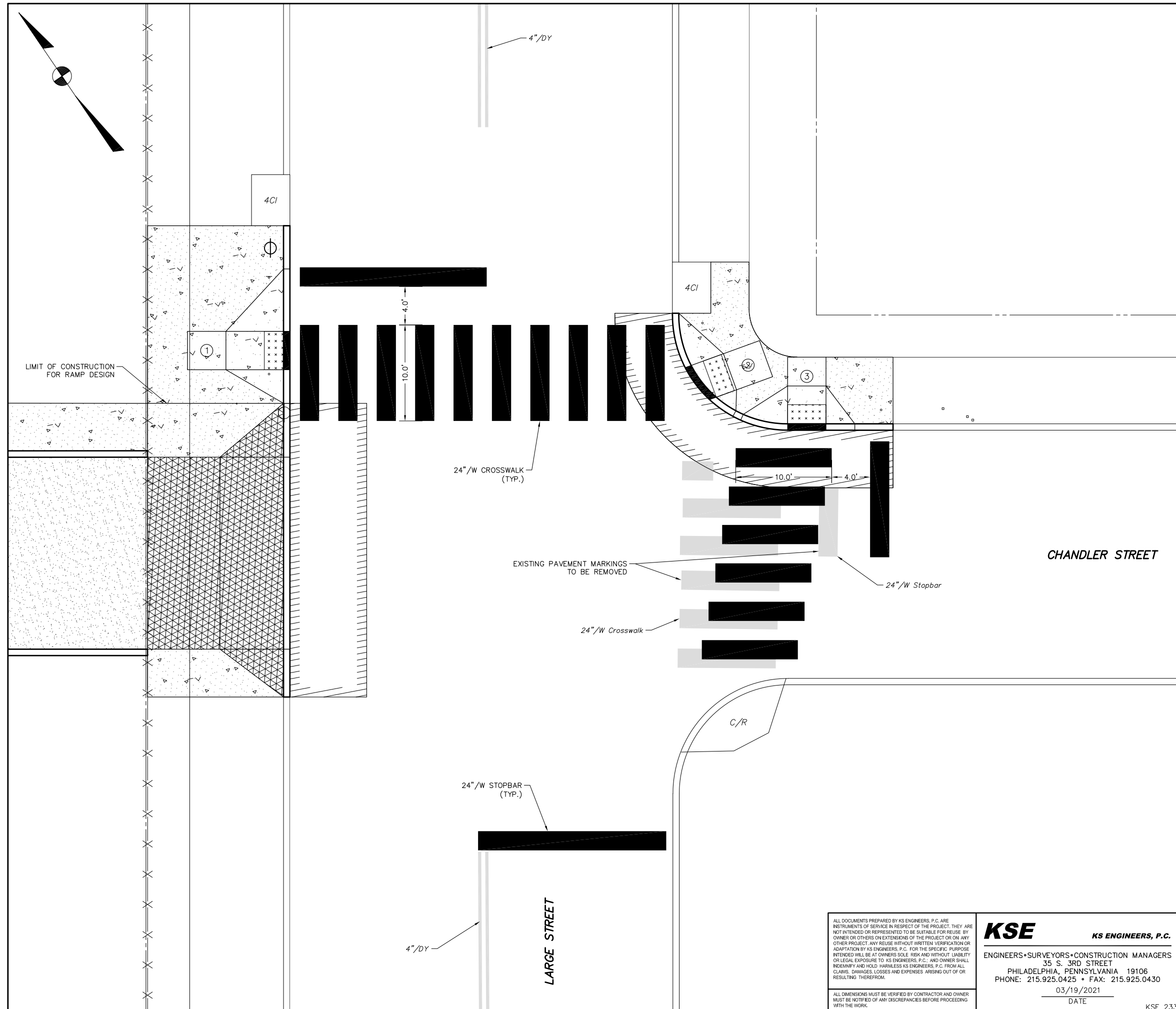


ELEVATION VIEW - D-D
SCALE: HOR. 1"=10'
VER. 1"=4'



ELEVATION VIEW - E-E
SCALE: HOR. 1"=10'
VER. 1"=4'





- NOTES:**
1. ALL CROSSWALKS ARE TO BE 8 FEET WIDE (OR AS NOTED) WITH 6" WHITE EDGE LINES, AND ARE TO BE INSTALLED AS SHOWN ON THE PLAN. STOP LINES MUST BE A MINIMUM OF 4 FEET FROM THE EDGE OF CROSSWALK.
 2. ALL EXISTING MARKINGS WHICH ARE NO LONGER APPROPRIATE SHALL BE ERADICATED BY THE CONTRACTOR USING AN ERADICATION METHOD APPROVED BY A PHILADELPHIA STREETS DEPARTMENT FIELD REPRESENTATIVE.
 3. THE LIMITS OF ALL SIDEWALK TRANSITION AREAS SHOULD MATCH THE EXISTING SIDEWALK ELEVATION. REPLACE SIDEWALK TO THE NEAREST SIDEWALK JOINT.
 4. WHEN SIDEWALK IS BEING LOWERED, THE GRASS AREA BEHIND THE SIDEWALK SHOULD BE RE-GRADED WITH A 3:1 MAXIMUM SLOPE.
 5. IF IT IS DETERMINED THAT THE PROPOSED SIDEWALK CAN BE LOWERED WITH GRADING OR EXTENDED DIRECTLY TO THE EXPOSED BUILDING/WALL FACADE THE CONTRACTOR IS DIRECTED TO COORDINATE THE REMOVAL OF THE CHEEK WALL FROM THE FINAL CONSTRUCTION WITH THE RESIDENT ENGINEER OR HIS/HER DESIGNEE.
 6. RESET ALL UTILITY VALVES, COVERS AND MANHOLES TO GRADE, AS NECESSARY.
 7. ALL RAMP LOCATIONS ARE DIMENSIONED FROM AN EXISTING FEATURE TO THE CENTERLINE OF THE RAMP AT THE FACE OF CURB.
 8. IN THE EVENT THAT THERE ARE ANY DISCREPANCIES FOUND BETWEEN THE PROPOSED SLOPES AND PROPOSED SPOT ELEVATIONS/DISTANCES, THE CONTRACTOR MUST CONTACT THE DESIGN ENGINEER BEFORE PROCEEDING WITH CONSTRUCTION.
 9. ALL PROPOSED SIGNAL FOUNDATIONS SHALL BE INSTALLED FLUSH WITH THE PROPOSED SIDEWALK IN ACCORDANCE WITH TRAFFIC SIGNAL STANDARDS TC-8800.
 10. * DENOTES RAMP WHICH IS TECHNICALLY INFEASIBLE.
 11. GRANITE CURB WITHIN THE LIMITS OF PROPOSED CURB SHALL BE REPLACED WITH CONCRETE CURB.
 12. IF, WHILE LOWERING THE SIDEWALK, THE BUILDING FOUNDATION IS EXPOSED AND DETERMINED THAT THE APPEARANCE IS NOT CONSISTENT OR COMPLIMENTARY TO THE BUILDING FACADE, AND/OR THAT JOINTS OR IRREGULARITIES NEED TO BE CONCEALED, THEN THE CONTRACTOR SHALL PARGE THE EXPOSED AREA USING THE PROTOCOLS DESCRIBED IN PWD'S PARGING DETAIL.
 13. IF THE CONDITION OF THE EXPOSED FOUNDATION REQUIRES A MORE SUBSTANTIAL TREATMENT THAN PARGING, THEN A CHEEK WALL MAY BE REQUIRED. SEE PWD'S CHEEK WALL DETAIL.
 14. IF BY LOWERING THE SIDEWALK IN FRONT OF AN EXISTING FENCE NECESSITATES THAT A CHEEK WALL BE PLACED BENEATH THE FENCE TO CLOSE THE GAP, THEN THE CONTRACTOR SHALL INSTALL A CHEEK WALL AS NECESSARY. THIS MAY REQUIRE TEMPORARILY REMOVING AND RESETTING THE FENCE TO INSTALL THE CHEEK WALL.
 15. THE PWD CONSTRUCTION ENGINEER SHALL DIRECT THE CONTRACTOR TO COORDINATE ANY PROPERTY MODIFICATIONS WITH THE PROPERTY OWNER. THESE MODIFICATIONS SHALL BE WITH WRITTEN CONSENT AND TO THE SATISFACTION OF THE PROPERTY OWNER. SIGNED PROPERTY OWNER CONSENT (POC) FORM SHALL BE PROVIDED TO STREETS DEPARTMENT ADA UNIT.

LEGEND

o v	EXISTING VENT	x 550.00	EXISTING ELEVATION
o g	EXISTING GAS VALVE	x 550.00	PROPOSED ELEVATION
o w	EXISTING WATER VALVE	x Tsn 550.00	TOP OF nTH STEP, PROPOSED ELEVATION
o FH	EXISTING FIRE HYDRANT		
(MH)	EX. MANHOLE		CONCRETE SIDEWALK/ TRANSITION AREA
φ	EXISTING UTILITY POLE		PAVEMENT ADJUSTMENT
-x-x-	EXISTING FENCE LINE		PAVEMENT ADJUSTMENT
	EXISTING TREE		DETECTABLE WARNING SURFACE
o TS	EXISTING SIGN		CONCRETE CURB RAMP
o MB	EXISTING MAILBOX		GRASS SEEDING AND SOIL SUPPLEMENTS
⊕	EX. UTILITY POLE W/LIGHT		DRIVEWAY APRON
	EXISTING INLET		PAVEMENT RECONSTRUCTION
	PROPOSED INLET		PAVEMENT RECONSTRUCTION
(X)	CURB RAMP IDENTIFIER		PLANTED AREA

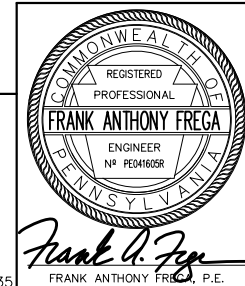
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ENGINEERS • SURVEYORS • CONSTRUCTION MANAGERS
 35 S. 3RD STREET
 PHILADELPHIA, PENNSYLVANIA 19106
 PHONE: 215.925.0425 • FAX: 215.925.0430
 03/19/2021
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KSE 2335



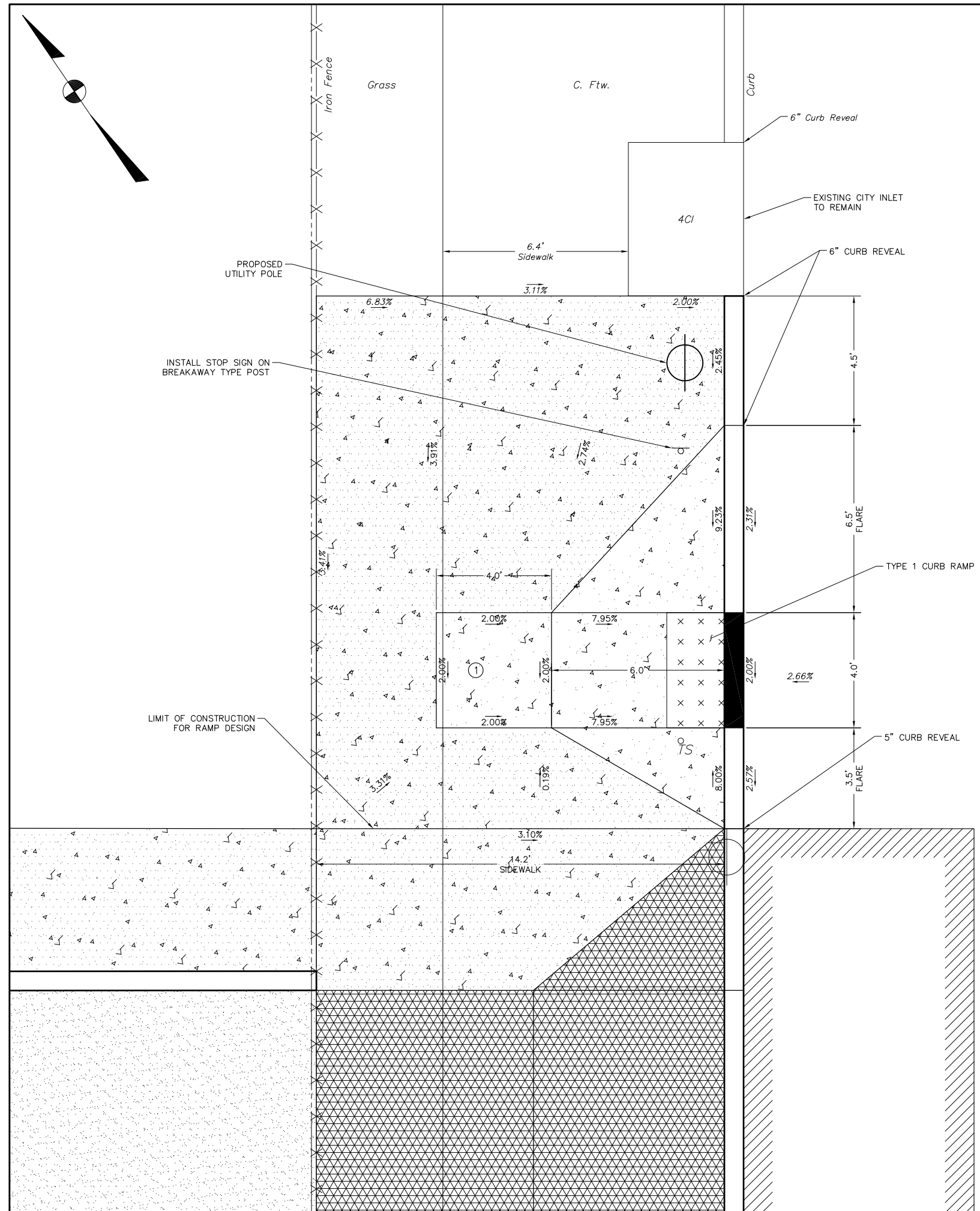
THE SCHOOL DISTRICT OF PHILADELPHIA
 RHAWNURST ELEMENTARY SCHOOL
 7809 CASTOR AVENUE

INTERSECTION STRIPING PLAN

LARGE STREET & CHANDLER STREET

CITY OF PHILADELPHIA PHILADELPHIA COUNTY

SHEET 1 OF 5 SCALE 5' 0' 5'



NOTES:

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2. ALL EXISTING MARKINGS WHICH ARE NO LONGER APPROPRIATE SHALL BE ERADICATED BY THE CONTRACTOR USING AN ERADICATION METHOD APPROVED BY A PHILADELPHIA STREETS DEPARTMENT FIELD REPRESENTATIVE.
3. THE LIMITS OF ALL SIDEWALK TRANSITION AREAS SHOULD MATCH THE EXISTING SIDEWALK ELEVATION. REPLACE SIDEWALK TO THE NEAREST SIDEWALK JOINT.
4. WHEN SIDEWALK IS BEING LOWERED, THE GRASS AREA BEHIND THE SIDEWALK SHOULD BE RE-GRADED WITH A 3:1 MAXIMUM SLOPE.
5. IF IT IS DETERMINED THAT THE PROPOSED SIDEWALK CAN BE LOWERED WITH GRADING OR EXTENDED DIRECTLY TO THE EXPOSED BUILDING/WALL FACADE THE CONTRACTOR IS DIRECTED TO COORDINATE THE REMOVAL OF THE CHEEK WALL FROM THE FINAL CONSTRUCTION WITH THE RESIDENT ENGINEER OR HIS/HER DESIGNEE.
6. RESET ALL UTILITY VALVES, COVERS AND MANHOLES TO GRADE, AS NECESSARY.
7. ALL RAMP LOCATIONS ARE DIMENSIONED FROM AN EXISTING FEATURE TO THE CENTERLINE OF THE RAMP AT THE FACE OF CURB.
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13. IF THE CONDITION OF THE EXPOSED FOUNDATION REQUIRES A MORE SUBSTANTIAL TREATMENT THAN PARGING, THEN A CHEEK WALL MAY BE REQUIRED. SEE PWD'S CHEEK WALL DETAIL.
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o g	EXISTING GAS VALVE	x 550.00	PROPOSED ELEVATION
o w	EXISTING WATER VALVE	x Tsn 550.00	TOP OF nTH STEP, PROPOSED ELEVATION
o FH	EXISTING FIRE HYDRANT		
(MH)	EX. MANHOLE		CONCRETE SIDEWALK/ TRANSITION AREA
o	EXISTING UTILITY POLE		PAVEMENT ADJUSTMENT
-x-x-	EXISTING FENCE LINE		DETECTABLE WARNING SURFACE
(+)	EXISTING TREE		CONCRETE CURB RAMP
o TS	EXISTING SIGN		GRASS SEEDING AND SOIL SUPPLEMENTS
o MB	EXISTING MAILBOX		DRIVEWAY APRON
o TL	EXISTING TRAFFIC LIGHT		PAVEMENT RECONSTRUCTION
o UPL	EX. UTILITY POLE W/LIGHT		PLANTED AREA
	EXISTING INLET		
	PROPOSED INLET		
(X)	CURB RAMP IDENTIFIER		

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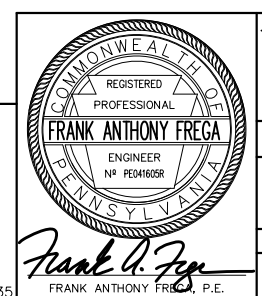
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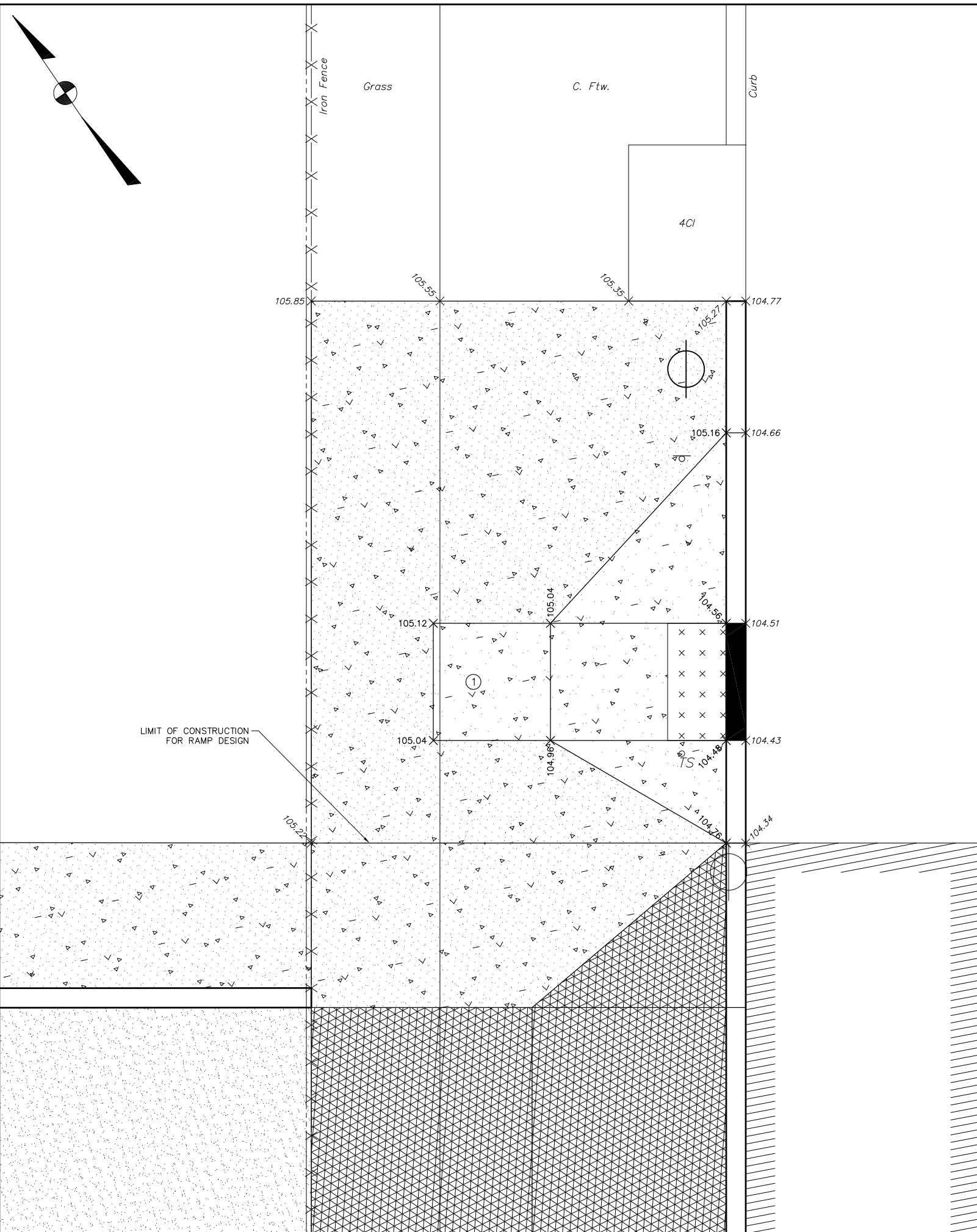
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SHEET 2 OF 5 SCALE 2" = 0' 2"



LARGE STREET

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⊕	EXISTING TRAFFIC LIGHT		GRASS SEEDING AND SOIL SUPPLEMENTS
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	EXISTING INLET		DRIVEWAY APRON
	PROPOSED INLET		DRIVEWAY APRON
⊗	CURB RAMP IDENTIFIER		DRIVEWAY APRON
			PLANTED AREA
			PAVEMENT RECONSTRUCTION

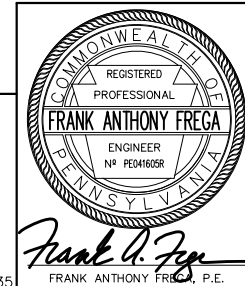
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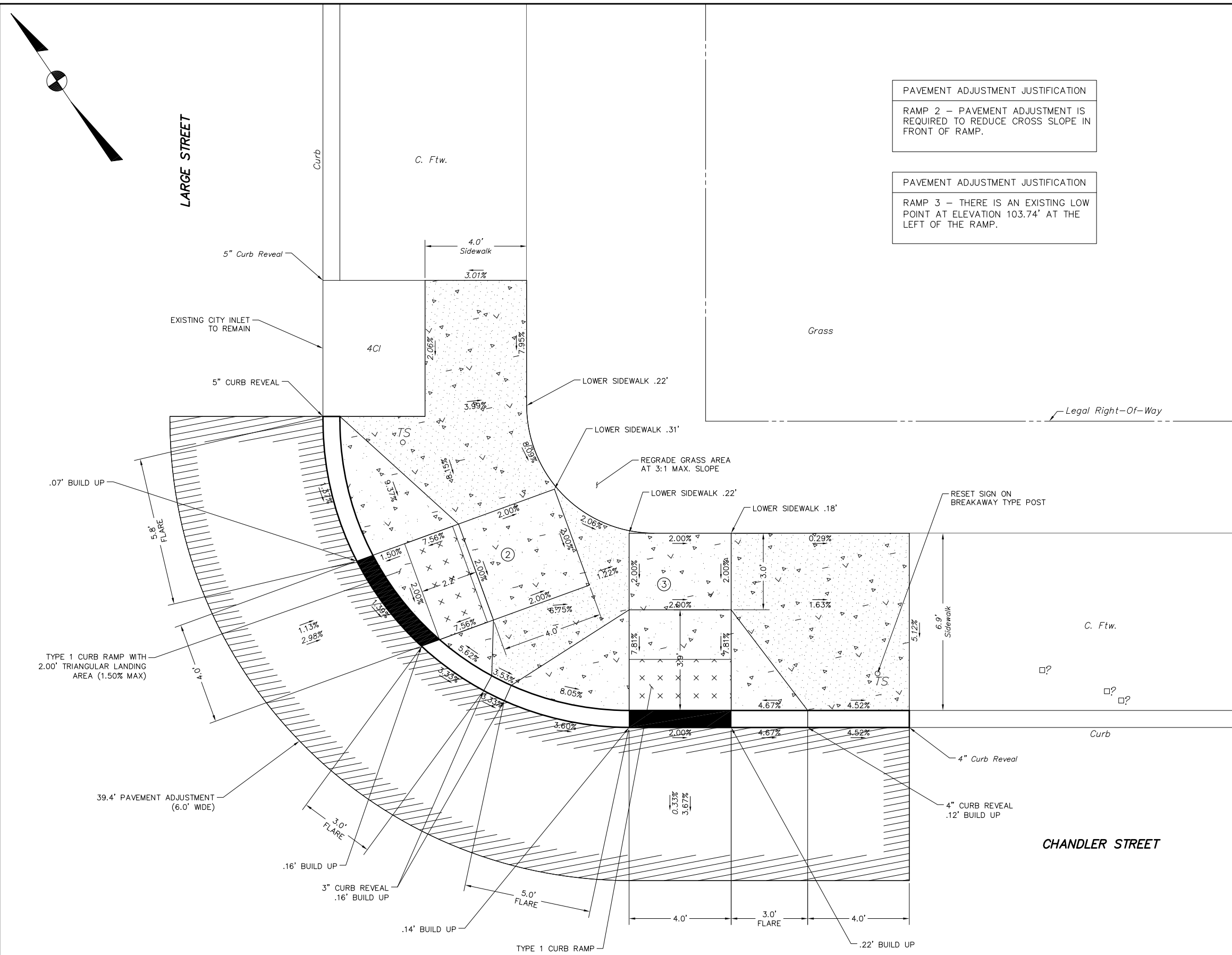
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SHEET 3 OF 5 SCALE 2" = 0' 2"



PAVEMENT ADJUSTMENT JUSTIFICATION
 RAMP 2 - PAVEMENT ADJUSTMENT IS REQUIRED TO REDUCE CROSS SLOPE IN FRONT OF RAMP.

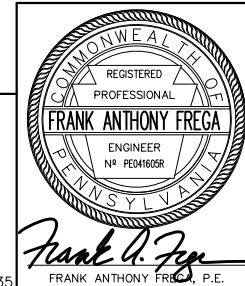
PAVEMENT ADJUSTMENT JUSTIFICATION
 RAMP 3 - THERE IS AN EXISTING LOW POINT AT ELEVATION 103.74' AT THE LEFT OF THE RAMP.

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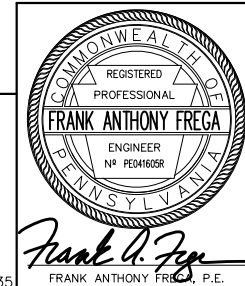
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ARCHITECT

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enikkelsen@cra-architects.com
Altru: R. Jeffrey Straub, AIA
Bygia Nikkelsen, AIA

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Phone: 215-925-0425

Email: sgavali@kseng.com
Altru: Steve Gavali

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03/02/2021

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2	03/19/2021	ACB-DJM/H2
1	03/15/2021	ACB-DJM/H1

NO. DATE REVISION

SCHOOL & LOCATION
R H A W N H U R S T E L E M E N T A R Y S C H O O L

7809 Castor Ave. Philadelphia, PA 19152

PROJECT TITLE
A D D I T I O N S & R E N O V A T I O N S

DRAWING TITLE
C O L O R S C H E M E S C H E D U L E

LOCATION NO.	FILE NO.
DRAWN BY	CHECKED BY

B-070	OF	2019 / 20
B-071	OF	2019 / 20
B-072	OF	2019 / 20
B-073	OF	2019 / 20

DRAWING NO.
A - 1

COLOR SCHEME 1
CLASSROOMS-BLUE
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
11. RUBBER TREAD: JOHNSONITE, NO. 28 MEDIUM GREY
12. VERTICAL CASEWORK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
13. SOLID SURFACE COUNTERTOP & BACKSPLASH: CORIAN, CONCRETE
14. GWB BULKHEAD PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWING FOR VCT & ACCENT WALL COLOR LOCATIONS.

COLOR SCHEME 2
CLASSROOMS-GREEN
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'E': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
11. RUBBER TREAD: JOHNSONITE, NO. 28 MEDIUM GREY
12. VERTICAL CASEWORK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
13. SOLID SURFACE COUNTERTOP & BACKSPLASH: CORIAN, CONCRETE
14. WOOD STAIN: TO BE DETERMINED PENDING SUBMITTAL.
15. GWB BULKHEAD PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWING FOR VCT & ACCENT WALL COLOR LOCATIONS.

COLOR SCHEME 3
CLASSROOMS-ORANGE
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6622 HEARTY ORANGE
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. VINYL COMPOSITION TILE, ACCENT 'F': ARMSTRONG, NO. 57538 HEAT WAVE
11. SLIP RESISTANT TILE: TO BE DETERMINED PENDING SUBMITTAL.
12. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
13. VERTICAL CASEWORK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
14. SOLID SURFACE COUNTERTOP & BACKSPLASH: CORIAN, CONCRETE
15. GWB BULKHEAD CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWING FOR VCT & ACCENT WALL COLOR LOCATIONS.

COLOR SCHEME 4
MUSIC CLASSROOMS
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
11. RUBBER TREAD: JOHNSONITE, NO. 28 MEDIUM GREY
12. VERTICAL CASEWORK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
13. SOLID SURFACE COUNTERTOP & BACKSPLASH: CORIAN, CONCRETE
14. ACOUSTICAL WALL PANELS: GULFORD OF MAINE, ANCHORAGE, NO. 22129 BIRCH
15. ACOUSTICAL WALL PANELS @ PAINTED ACCENT WALL: GULFORD OF MAINE, ANCHORAGE, NO. 2094 LAPIS
16. GWB BULKHEAD CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWING FOR VCT & ACCENT WALL COLOR LOCATIONS.

COLOR SCHEME 5
ART & MAKER SPACE
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6622 HEARTY ORANGE
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
11. RUBBER TREAD: JOHNSONITE, NO. 28 MEDIUM GREY
12. VERTICAL CASEWORK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
13. SOLID SURFACE COUNTERTOP & BACKSPLASH: CORIAN, CONCRETE
14. ACOUSTICAL WALL PANELS: GULFORD OF MAINE, ANCHORAGE, NO. 22129 BIRCH
15. ACOUSTICAL WALL PANELS @ PAINTED ACCENT WALL: GULFORD OF MAINE, ANCHORAGE, NO. 2094 LAPIS
16. GWB BULKHEAD CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWING FOR VCT & ACCENT WALL COLOR LOCATIONS.

COLOR SCHEME 6
CLASSROOM CORRIDORS
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
3. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6622 HEARTY ORANGE
4. ACCENT PAINT 'E': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
5. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
6. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
7. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
8. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
9. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
10. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
11. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
12. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
13. RUBBER, FIELD @ RAMP: JOHNSONITE, NO. 28 MEDIUM GREY
14. RUBBER ACCENT C @ RAMP: JOHNSONITE, NO. 70 BLUEREST
15. RUBBER ACCENT D @ RAMP: JOHNSONITE, NO. 62 TANGERINE TANGO
16. RUBBER ACCENT E @ RAMP: JOHNSONITE, COLOR TO BE DETERMINED
17. GWB BULKHEAD ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
18. GWB BULKHEAD ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6622 HEARTY ORANGE
19. GWB BULKHEAD ACCENT PAINT 'E': SHERWIN WILLIAMS, NO. SW718 OVERT GREEN
20. GWB BULKHEAD CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
21. STEEL COLUMN PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
SEE SUPPLEMENTAL DRAWING FOR VCT, ACCENT WALL & CEILING COLOR LOCATIONS.

COLOR SCHEME 7
COMMONS & LOBBY
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
3. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6622 HEARTY ORANGE
4. ACCENT PAINT 'E': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
5. ACCENT PAINT 'F': TO BE DETERMINED PENDING BRICK SUBMITTAL.
6. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
7. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
8. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
9. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
10. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
11. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
12. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
13. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
14. RUBBER TREAD: JOHNSONITE, NO. 28 MEDIUM GREY
15. RUBBER TREAD ACCENT @ GYM ENTRANCE: JOHNSONITE, NO. 70 BLUEREST
16. PAINTED RISER & STRINGER: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
17. PORCELAIN WALL TILE & BASE: CROSSVILLE, JAVA JOINT, NO. HOUSE BLEND
18. PORCELAIN TILE, GROUT: MAPEI, NO. 93 WARM GRAY
19. DECORATIVE PROTECTION PANEL: FORMICA, HARSTOP, NO. 7759-43 SELECT CHERRY
20. WOOD TRIM: STAINED TO MATCH FORMICA, NO. 7759-43 SELECT CHERRY
21. SOLID SURFACE BENCH-TOP: CORIAN, NO. COOL GRAY
22. GWB BULKHEAD ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
23. GWB BULKHEAD ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6622 HEARTY ORANGE
24. GWB BULKHEAD ACCENT PAINT 'E': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
25. GWB BULKHEAD CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
26. GWB CEILING PAINT UNDER STAIRS: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
27. WOOD STAIN AT CEILING TRIM: TO BE DETERMINED PENDING SUBMITTAL.
28. EXPOSED STRUCTURE: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
29. STEEL COLUMN PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
SEE SUPPLEMENTAL DRAWING FOR VCT, ACCENT WALL & CEILING COLOR LOCATIONS.

COLOR SCHEME 8
CAFETERIA
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. VINYL COMPOSITION TILE, ACCENT 'F': ARMSTRONG, NO. 57538 HEAT WAVE
11. PORCELAIN TILE BASE & WALL (PT1): CROSSVILLE, JAVA JOINT, NO. FRENCH PRESS
12. PT1 GROUT: MAPEI, NO. 107 IRON
13. PORCELAIN TILE BASE & WALL (PT2): CROSSVILLE, JAVA JOINT, NO. HOUSE BLEND
14. PT2 GROUT: MAPEI, NO. 93 WARM GRAY
15. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
16. ACOUSTICAL WALL PANELS: GULFORD OF MAINE, NO. 2035 ANGORA
17. GWB CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
18. STEEL COLUMN PAINT: SHERWIN WILLIAMS, NO. SW7674 PEPPERCOORN
19. EXPOSED STRUCTURE: SHERWIN WILLIAMS, NO. SW7674 PEPPERCOORN
20. METAL CEILING (MTL1): TO BE DETERMINED PENDING SUBMITTAL.
SEE SUPPLEMENTAL DRAWING FOR VCT, ACCENT WALL & CEILING COLOR LOCATIONS.

COLOR SCHEME 9
STAIRS
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6622 HEARTY ORANGE
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
7. RUBBER TREAD: JOHNSONITE, NO. 28 MEDIUM GREY
8. PAINTED RISER & STRINGER: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
9. GWB CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
10. STEEL COLUMN PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
SEE SUPPLEMENTAL DRAWING FOR ACCENT WALL & CEILING COLOR LOCATIONS.

COLOR SCHEME 10
ADMINISTRATION, GUIDANCE & HEALTH
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. VINYL COMPOSITION TILE, ACCENT 'F': ARMSTRONG, NO. 57538 HEAT WAVE
11. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
12. VERTICAL CASEWORK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
13. SOLID SURFACE COUNTERTOP & BACKSPLASH: CORIAN, CONCRETE
14. RECEPTION DESK TRANSACTION LEDGE: CORIAN QUARTZ, NO. COARSE PEPPER
15. RECEPTION DESK WORKSURFACE: CORIAN, CONCRETE
16. RECEPTION DESK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
17. RECEPTION DESK BASE: JOHNSONITE, NO. 63 BURNT UMBER
18. RECEPTION DESK TACKBOARD: CARNEGIE, PATTERN: XOREL, NO. 732
19. CUBICAL CURTAIN: MAHARAM, WINK, NO. 004 GROW
20. GWB BULKHEAD ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
SEE SUPPLEMENTAL DRAWING FOR VCT, ACCENT WALL & CEILING COLOR LOCATIONS.

COLOR SCHEME 11
MEDIA CENTER
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'C': SHERWIN WILLIAMS, NO. SW6959 BLUE CHIP
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
6. VINYL COMPOSITION TILE, ACCENT 'B': ARMSTRONG, NO. 51812 LEMON YELLOW
7. VINYL COMPOSITION TILE, ACCENT 'C': ARMSTRONG, NO. 57535 BLUE MOON
8. VINYL COMPOSITION TILE, ACCENT 'D': ARMSTRONG, NO. 57546 LIME ZEST
9. VINYL COMPOSITION TILE, ACCENT 'E': ARMSTRONG, NO. 57538 HEAT WAVE
10. VINYL COMPOSITION TILE, ACCENT 'F': ARMSTRONG, NO. 57538 HEAT WAVE
11. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
12. VERTICAL CASEWORK LAMINATE: WILSONART, NO. 7924K-07 BILTMORE CHERRY
13. SOLID SURFACE COUNTERTOP & BACKSPLASH: CORIAN, CONCRETE
14. WOOD STAIN @ EXISTING BENCH: TO BE DETERMINED PENDING SUBMITTAL.
15. LIBRARY FURNITURE - WOOD: TO BE DETERMINED PENDING SUBMITTAL.
16. LIBRARY FURNITURE - METAL: TO BE DETERMINED PENDING SUBMITTAL.
17. LIBRARY FURNITURE - PLASTIC LAMINATE: TO BE DETERMINED PENDING SUBMITTAL.
18. LIBRARY FURNITURE CHAIRS, POLY: TO BE DETERMINED PENDING SUBMITTAL.
19. LIBRARY FURNITURE CHAIRS, METAL: TO BE DETERMINED PENDING SUBMITTAL.
20. GWB BULKHEAD ACCENT PAINT 'E': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
SEE SUPPLEMENTAL DRAWINGS FOR VCT & ACCENT WALL COLOR LOCATIONS.

COLOR SCHEME 12
AUDITORIUM & STAGE
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. WALL PAINT @ STAGE: SHERWIN WILLIAMS, NO. SW6258 TRICORN BLACK
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, ACCENT 'A': ARMSTRONG, NO. 51904 STERLING
5. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
6. WOOD STAIN @ STAIR, TREAD, RISER & LANDINGS: TO BE DETERMINED PENDING SUBMITTAL.
7. WOOD STAIN @ STAGE FLOOR: TO BE DETERMINED PENDING SUBMITTAL.
8. DECORATIVE PROTECTION PANEL: FORMICA, HARSTOP, NO. 7759-43 SELECT CHERRY
9. STAGE CURTAIN: TO BE DETERMINED PENDING SUBMITTAL.

COLOR SCHEME 13
GYMNASIUM
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
3. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
6. WOOD STAIN @ EXISTING BASE: TO BE DETERMINED PENDING SUBMITTAL.
7. WALL PADS: TO BE DETERMINED PENDING SUBMITTAL.
8. BACKSTOP COLOR: TO BE DETERMINED PENDING SUBMITTAL.
9. BACKBOARD PADDING: TO BE DETERMINED PENDING SUBMITTAL.
10. ACOUSTICAL WALL PANELS: GULFORD OF MAINE, ANCHORAGE, NO. 22129 BIRCH
11. CEILING PAINT:
a. EXPOSED DECK: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
b. EXPOSED MAIN STRUCTURAL JOISTS: SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
c. EXPOSED DUCTWORK: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWINGS FOR ACCENT & GAME LINE COLOR LOCATIONS

COLOR SCHEME 14
GIRLS & BOYS' TOILET
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
3. PORCELAIN FLOOR & BASE TILE (PT1): CROSSVILLE, JAVA JOINT, NO. FRENCH PRESS
4. PORCELAIN FLOOR & BASE TILE (PT2): CROSSVILLE, JAVA JOINT, NO. FRENCH PRESS
5. GROUT, FLOOR & BASE TILE: MAPEI, NO. 107 IRON
6. PORCELAIN BASE TILE (PT3): DAL TILE, COLOR WHEEL, NO. 0790 ARCTIC WHITE
7. GROUT, BASE & WALL TILE: MAPEI, NO. 30 AVALANCHE
8. PORCELAIN WALL TILE (PT4): DAL TILE, COLOR WHEEL, NO. 1194 ELECTRIC BLUE
9. PORCELAIN WALL TILE (PT5): DAL TILE, COLOR WHEEL, NO. 0115 EMERALD
10. PORCELAIN WALL TILE (PT6): DAL TILE, COLOR WHEEL, NO. D650 SUNFLOWER
11. TOILET PARTITIONS: TO BE DETERMINED PENDING SUBMITTAL.
12. GWB CEILING BULKHEAD PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWINGS FOR ACCENT TILE PATTERN & LOCATIONS.

COLOR SCHEME 15
STAFF TOILET/TOILET
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
3. PORCELAIN FLOOR & BASE TILE (PT1): CROSSVILLE, JAVA JOINT, NO. FRENCH PRESS
4. PORCELAIN FLOOR & BASE TILE (PT2): CROSSVILLE, JAVA JOINT, NO. FRENCH PRESS
5. GROUT, FLOOR & BASE TILE: MAPEI, NO. 107 IRON
6. PORCELAIN BASE & WALL TILE (PT3): DAL TILE, COLOR WHEEL, NO. 0790 ARCTIC WHITE
7. GROUT, BASE & WALL TILE: MAPEI, NO. 30 AVALANCHE
8. GWB CEILING PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
SEE SUPPLEMENTAL DRAWINGS FOR WALL & ACCENT TILE PATTERN & LOCATIONS.

COLOR SCHEME 16
KITCHEN
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
3. QUARRY TILE, FLOOR & BASE: DAL TILE, NO. 0703 ASHEN GRAY
4. GROUT, FLOOR & BASE: MAPEI, NO. 106 WALNUT
5. PORCELAIN WALL TILE & BASE: CROSSVILLE, JAVA JOINT, NO. HOUSE BLEND
6. PORCELAIN TILE, GROUT: MAPEI, NO. 93 WARM GRAY
7. PORCELAIN BASE & WALL TILE (PT3): DAL TILE, COLOR WHEEL, NO. 0790 ARCTIC WHITE
8. GROUT, BASE & WALL TILE: MAPEI, NO. 30 AVALANCHE
9. LOCKERS: TO BE DETERMINED PENDING SUBMITTAL.
SEE SUPPLEMENTAL DRAWINGS FOR WALL & ACCENT TILE PATTERN & LOCATIONS.

COLOR SCHEME 17
MISCELLANEOUS
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
3. ACCENT PAINT 'D': SHERWIN WILLIAMS, NO. SW6718 OVERT GREEN
4. VINYL COMPOSITION TILE, FIELD: ARMSTRONG, NO. 59234 SILK
5. SEALED CONCRETE
6. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
7. GWB CEILING & BULKHEAD PAINT: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
8. EXPOSED STRUCTURE: SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE
9. STEEL COLUMN PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
COLOR SCHEME 18
VESTIBULES
1. WALL PAINT: SHERWIN WILLIAMS, NO. SW7015 REPOSE GRAY
2. TRIM PAINT: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
3. ACCENT PAINT: COLOR TO BE DETERMINED PENDING BRICK SUBMITTAL.
4. RUBBER BASE: JOHNSONITE, NO. 63 BURNT UMBER
5. ENTRANCE MAT: TO BE DETERMINED PENDING SUBMITTAL.
6. DECORATIVE PROTECTION PANEL: FORMICA, HARSTOP, NO. 7759-43 SELECT CHERRY
7. WOOD TRIM & MOULDINGS: STAINED TO MATCH FORMICA, NO. 7759-43 SELECT CHERRY
8. LINEAR METAL SOFFIT (MTL2): TO BE DETERMINED PENDING SUBMITTAL.
THE FOLLOWING MATERIALS ARE TO BE APPLIED AT ALL LOCATIONS WHERE SPECIFIED UNLESS OTHERWISE NOTED:
1. MARKER BOARDS: TO BE DETERMINED PENDING SUBMITTAL.
2. VINYL TACK BOARDS: TO BE DETERMINED PENDING SUBMITTAL.
3. MAP RAIL/TACK STRIPS: TO BE DETERMINED PENDING SUBMITTAL.
4. CASEWORK PVC EDGING: TO BE DETERMINED PENDING SUBMITTAL.
5. CASEWORK DOOR AND DRAWER PULLS: ANODIZED ALUMINUM
6. CASEWORK HINGES: TO BE DETERMINED PENDING SUBMITTAL.
7. CASEWORK INTERIORS: TO BE DETERMINED PENDING SUBMITTAL.
8. CASEWORK INTERIORS - OPEN CABINETS: SHALL MATCH EXTERIOR LAMINATE
9. METAL SUPPORT BRACKETS: TO BE DETERMINED PENDING SUBMITTAL.
10. WOOD DOORS: TO BE DETERMINED PENDING SUBMITTAL.
11. VINYL TACK DISPLAY CASES:
a. FRAME: TO BE DETERMINED PENDING SUBMITTAL.
b. VINYL: TO BE DETERMINED PENDING SUBMITTAL.
c. PLASTIC LAMINATE SIDES: TO BE DETERMINED PENDING SUBMITTAL.
12. WINDOW STOOLS: TO BE DETERMINED PENDING SUBMITTAL.
13. ROLLER WINDOW SHADES: TO BE DETERMINED PENDING SUBMITTAL.
14. ELEVATOR:
a. PLASTIC LAMINATE: TO BE DETERMINED PENDING SUBMITTAL.
b. PLASTIC LAMINATE: TO BE DETERMINED PENDING SUBMITTAL.
c. BAKED ENAMEL: TO BE DETERMINED PENDING SUBMITTAL.
15. INTERIOR PANEL SIGNS:
a. FRAME AND BACKGROUND:
b. LETTERS:
16. ALL MAPLE BENCHES SHALL RECEIVE STAINED TO MATCH FORMICA, NO. 7759-43 SELECT CHERRY
17. ALL DRYWALL CEILINGS SHALL BE PAINTED SHERWIN WILLIAMS, NO. SW7006 EXTRA WHITE UNLESS NOTED OTHERWISE.
18. STEEL LINTELS SHALL BE PAINTED TO MATCH ADJACENT WALL SURFACE.
19. STEEL COLUMNS @ CORNER GLASS CURTAIN WALLS: SHERWIN WILLIAMS, NO. SW7069 IRON ORE
20. EXTERIOR HOLLOW METAL DOORS & FRAMES: PAINT TO MATCH ADJACENT BRICK OR GROUNDFACE CMU. (PROVIDE DRAW-DOWNS FOR ARCHITECT'S APPROVAL.)
NOTES:
A. IF ROOM IS NOT INDICATED TO RECEIVE A FLOOR PATTERN, FIELD COLOR VCT SHALL BE USED.
B. VCT SHALL BE INSTALLED IN ONE DIRECTION. DO NOT USE BASKETWEAVE PATTERN.
C. ARCHITECT REQUIRES AN ON-SITE MOCK-UP FOR EACH PAINT COLOR. PROVIDE A MINIMUM 8x10' AREA, A DOOR FRAME. CONTRACTOR MUST RECEIVE ARCHITECT'S APPROVAL BEFORE ORDERING.
D. VERTICAL AND HORIZONTAL PLANES OF SOFFIT AND BULKHEAD SHALL BE PAINTED ACCENT COLOR AS NOTED.

GENERAL NOTE FOR ALL FINISH PACKAGE DRAWINGS

1. ALL FINISHES REQUIRE FINAL APPROVAL BY OWNER & DESIGNER PENDING RECEIPT & APPROVAL OF ALL SHOP DRAWING SUBMISSIONS. MATERIALS SHALL NOT BE PURCHASED PRIOR TO THIS APPROVAL.

NUMBER	NAME	COLOR SCHEME	FLOOR	BASE	WALLS		CEILING FINISH	REMARKS	
					WALL FINISH	WAINSCOT			
						FINISH			HEIGHT
FIRST FLOOR									
A100	CORRIDOR	6	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
A101	FACULTY WORK ROOM	17	VCT	RB	PNT		ACT1/PNT	R53, R77	
A102	CLASSROOM	1	VCT	RB	PNT		ACT1/PNT	R53, R77	
A103	SPECIAL EDUCATION	1	VCT	RB	PNT		ACT1/PNT	R53, R77	
A104	CLASSROOM	1	VCT	RB	PNT		ACT1/PNT	R53, R77	
A105	CLASSROOM	1	VCT	RB	PNT		ACT2/PNT	R53, R77	
A106	CLASSROOM	1	VCT	RB	PNT		ACT1/PNT	R53, R77	
A107	BOYS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	R56, R77	
A108	VESTIBULE	18	EM	RB	PNT		ACT2		
A109	STORAGE	17	ETR	RB	PNT		ACT1		
A110	MUSIC	4	VCT	RB	PNT		ACT1/PNT	R53, R77	
A111	CORRIDOR	7	VCT	PT2	PNT/PT2		ACT2/PNT	R54, R77, R78	
B100	VESTIBULE	18	EM/ETR	ETR/RB	STN/PNT	DPP	MATCH EXIST	ACT5 R10, R82	
B101	RECEPTION	10	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
B101A	CONFERENCE	10	VCT	RB	PNT		ACT2		
B101B	PRINCIPAL	10	VCT	RB	PNT		ACT2		
B101C	TILT	15	PT7	PT3	EPX	PT3	4'-0"	ACT2 R56	
B101D	SECURE STORAGE	10	VCT	RB	PNT		ACT1		
B101E	ADMIN	10	VCT	RB	PNT		ACT2/PNT		
B102	CUST	17	ETR	RB	EPX		PSTR		
B103	GIRLS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	ACT2 R56	
B104	STAIR 3	9	VCT	RB	PNT		--	R7	
B105	MDF	--	ETR	ETR	PNT/PT2		ETR		
B106	LOBBY	7	VCT	PT2/RB	PNT/PT2	DPP	MATCH EXIST	ACT5/PNT R29, R52, R53, R54, R77, R78, R82	
B107	AUDITORIUM	12	ETR/VCT	RB	PNT	DPP	MATCH EXIST	ETR R5, R9, R29	
B107A	STAGE	12	ETR	ETR	PNT		ETR	R6, R9, R11, R29	
B108	STORAGE	--	ETR	ETR	ETR		ETR		
B109	FAMILY TOILET	15	PT1	PT3	EPX	PT3	4'-0"	ACT3 R56	
B110	WAITING	10	VCT	RB	PNT		ACT1		
B110A	STORAGE	10	VCT	RB	PNT		ACT1		
B110B	COTS	10	VCT	RB	PNT		ACT1		
B110C	OFFICE	10	VCT	RB	PNT		ACT1		
B110D	EXAM	10	VCT	RB	PNT		ACT1		
B110E	TOILET	15	PT1	PT3	EPX	PT3	4'-0"	ACT3/EPX R3, R27, R55, R56, R77, R79	
B111	LEAD OFFICE	10	VCT	RB	PNT		ACT2		
B111A	STORAGE	10	VCT	RB	PNT		PNT		
B112	GUIDANCE	10	VCT	RB	PNT		ACT2		
B113	CORRIDOR	7	VCT	RB/PT2	PNT/PT2		ACT2/PNT	R77, R78	
B114	STAIR 2	9	VCT	RB	PNT		--	R7, R77	
B114A	STORAGE	17	ETR	RB	PNT		--		
B115	KINDERGARTEN	2	VCT	RB	PNT		ACT1/PNT	R53, R77	
B115A	TOILET	14	PT1	PT1	EPX		ACT1		
B115B	TOILET	14	PT7	PT7	EPX		ACT1		
B115C	TOILET	14	PT7	PT7	EPX		ACT1		
B116	EARLY CHILDHOOD	2	VCT	RB	PNT		ACT1/PNT	R53, R77	
B116A	TOILET	14	PT1	PT1	EPX		ACT1		
B116B	TOILET	14	PT7	PT7	EPX		ACT1		
B116C	TOILET	14	PT7	PT7	EPX		ACT1		
B117	KINDERGARTEN	2	VCT	RB	PNT		ACT1/PNT	R53, R77	
B117A	TOILET	14	PT1	PT1	EPX		ACT1		
B117B	TOILET	14	PT7	PT7	EPX		ACT1		
B117C	TOILET	14	PT7	PT7	EPX		ACT1		
B118	KINDERGARTEN	2	VCT	RB	PNT		ACT1/PNT	R53, R77	
B118A	TOILET	14	PT1	PT1	EPX		ACT1		
B118B	TOILET	14	PT7	PT7	EPX		ACT1		
B118C	TOILET	14	PT7	PT7	EPX		ACT1		
B119	KINDERGARTEN	2	VCT	RB	PNT		ACT1	R53	
B119A	TOILET	14	PT7	PT3	EPX	PT3/PT4/PT5	4'-0"	ACT1	
B120	SGI	2	VCT	RB	PNT		ACT1		
B120A	STORAGE	2	VCT	RB	PNT		ACT1		
B121	STAIR	9	VCT	RB	PNT		ACT2	R7	
B122	STAIR	9	VCT	RB	PNT		ACT2	R7	
B122A	STAIR	9	VCT	RB	PNT		ACT2	R7	
B124	CORRIDOR	6	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
C100	CORRIDOR	7	VCT	RB/PT2	ETR/PNT/PT2		ACT2/PNT	R52, R77	
C101	MEN'S FACULTY	15	PT1	PT3	EPX	PT3	4'-0"	ACT1 R56	
C101A	VEST	18	EM	RB	PNT		ACT2		
C102	WOMEN'S FACULTY	15	PT1	PT3	EPX	PT3	4'-0"	ACT1 R56	
C103	FACULTY DINING	17	VCT	RB	PNT		ACT1	R53	
C104	GYM STORAGE	17	VCT	RB	PNT		PSTR		
C105	CAFETERIA	8	VCT	RB/PT1/PT2	PNT/BRK/PT1/PT2		MTL1/PSTR/PNT	R52, R77	
C105A	CUST	17	SCONC	RB	EPX		PSTR		
C106	KITCHEN	16	QT	QT/PT2	EPX/PT2		ACT4		
C106A	LOCKER	16	QT	QT	EPX		ACT4		
C106A-A	TOILET	16	QT	QT	EPX	PT3	4'-0"	ACT4	
C106B	DRY STORAGE	16	QT	QT	EPX		ACT4		
C106C	OFFICE	16	QT	QT	EPX		ACT4		
C106D	COLD STORAGE	16	QT	QT	EPX		ACT4		
C106E	REF/FREEZ	16	QT	QT	*		*	R28, R57, R81	
C107	GYMNASIUM	13	ETR	ETR/RB	PNT		PNT	R8, R29, R53, R80	
C107A	GYM OFFICE	13	VCT	RB	PNT		ACT1		
C108A	VESTIBULE	18	VCT	RB	PNT/BRK		MTL2	R7	

NUMBER	NAME	COLOR SCHEME	FLOOR	BASE	WALLS		CEILING FINISH	REMARKS	
					WALL FINISH	WAINSCOT			
						FINISH			HEIGHT
C109	CORRIDOR	6	VCT	RB	PNT/BRK/ETR		ACT2/PNT	R52, R77, R78	
C109	RAMP	6	RBR	RB	PNT/BRK/ETR		ACT2/PNT	R12, R52, R77, R78	
C110	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C111	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C112	CORRIDOR	6	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
C113	STAIR C1	9	VCT	RB	PNT		--ACT2/PNT	R7, R53	
C114	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C115	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C116	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C117	SGI	3	VCT	RB	PNT		ACT1	R53	
C118	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C119	STORAGE	17	VCT	RB	PNT		ACT1		
C119A	TOILET	15	PT1	PT3	EPX	PT3	4'-0"	ACT1 R56	
C120	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C121	FACULTY PLANNING	17	VCT	RB	PNT		ACT1	R53	
C122	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C123	ELECTRICAL	17	SCONC	RB	PNT		PSTR		
C124	GIRLS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	ACT2	
C125	BOYS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	ACT2	
C126	ELEV.	17	VCT	*	*		*	*PRE-FINISHED UNIT, REFER TO SPECS	
C127	CUST	17	SCONC	RB	EPX		PSTR		
C128	LOBBY	7	VCT	RB/PT2	PNT/BRK/ETR/PT2		ACT2/PNT/PSTR	R7, R52, R77, R78	
C129	VESTIBULE	18	EM	RB	PNT/BRK		MTL2	R53	
C130	CORRIDOR	6	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
C131	STORAGE	17	VCT	RB	PNT		PSTR		
C220	CORRIDOR	7	VCT	PT2	PNT/PT2		ACT2/PNT	R54, R77, R78	
EXISTING SECOND FLOOR									
A200	CLASSROOM	1	VCT	RB	PNT		ACT1/PNT	R53, R77	
A201	CLASSROOM	1	VCT	RB	PNT		ACT1/PNT	R53, R77	
B200	CORRIDOR	6	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
B201	STAIR 3	9	VCT	RB	PNT		ACT2	R7	
B202	BOYS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	ACT2 R56	
B203	OFFICE	17	VCT	RB	PNT		ACT1		
B204	CUST	17	VCT	RB	PNT		ACT1		
B205	MECHANICAL	--	ETR	ETR	ETR		ETR		
B206	MEDIA CENTER	11	VCT	RB	PNT		ACT2/PNT	R53, R59, R77, R78	
B206A	WORK ROOM	11	VCT	RB	PNT		ACT2		
B207	STAIR 2	9	VCT	RB	PNT		ACT2	R7	
B208	OFFICE	17	VCT	RB	PNT		ACT1		
B209	CLASSROOM	2	VCT	RB	PNT		ACT1/PNT	R53, R77	
B210	GIRLS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	ACT2 R56	
B212	CLASSROOM	2	VCT	RB	PNT		ACT1/PNT	R53, R77	
C200	CORRIDOR	7	VCT	RB/PT2	PNT/BRK/ETR/PT2		ACT2/PNT	R12, R52, R77, R78	
C201	CUST	17	SCONC	RB	EPX		PSTR		
C202	ELEV.	17	VCT	*	*		*	*PRE-FINISHED UNIT, REFER TO SPECS	
C203	BOYS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	ACT2	
C204	GIRLS	14	PT1	PT3	EPX	PT3/PT4/PT5/PT6	6'-0"	ACT2	
C205	IDF	17	SCONC	RB	PNT		PSTR		
C206	MAKER SPACE	5	SRT	RB	PNT		MTL1/PSTR	R53, R77	
C206A	STOR	5	VCT	RB	PNT		ACT1		
C207	FACULTY PLANNING	17	VCT	RB	PNT		ACT1		
C208	ART	5	SRT	RB	PNT		MTL1/PSTR	R53, R77	
C208A	KILN	5	SCONC	RB	PNT		ACT1		
C208B	STORAGE	5	VCT	RB	PNT		PSTR		
C208C	STOR	5	SCONC	RB	PNT		ACT1		
C209	SGI	3	VCT	RB	PNT		ACT1/PNT	R77, R78	
C210	SCIENCE CLASSROOM	3	SRT	RB	PNT		ACT1/PSTR	R53, R77	
C210A	STOR	3	VCT	RB	PNT		ACT1		
C210B	TOILET	15	PT1	PT2	EPX	PT2	4'-0"	ACT1 R56	
C211	SGI	3	VCT	RB	PNT		ACT1/PNT	R77, R78	
C212	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C213	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C214	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C215	STAIR C1	9	VCT	RB	PNT		ACT2/PNT	R7, R53, R77	
C216	CLASSROOM	3	VCT	RB	PNT		ACT1	R53	
C217	CORRIDOR	6	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
C218	CORRIDOR	6	VCT	RB	PNT		ACT2/PNT	R53, R77, R78	
C219	STOR	17	VCT	RB	PNT		ACT1		

ROOM FINISH SCHEDULE LEGEND

FLOOR FINISH

EM ENTRANCE MAT
PT PORCELAIN TILE
QT QUARRY TILE
RBR RUBBER/RUBBER TILE
SCONC CONCRETE WITH SEALER
SRT SLIP RESISTANT TILE
VCT VINYL COMPOSITION TILE

FLOOR REMARKS

R1: NOT USED
R2: SEE FLOOR PATTERN PLANS FOR VARYING FLOOR MATERIALS.
R3: PROVIDE PORCELAIN TILE (PT7) FLOORS AT SHOWER.
R4: PROVIDE QUARRY TILE FLOOR IN WALK-IN COOLER &

SEAL:



R. JEFFREY STRAUB, AIA
STATE AND LICENSE NO: RA403652

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03/02/2021

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2	03/19/21 ADDENDUM #2	
1	03/15/21 ADDENDUM #1	
NO.	DATE	REVISION

**SCHOOL & LOCATION
RHAWNURST ELEMENTARY
SCHOOL**

7809 Castor Ave, Philadelphia, PA 19152

PROJECT TITLE

ADDITIONS & RENOVATIONS

DRAWING TITLE

OVERALL SECOND FLOOR - FINISH PLAN

LOCATION NO.	FILE NO.
DRAWN BY Author	CHECKED BY Checker
B-070	OF 2019 / 20
B-071	OF 2019 / 20
B-072	OF 2019 / 20
B-073	OF 2019 / 20

DRAWING NO.

17.10



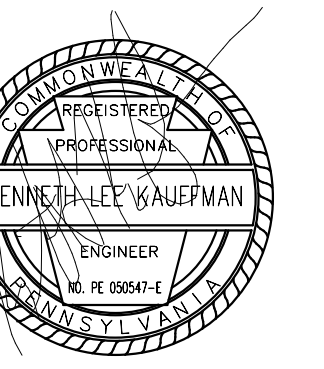
1 OVERALL SECOND FLOOR FINISH PLAN
17.10 1/16" = 1'-0"

FINISH PLAN LEGEND	
	= STAIN EXISTING WOOD
	= EXISTING RED BRICK
	= NEW RED BRICK
	= NEW BLUE BRICK
	= NEW YELLOW BRICK
	= TILE
	= DECORATIVE PROTECTION PANEL
	= EXISTING MOSIAC TILE
	= PAINTED ACCENT COLOR, COLOR TBD
	= WALL GRAPHIC - REFER TO ARCHITECTURAL DWG

GENERAL NOTE IN REFERENCE TO ALL FINISH PLAN DRAWINGS

1. DRAWINGS ARE FOR CLARIFICATION OF MATERIAL LOCATIONS. REFER TO ROOM FINISH SCHEDULE, INTERIOR AND ARCHITECTURAL ELEVATIONS/PLANS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

SEAL:



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STATE AND LICENSE NO: PA 050547-E

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03/02/2021

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1	3/22/2021 ADDENDUM #2	
NO.	DATE	REVISION

**SCHOOL & LOCATION
RHAWNURST ELEMENTARY
SCHOOL**

7809 Castor Ave, Philadelphia, PA 19152

PROJECT TITLE

**ADDITIONS &
RENOVATIONS**

DRAWING TITLE

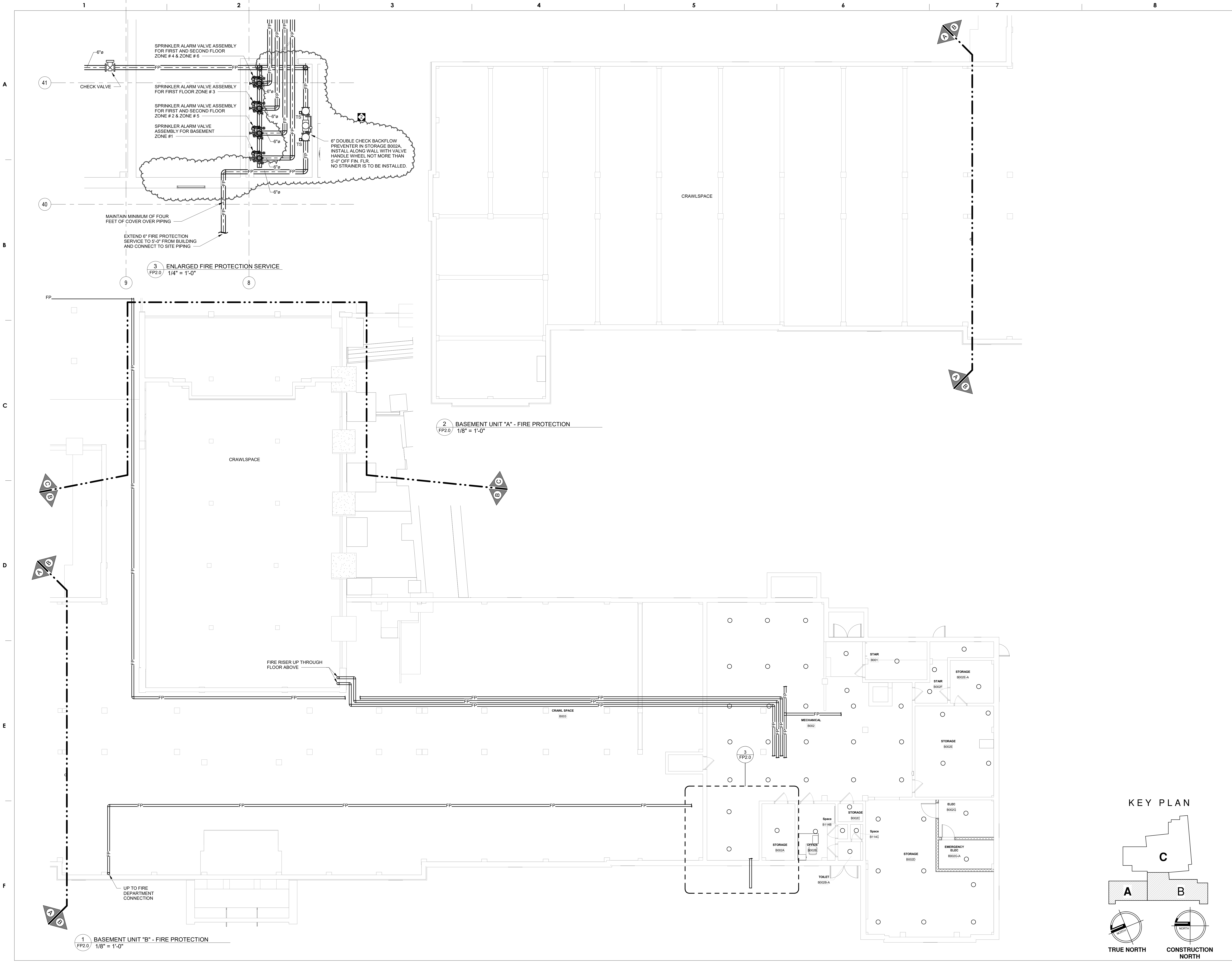
**BASEMENT UNIT "A" & "B"
FIRE PROTECTION**

LOCATION NO.	FILE NO.
DRAWN BY	CHECKED BY

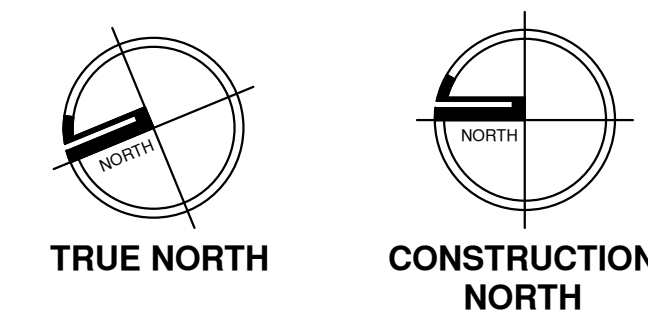
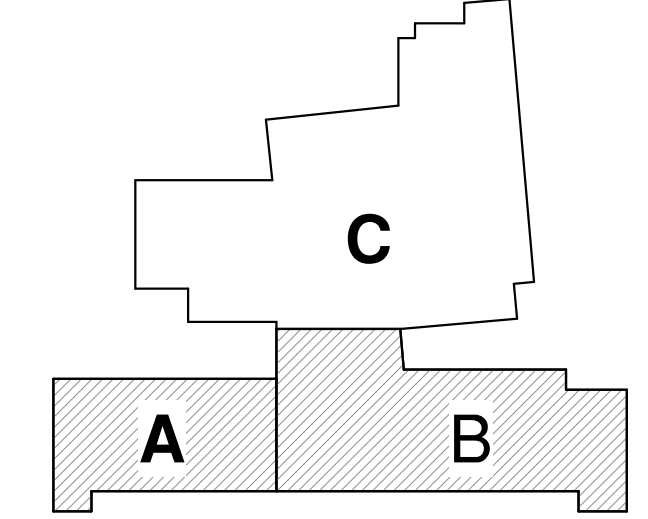
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B-071	OF	2019 / 20
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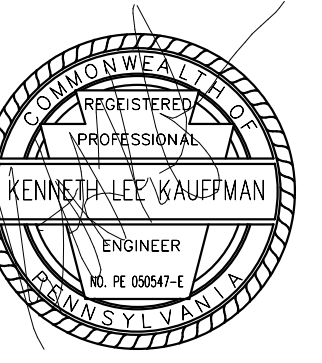
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FP2.0



KEY PLAN





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03/02/2021

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1	3/22/2021 ADDENDUM #2	
NO.	DATE	REVISION

SCHOOL & LOCATION
RHAWNURST ELEMENTARY SCHOOL

7809 Castor Ave, Philadelphia, PA 19152

PROJECT TITLE
ADDITIONS & RENOVATIONS

DRAWING TITLE

ROOF POWER

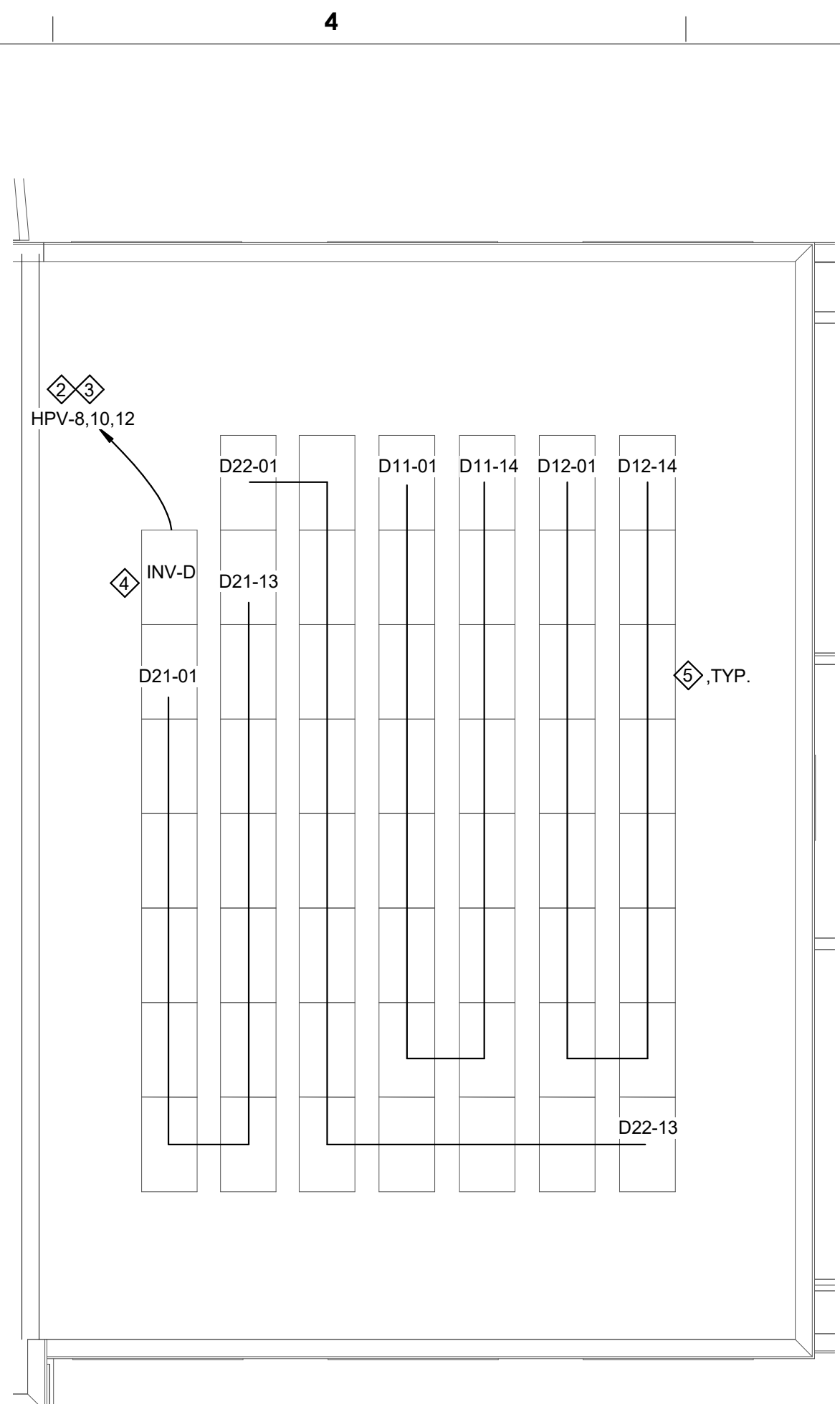
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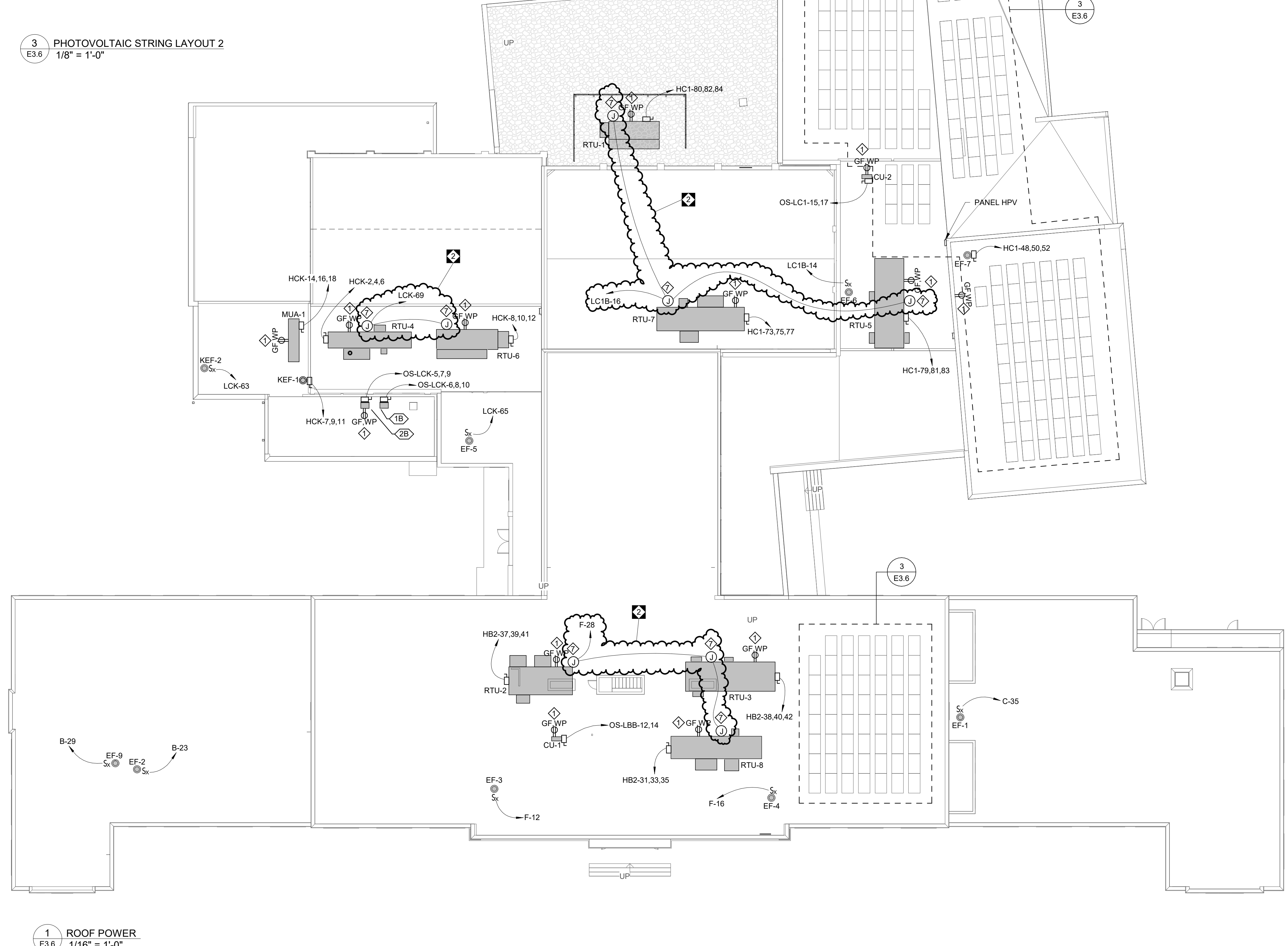
E3.6

- GENERAL NOTES:**
- REFER TO VOLTAGE DROP SCHEDULE ON DRAWING E10.4 FOR PHOTOVOLTAIC STRING SIZING.
 - REFER TO PHOTOVOLTAIC SYSTEM INVERTER SCHEDULE ON DRAWING E10.4 FOR INVERTER SIZES.
 - REFER TO PHOTOVOLTAIC PANEL SCHEDULE ON DRAWING E10.4 FOR PHOTOVOLTAIC PANEL RATINGS.
 - PROVIDE ROOFTOP CONDUIT SUPPORTS, SPACING AS REQUIRED BY THE NEG. COOPER B-LINE DURA-BLOK, OR APPROVED EQUAL.

- DRAWING NOTES:**
- CONNECT TO 120V BRANCH CIRCUIT SERVING GENERAL PURPOSE RECEPTACLES ON FLOOR BELOW.
 - ROUTE ACROSS ROOF TO PANEL. PROVIDE PULL BOXES AS REQUIRED. USE LIQUID TIGHT FLEXIBLE METAL CONDUIT WHEN CROSSING ROOF/EXPANSION JOINTS.
 - REFER TO VOLTAGE DROP SCHEDULE ON DRAWING E10.4 FOR HOMERUN SIZING OF INVERTERS.
 - PROVIDE ANGLED ROOF INVERTER RACK AND INVERTER SUN SHADE COVER.
 - PROVIDE A BALLAST FLAT ROOF PHOTOVOLTAIC MODULE MOUNTING SYSTEM.
 - REFER TO POWER RISER FOR WIRING INFORMATION AND SIZING.
 - CONNECT TO BIPOLAR IONIZATION UNIT PROVIDED BY MC.



3 PHOTOVOLTAIC STRING LAYOUT 2
E3.6 1/8" = 1'-0"



1 ROOF POWER
E3.6 1/16" = 1'-0"

2 PHOTOVOLTAIC STRING LAYOUT 1
E3.6 1/8" = 1'-0"