July 18, 2025

ADDENDUM No. 1

Project: **2024922**
South Jones High School Athletic Buildings
Jones County School District
Ellisville, Mississippi

The following additions, changes, clarifications, and substitutions to the drawings and specifications, dated June 25, 2025, are to be included as part of the contract documents. Acknowledge receipt of this addendum by inserting its number and date in the proposal form.

Addendum Table of Contents:			
	4	**8-1/2 x 11**	**pages of Addendum Items**
	108	**8-1/2 x 11**	**pages of Specifications**
	13	**24x36**	**pages of Drawings**

Total of 125 pages of Addendum

REGISTERED ARCHITECT
J Guadalupe Arellano
4679
STATE OF MISSISSIPPI
2025.07.18

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Refer to Specifications

Item No. 1. Refer to Project Manual – Add the following specifications:

Section 22 04 40	Plumbing Fixtures, Trim and Accessories
Section 22 04 50	Domestic Water Heaters and Accessories
Section 23 06 70	Packaged Air Conditioners
Section 23 07 56	Packaged Heat Recovery Equipment
Section 23 08 30	Heating/Cooling Terminal Units
Section 23 08 60	Fans
Section 23 08 85	Air Cleaning/Treatment
Section 23 08 90	Ductwork
Section 23 09 10	Ductwork Accessories
Section 23 09 80	Controls and Instrumentation
Section 23 09 90	Testing, Adjusting and Balancing
Section 31 23 14	Stripping Excavation
Section 31 23 23.33	Flowable Fill
Section 32 01 19	Soil-Lime-Water Mixing
Section 32 91 20	Site Restoration
Section 32 92 01	Commercial Fertilizer
Section 32 92 20	Vegetative Materials for Mulch
Section 33 31 11	Public Sanitary Sewerage Gravity Piping

Item No. 2. Refer to Section 00 41 00 Bid Form – Replace with enclosed Section 00 41 00 Bid From. Bothalternate shall be adds.

Item No. 3. Refer to Section 01 23 00 Alternates – Clarification: Both alternates shall be add to the base bid.

Item No. 4. Refer to Section 31 05 17 Granular Material – Item “1.2 PAYMENT” is to be completely removed from the specification.

Item No. 5. Refer to Section 31 23 16 Excavation – Item “1.2 PAYMENT & 1.3 MEASUREMENT” is to be completely removed from the specification.

Item No. 6. Refer to Section 31 25 00 Erosion and Sediment Controls – Item “1.2 UNIT PRICE – MEASUREMENT AND PAYMENT” is to be completely removed from the specification.

Item No. 7. Refer to Section 32 12 16 Asphalt Paving – Item “1.2 PRICE AND PAYMENT PROCEDURES” is to be completely removed from the specification.

Item No. 8. Refer to Section 32 16 23 Sidewalks – Item “1.2 PAYMENT” is to be completely removed from the specification.

Item No. 9. Refer to Section 32 17 23 Pavement Markings – Omit this section in its entirety.

Item No. 10. Refer to Section 33 01 10.58 Disinfection of Water Utility Piping Systems – Item “1.2 UNIT PRICE – MEASUREMENT AND PAYMENT” is to be completely removed from the specification.

Item No. 11. Refer to Section 33 05 61 Concrete Manholes – Item “1.3 PAYMENT” is to be completely removed from the specification.

Item No. 12. Refer to Section 33 05 76 Fiberglass Manholes – Omit this section in its entirety.

Item No. 13. Refer to Section 33 11 17 Water Distribution Piping:

Item “1.2 PRICE AND PAYMENT PROCEDURES” is to be completely removed from the specification.

Item “2.1 WATER PIPING” shall be replaced with the following:

2.1 WATER PIPING

A. Water Pipe: Water Pipe, SDR11, PER ASTM D3035:

1. Fittings: AWWA C153, Mechanical Joint Ductile Iron

2. Joints: ASTM D3139 compression gasket ring.

3. All water pipes shall be marked with an NFS stamp.

Item No. 14. Refer to Section 33 12 16 Water Distribution Gate Valves – Replace with enclosed Section 33 12 16 Water Distribution Gate Valves.

Item No. 15. Refer to Section 33 31 23 Sanitary Sewerage Force Main Piping – Replace with enclosed Section 33 31 23 Sanitary Sewerage Force Main Piping.

Item No. 16. Refer to Section 33 32 17 Wastewater Pumping Stations – Grinder – Item “1.2 PAYMENT” is to be completely removed from the specification.

Item No. 17. Refer to Section 33 42 13 Stormwater Culverts – Item “1.2 UNIT PRICE – MEASUREMENT AND PAYMENT” is to be completely removed from the specification.

Refer to Drawings

Item No. 18. Refer to Drawing set and replace the following sheets:

- Sheet C0.00 – General Notes
- Sheet C1.10 – Softball Press box Site Plan – This drawing was replaced due to the change of the location for proposed pump station
- Sheet C1.11 – Softball Press Box Site Plan Enlargement – This drawing was replaced due to the change of the location for proposed pump station
- Sheet C1.20 – Softball Press Box Grading Plan – This drawing was replaced due to the change of the location for proposed pump station
- Sheet C1.30 – Softball Press Box SWPPP – This drawing was replaced due to the change of the location for proposed pump station
- Sheet C2.10 – Softball Fieldhouse Site Plan – This drawing was replaced due to the change of the location for proposed pump station
- Sheet C2.11 – Softball Fieldhouse Site Plan Enlargement – This drawing was replaced due to the change of the location for proposed pump station
- Sheet C2.20 – Softball Fieldhouse Grading Plan – This drawing was replaced due to the change of the location for proposed pump station

- Sheet C2.30 – Softball Fieldhouse SWPPP – This drawing was replaced due to the change of the location for proposed pump station
- Sheet C3.00 – Soccer/Volleyball Fieldhouse Existing Site Conditions/Demolition Plan – The demolition notes for the existing sanitary sewer was changed
- Sheet C3.10 – Soccer/Volleyball Fieldhouse Site Plan – The design of the gravity sewer was changed
- Sheet C4.00 – Site Plan Details
- Sheet C4.30 – Pump Station Details

End of Addendum No. One Items

South Jones High School
Athletic Buildings
Jones County School District
Ellisville, Mississippi

SECTION 00 41 00

BID FORM

Date:_____ **Certificate of Responsibility Number: _____**

Proposal of: _____

Project: 2024922
South Jones High School
Athletic Buildings
Ellisville, Mississippi

Owner: Jones County School District
5204 Highway 11 North
Ellisville, MS 39437

The receipt of the following Addenda to the Contract Documents is hereby acknowledged:

Addendum No. ___ Date _____ Pages: ____ Addendum No. ___ Date _____ Pages: ____

Addendum No. ___ Date _____ Pages: ____ Addendum No. ___ Date _____ Pages: ____

Having carefully examined the Contract Documents entitled South Jones High School Athletic Buildings, prepared by PryorMorrow PC, and dated June 25, 2025, as well as the premises and conditions affecting the work, the undersigned proposes to furnish all labor, materials, and services required by the Contract Documents for the work described as follows:

Both alternates shall be adds to the base bid.

BASE BID:

_____

_____DOLLARS ($_____)

ALTERNATE #1: Softball-Soccer Field House size increase by 16’-0”.

_____

_____DOLLARS ($_____)

ALTERNATE #2: Add Tectum Clouds at Weight Room Ceiling (TYPE V)

_____

_____DOLLARS ($_____)

Unit Price #1: The Contractor shall provide a unit price for additional concrete sidewalks. This shall be a per s.f. cost as an additive or deductive cost associated with the base. (Note: All concrete sidewalks shown on the drawings shall be included in the base bid).

_____

_____DOLLARS ($_____)

Unit Price #2: (The Contractor shall provide a unit price for excavation and fill). This shall be per c.y. cost as an additive or deductive cost associated with the base. (refer to drawings for volume/quantity to be included in the base bid).

_____

_____DOLLARS ($_____)

The OWNER and the CONTRACTOR recognize that time is of the essence in this Agreement and that the OWNER will suffer financial loss if the project is not substantially completed **as follows:**
Soccer-Volleyball Field House on or before May 15, 2026.
Softball Fieldhouse on or before July 24, 2026.
Softball Pressbox on or before December 11, 2026.

They also recognize the delays, expenses and difficulties involved in proving in a legal arbitration preceding the actual loss suffered by the OWNER if the Work is not substantially complete on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) the Owner will deduct the sum of **$500.00 for each calendar day** that expires after the time specified above.

The Contractor represents that it has (1) examined all available records and data furnished by the Owner and the Architect and has from such examination informed itself fully concerning all surface conditions in connection with the work and the services to be performed hereunder, (2) determined that the site of the work is satisfactory in all respects for the work, and (3) read the Contract Documents and is fully cognizant of and is familiar with all of the terms and conditions thereof.

Respectfully Submitted:

Signed: _____

Print Name: _____

Title: _____

Address: _____

*If the bidder is a corporation, write State of Incorporated under signature. If the bidder is a partnership, show the names of all partners.

Note: The bidder's Certificate of Responsibility number is required on the outside of the envelope that contains the proposal of the bidder.

END OF SECTION

SECTION 220440 - PLUMBING FIXTURES, TRIM & ACCESSORIES

PART 1 – GENERAL

1.1 SCOPE

A. Provide all labor, equipment, materials, etc., required to complete installation as specified herein and/or shown or scheduled on plans.

B. Work Included: Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

PART 2 – PRODUCTS

2.1 FIXTURE TRIM

A. All exposed metal parts of all fixtures, including faucets, waste fittings, waste plugs, flush valves, traps, supplies, nipples, and escutcheons shall be chrome-plated brass unless other materials or finish is specified. Basket and similar strainer assemblies for sinks shall be stainless steel.

B. Drain and waste assemblies below lavatories and sinks shall be minimum 17-gauge chrome plated brass and traps shall include cleanout plugs.

C. Stops and supplies:

1. All stops and supplies shall be NSF 61 compliant and contain less than 0.25% lead (Pb) by weight.

2. Chrome plated brass/copper supplies shall be provided on all water supplies to fixtures. All hot/cold faucet handles for lavatories, sinks and bath/shower supply fittings shall include red and blue color code indications.

3. Stops shall be chrome-plated brass, angle all bronze compression quarter turn ball type as McQuire LFBV series. Locate stops centrally above or below fixture in accessible locations.

2.2 ESCUTCHEONS

A. Provide chrome-plated escutcheons on all water and drain piping in wall, floor and ceiling penetrations.

B. Heavy-duty type escutcheons, with setscrews shall be utilized in exposed applications under wall mounted lavatories and sinks and on exposed piping applications on tank type water closet stops and on exposed piping to flush valves, etc.

C. Light duty slip-on type may be utilized in concealed installations within cabinets.

2.3 CARRIERS

A. Provide appropriate carriers for all wall mounted water closets, urinals, lavatories, electric drinking fountains, and sinks, and as indicated elsewhere in these specifications or on the drawings, or as required. All carriers shall be concealed, floor mounted type unless otherwise approved by the PROFESSIONAL.

B. Where wall hung water closets, urinals, lavatories, electric drinking fountains, or sinks are installed back to back and carriers are specified, provide one carrier to

serve both fixtures in lieu of individual carriers.

2.4 HANDICAPPED SERVICES

A. Provide where required and/or indicated plumbing fixtures and installations that comply with the latest version of "American with Disabilities Act" (ADA).

B. Provide neat pre-packaged molded insulation protection on an exposed drain and water piping below sinks and lavatories equal to TRUEBO Models #102 and #105.

2.5 PLUMBING FIXTURES AND TRIM

Furnish and install all plumbing fixtures specified herein and shown on plans. Kohler fixtures are specified, however, Eljer, or American Standard may be used if they are equal in all respects to those specified. CONTRACTOR shall submit data on trim as well as fixtures. All water closets, urinals and other fixtures associated with flush valves shall be water conservation type unless specified otherwise. All lavatory and shower supply fittings shall be of the flow restrictor type, unless specified otherwise. Flush valves shall be Zurn type “AV” or Sloan Royal with clog resistant design and vandal resistant stop cap.

A. Water Closets: All water closet seats shall have stainless steel mounting post and fasteners with “Sta-Tite” technology as Bemis or Church.

1. WC-1 – ADA Compliant floor mounted vitreous china siphon jet with elongated bowl and 1-1/2” top spud, 2” passage and 1.6-gallon flush. (Coordinate with grab bar and ARCHITECT’s details per ADA requirements. Install with handle opposite nearest corner installation).
   a. Fixture: Kohler Model K96057 (Highcliff Ultra).
   b. Flush valve: Manual flush valve equal to Zurn Z-6000AV-WS1-ADA or Sloan Royal 111.
   c. Seat: Bemis Model 10SSCT.

2. WC-2 Floor mounted vitreous china siphon jet with elongated bowl and 1-1/2” top spud, 2” passage and 1.6-gallon flush.
   a. Fixture: Kohler Model K96053 (Welcomme Ultra).
   b. Flush valve: Manual flush valve equal to Zurn Z-6000AV-WS1-ADA or Sloan Royal 111.
   c. Seat: Bemis Model 10SSCT.

B. Urinals:

1. U-1 – ADA Compliant wall mounted vitreous china washout design with 3/4” top spud, 2” outlet and high efficiency 1.0-gallon flush.
   a. Fixture: Kohler Model K 4904-ET-0 (Bardon).
   b. Flush valve: Manual flush valve equal to Zurn Z-6003AV-WS1-ADA or Sloan Royal 186-1.
   c. Carrier: Zurn adjustable floor mounted wall carrier(s) as required.

2. U-1 – Wall mounted vitreous china washout design with 3/4” top spud, 2” outlet and high efficiency 1.0-gallon flush.
   a. Fixture: Kohler Model K 4904-ET-0 (Bardon).
   b. Flush valve: Manual flush valve equal to Zurn Z-6003AV-WS1-ADA or Sloan Royal 186-1.
   c. Carrier: Zurn adjustable floor mounted wall carrier(s) as

required.

C. Lavatories:

1. L-1 – ADA Compliant wall mounted vitreous china with 8” faucet centers and 5” backsplash.
   a. Fixture: Kohler Model K 2006 (Kingston).
   b. Faucet: T&S Brass Model B-2990-WH4-QT, low height lavatory faucet, 2” clearance, 5-1/4” reach, 4” wrist blade handles, 0.5 gpm vandal resistant laminar flow outlet.
   c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

2. L-2 – Wall mounted vitreous china with 8” faucet centers and 5” backsplash.
   a. Fixture: Kohler Model K 2006 (Kingston).
   b. Faucet: T&S Brass Model B-2990-WH4-QT, low height lavatory faucet, 2” clearance, 5-1/4” reach, 4” wrist blade handles, 0.5 gpm vandal resistant laminar flow outlet.
   c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

3. L-3 – ADA Compliant wall mounted vitreous china with single hole drilling and 5” backsplash.
   a. Fixture: Kohler Model K 2007 (Kingston).
   b. Faucet: T&S Brass Model B-0712-VF05, metering single hole faucet with adjustable metering cycle, 4-1/2” high, 7/8” clearance, 4” reach, 0.5 gpm vandal resistant aerator.
   c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

4. L-4 – Wall mounted vitreous china with single hole drilling and 5” backsplash.
   a. Fixture: Kohler Model K 2007 (Kingston).
   b. Faucet: T&S Brass Model B-0712-VF05, metering single hole faucet with adjustable metering cycle, 4-1/2” high, 7/8” clearance, 4” reach, 0.5 gpm vandal resistant aerator.
   c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

D. Service Sinks:

1. SS-1 – Terrazzo, drop front, floor mounted, mop sink (size 24”x24”x12”).
   a. Fixture: Stern Williams Model HL-1800.
   b. Faucet: T&S Brass Model B-0665-BSTR mop sink faucet with vacuum breaker, wall brace and pail hook.
   c. Accessories and Trim:
      i. 20 ga. stainless steel cap on drop front
      ii. 12” high stainless-steel back panels on all walls.
      iii. Stern Williams Model T-40 mop hanger (mounted above sink).

E. Sinks: Sink sizes herein are listed as overall dimensions. Unless noted otherwise the order of dimensions is listed as front-to-back x left-to-right x bowl depth. Coordinate number of holes required with faucet and other accessories specified.

1. S-1 – Double compartment, 18 ga. self-rimming (size 22"x33"x10-1/2").
   a. Fixture: Just Model DLX-2233-A-GR.
   b. Faucet: T&S Brass Model B-2347-05, swivel gooseneck faucet, 13-1/2" high, 6" clearance, 8-3/4" reach, 4" wrist blade handles, 1.0, 1.5, 2.2 gpm vandal resistant aerator, hose and spray.
   c. Trim: Just Model J-35 stainless steel basket strainer (2 each).

F. Showers: Note: provide for each shower head, a separate high-temperature shut-off device equal to Powers HydroGuard Model HT115.

1. SH-1 – ADA Compliant shower enclosure, fittings and drain.

   a. Shower Enclosure: Comfort Designs Model XST 6236 TR 1.125. Open top acrylic shower unit, full wood backing, pre-leveled easy base, barrier free threshold, integral stainless-steel grab bars on 3 sides, integral vertical stainless-steel grab bar, no caulk brass drain, stainless steel curtain rod/cups.
   b. Shower Valve: Zurn Model Z-7101-SS-LH-DVP2-HW-MT, pressure balancing valve with single metal handle, metal cover, escutcheon and stem handle, diverter valve.
   c. Spray Head: Zurn Model Z7000-S1, shower head with 2.5 gpm water flow control.
   d. Accessories and Trim:
      i. 2.5 gpm hand/wall shower head
      ii. 60" flexible metal hose
      iii. 36" wall mounted slide bar

G. Drinking Fountains/Bottle Fillers: All capacities (G. P. H.) are based on 50-degree F., drinking water, 80-degree F., inlet water and 90-degree F. ambient. All shall be NSF 61 compliant and contain less than 0.25% lead (Pb) by weight.

1. EDF-1 – ADA Compliant wall mounted barrier-free, one-piece stainless-steel basin with integral drain and push button and stainless-steel cabinet. 8.0 gallons per hour.
   a. Murdock Model A171408F-UG
   b. Accessories and Trim:
      i. BF12S – Sensor operated stainless steel water bottle filling station
      ii. WF1 – Water Filter, NSF 42 and 53, 1500-gallon capacity, 1 micron.
      iii. SK-5 - Cane touch apron for installation on exposed wall applications
   c. Carrier: Wade adjustable floor mounted wall carrier(s) as required.

H. Hose Bibbs:

1. HB-1 - Hose Bibb: Non-freeze wall hydrant (designed to fit one standard modular masonry course), stainless steel box with hinged locking cover

stamped “WATER”, bronze hydrant, hose connection with integral vacuum breaker, and "T" handle key, Wade Model 8701-BB, Hydrant shall be 3/4 inch.

2. HB-2 - Hose Bibb: Mild climate box wall hydrant, Hydrant in hinged covered box, stainless steel box and hinged cover and, "T" handle key, Wade Model 8708, hydrant shall be 3/4 inch.

3. HB-3 - Hose Bibb: Quarter-turn ball hose end valve equal to American Valve Model M74QT. Provide with American Valve Model MVB vacuum breaker.

I. Trap Primers:

1. TP-1 Trap Primer: Trap primer shall be connected to water closet flush valve. Exposed piping shall be chrome plated, provide chrome-plated escutcheon at mount to wall. Zurn Model Z-6000 TPO.

J. Trap Guard

1. TG-1 - Trap Guard: Flexible elastomeric tube treated to roll up when water is not passing through to resist emission of sewer gases, as ProSet®, MiFab, Smith, or Green Drain. Trap guard to be designed to meet dimensional and installation requirements of specified floor drain.

K. Water Hammer Arrestors (WHA):

1. Water hammer arrestors shall be piston type.

2. Water hammer arresters shall be type approved for installation with no access panel required.

3. All water hammer arresters shall be NSF 61 compliant and contain less than 0.25% lead (Pb) by weight.

4. The following schedule for Sioux Chief Hyrda-Rester arrestors shall apply:

P.D.I SYMBOL	FIXTURE UNIT RATINGS
A	4-11
B	12-32
C	33-60
D	61-113
E	114-154
F	155-330

L. IMB – Ice Maker Box: White powder coated steel recessed metal box with quarter-turn ball valve and integral water hammer arrester. Box equal to Guy Gray Model MIB1HAAB where installed in non-fire rated construction. Provide with NSF 61 compliant (lead free) 10-foot-long stainless-steel icemaker connector equal. Make final connection to equipment.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed

with silicone based caulking. Grout other excessive gaps as required.

B. Supports and Fastenings: Secure all fixtures, equipment and trimmings to partitions, walls, etc., with brass through bolts, toggle bolts, expansion bolts, or power set fasteners, as required. Exposed heads of bolts and nuts in finished rooms to be hexagonal, polished chromium plated brass with rounded tops.

C. Support wall hung lavatories and urinals by appropriate carriers.

D. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

E. Attach floor mounted water closets to closet flange.

F. Items supplied by others as denoted are to be furnished complete with stops, risers, faucets, strainers, tailpiece, and traps. The intent is that this CONTRACTOR shall provide all "rough in" through face of wall and shall connect equipment provided by others, except where otherwise noted.

G. All exposed metal trim and piping shall be chrome plated brass and polished.

H. Trim which can be removed or disassembled without tools is not permitted.

I. Furnish and install plumbing fixtures and pertaining appurtenances of the manufacturer and model number as indicated in these specifications and/or noted on the plans.

J. Replace any fixtures or equipment broken, cracked, discolored, pitted, or otherwise imperfect.

K. Setting height or location of fixtures shall be as dimensioned or as directed by ARCHITECT.

L. Provide plumbing fixtures with accessible stops in supplies or with integral stops in faucets. Provide lavatory faucets, sink faucets, and supply stops with renewable seats.

M. Provide closets with white bolt caps with retainer clips. Use all mineral gasket with plastic discharge sleeve having ethane core reinforcement.

N. Install all wall, roof and ground hydrants in strict accordance with manufacturer’s recommendations and applicable details on Drawings. Hydrants shall be installed such that box/hydrant is square and plumb with adjacent building construction. Where wall hydrants are specified to match standard brick dimensions, adjust location in field to avoid cutting bricks and install with long dimension horizontal and hinge on bottom of box.

O. Install all fixtures in strict accordance with manufacturer's recommendations.

P. Water Hammer Arrestors:

1. All water supply piping fittings and fixtures shall be protected against water hammer, shock or surge pressure by installation water hammer arrestors.

2. Water hammer arresters shall be installed per the manufacturer’s recommendations. This shall include spacing, sizing, etc.

3. Fixture piping shall be adequately anchored to prevent vibration.

4. CONTRACTOR must guarantee against water hammer at end of project.

3.2 CLEANING:

At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

3.3 OPERATIONAL TESTS

Pour at least five (5) gallons of water into every floor drain to test for pipe stoppage. Remedy all stoppage.

END OF SECTION

SECTION 220450 - DOMESTIC WATER HEATERS AND ACCESSORIES

PART 1 – GENERAL

1.1 SCOPE

Provide all labor, equipment, material, etc., required to complete water heater installations specified herein and/or shown or scheduled on Contract Drawings.

1.2 APPLICABLE STANDARDS

A. A.S.M.E. Code Sections where referenced or applicable.

B. The water heater shall include all standard equipment as shown on manufacturer's specification sheet, shall fit properly into the space provided for it and shall conform to the Drawing requirements. The complete installation shall be in accordance with all applicable state and local codes and installation drawings/details.

PART 2 – PRODUCTS

2.1 DOMESTIC HOT WATER EQUIPMENT

A. Large Commercial Electric Glass Lined Water Heaters:

1. The heater shall include a glass lined storage tank rated at 150 psi working pressure with ASME construction. The tank shall be accessible from a boiler type hand hole cleanout with gasketed cover. Unit shall include factory installed anode rod for cathodic protection.

2. Temperature is to be maintained by surface mounted thermostats adjustable to 180-degree F. Provide a separate thermostat for each element with over temperature protection high limit controls.

3. The water heater control system shall include the following components: The elements shall be switched through magnetic contactors and protected by power fuses. For element protection, an electronic low water cutoff shall be installed with a combination high and low-pressure sensing device. A safety door interlock will prevent entrance to the electrical compartment when power is "ON".

4. Solderless power distribution blocks shall be provided to accept the power supply. A 120V transformer and a control circuit switch, fuse, and pilot light shall be factory wired. An ASME temperature and pressure relief valve shall be installed. The water heater shall have nickel or stainless-steel element protection, solid state proportional sequence, shunt trip circuit interrupter, temperature and pressure gauges, manual reset temperature limiting device, manual override switches, seven-day time clock with spring carry over, thermal expansion control valve.

5. The water heater shall be insulated with heavy density fiberglass insulation and trimmed with a baked enamel steel jacket. Unit shall provide minimum requirements of ASHRAE 90A 80.

6. Capacities and characteristics shall be as indicated on Plans.

2.2 ACCESSORIES

A. Relief Valve for Gas and Electric Water Heaters: Brass or bronze, fully automatic,

self-closing combination pressure and temperature ASME relief valve. Pressure relief valve shall be spring operated with testing lever, set for 100 pounds pressure. Temperature relief valves shall contain a non-corrosive metal thermostat with bulb. Pipe discharge to floor or as directed on Drawings or by PROFESSIONAL.

B. Circulating Pump:

In line pumps shall be circulators with all bronze or stainless-steel waterway design. Pumps shaft shall have mechanical seal and shall be connected to motor shaft. Pump motor shall be sized for continuous duty operation, with sleeve or ball bearings and lubrication fittings, or system lubricated type. Pump shall be B & G, Grundfos, Taco or equal.

C. Potable Water Expansion Tank (EXPT)

Provide potable water expansion tanks with factory finished metal outer jacket with FDA approved rubberized bladder with pre-charged tank and charging valve. Acceptance volume shall be within five percent (5%) of minimum specified (see detail(s) on schedule on Drawings). Support units as recommended by unit manufacturer and Industry Standards. Expansion tanks shall be rated for 125 psi. ASME construction shall be provided where water heater is ASME constructed. See Schedule/Drawings for more information.

PART 3 – EXECUTION

3.1 LEAKAGE TEST:

Before connections are made, test heaters and tanks with hydrostatic pressure of 150 psig and prove tight.

3.2 PERFORMANCE TEST:

A. Prove system is balanced and 105 degrees F. is available at farthest outlet from heaters.

B. Install heater as per manufacturer's instructions. Refer to Section *Basic Mechanical Materials and Methods* for instruction of ferrous to non-ferrous piping connections. Refer to Drawings for detail of water heater installation, if applicable.

C. Provide all pipe, fittings, and accessories as indicated or required for complete installation.

END OF SECTION

SECTION 230670 - PACKAGED AIR CONDITIONERS

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Work Included: Self-contained units, rooftop units, window units, through-wall units, computer room units, and split systems.

C. Definitions:

1. Energy Efficiency Ratio (EER): A ratio calculated by dividing the cooling capacity in Btuh by the power input in watts at any given set of rating conditions, expressed in Btuh per watt (Btuh/watt).

2. Unitary (ARI): Consists of one or more factory-made assemblies, which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function.

1.2 APPLICABLE STANDARDS

A. Refer to Section *Basic Mechanical Materials and Methods*.

B. Safety Standards:

1. Design, manufacture and installation of mechanical refrigeration equipment: ANSI B9.1.

2. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated unit casings.

C. Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc-coating conforming to ASTM A386 or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall be tested for 500 hours. The salt-spray fog test shall be in accordance with ASTM B117 using a 20 percent sodium chloride solution with no visible signs of corrosion.

D. ARI Standards:

1. Capacity 135,000 BTU/HR and Greater: ARI 360.

2. Capacity Below 135,000 BTU/HR: ARI 210. Units shall be listed in the ARI Directory of Certified Unitary Air Conditioners.

PART 2 – PRODUCTS

2.1 SPLIT DIRECT EXPANSION SYSTEMS

A. Ductless Mini-Split Systems:

1. Unit shall consist of reverse-cycle heating section and cooling coil in preassembled package. Unit shall consist of a supply fan, evaporator/heat

pump coil and air filter section assembled in common cabinet.

2. Compressor shall be inverter driven variable speed type. Provide with refrigerant isolation valves on unit.

3. Unit shall include automatic restart capability following power outage.

4. Capacity and characteristics shall be as indicated on Contract Drawings. Provide data on air pressure drop of evaporator.

2.2 REFRIGERANT SPECIALTIES

A. Refrigerant specialties shall be provided and include thermostatic type expansion valves, refrigerant strainers, liquid sight-flow fittings, moisture indicator, and other devices indicated by the drawings and diagrams. Thermostatic expansion valves shall have externally mounted thermostatic elements connected to valve through capillary tubing of suitable length with external equalizer and with super heat adjustment.

B. Solenoid valves shall be suitable for a minimum of 250 lbs. working pressure fitted solder type or threaded connections and with seal-cap type manual lifting stem. Valves shall be suitable for operation with available current and provided with suitable solenoid coil protector. Specialties shall be Alco or Sporlan.

C. Provide ahead of each expansion valve a sight glass. Provide ahead of each expansion valve and/or solenoid valve a filter-dryer and moisture indicator.

PART 3 – EXECUTION

3.1 INSTALLATION

Handle and install units and accessories in accordance with ARI 260 and the manufacturer's printed instructions. Unit shall be started up and checked out by a factory service representative. CONTRACTOR shall furnish PROFESSIONAL completed start-up report covering unit operation and start-up. A copy of same shall be included in Close-out Documents. See Section MECHANICAL CLOSE-OUT REQUIREMENTS.

3.2 TESTS

Perform tests and make reports in accordance with Sections *Basic Mechanical Materials and Methods* and *Testing, Adjusting, and Balancing*.

3.3 UNIT CAPACITY

Characteristics and capacity of systems shall be as indicated on Contract Drawings.

3.4 CONTROLS

All systems will be provided with automatic heating/cooling changeover controls; one or two stage heating and/or cooling as required. Provide auxiliary time clocks and thermostats and/or humidistats as indicated in Section *Controls and Instrumentation*.

3.5 AIR FILTRATION

See Section *Air Cleaning/Treatment* for specific requirements.

END OF SECTION

SECTION 230756 - PACKAGED HEAT RECOVERY EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Work Included: Self-contained units, rooftop units and split systems involving heat and/or energy recovery HVAC applications and equipment for space temperature and humidity control in accordance with ASHRAE 62.1.

C. Definitions:

1. Energy Efficiency Ratio (EER): A ratio calculated by dividing the cooling capacity in Btuh by the power input in watts at any given set of rating conditions, expressed in Btuh per watt (Btuh/watt).

2. Unitary (ARI): Consists of one or more factory made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function.

1.2 APPLICABLE STANDARDS

A. Refer to Section *Basic Mechanical Materials and Methods*.

B. Safety Standards:

1. Design, manufacture and installation of mechanical refrigeration equipment: ANSI B9.1.

2. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated unit casings.

C. Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc coating conforming to ASTM A386 or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt spray fog test, except that equipment located outdoors shall be tested for 500 hours. The salt spray fog test shall be in accordance with ASTM B117 using a 20 percent sodium chloride solution.

D. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion, and the specimen shall show no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. The film thickness of the factory coating or paint system applied on the equipment shall be not less than film thickness used on the test specimen.

E. Applicable ARI Standards:

1. Capacity 135,000 BTU/HR and Greater: ARI 360.

2. Capacity Below 135,000 BTU/HR: ARI 210. Units shall be listed in the ARI Directory of Certified Unitary Air Conditioners.

F. Electrical:

All motors shall be of premium/high efficiency type, with starters/controllers in conformance with Section *Electrical Requirements*.

G. Fans:

1. Fans shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.
2. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
3. Fans shall comply with the following standards:
    a. Testing and Rating: AMCA 210.
    b. Sound Rating: AMCA 300.
4. Performance Criteria:
    a. The schedule shows CFM and design external static pressure. Scheduled fan motors, ½ horsepower and larger, are to be sized for design CFM at 110 percent design static pressure, but not to exceed 3/4-inch additional pressure.
    b. Provide fans and motors capable of stable operation at design conditions and at 110 percent pressure as stated above.
    c. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation, a smaller motor may be approved in the interest of energy conservation.
    d. Select fan operating point as follows:
        i. Forward curved and axial fans: Right hand side of peak pressure point on applications less than 1-1/2" total static pressure.
        ii. Airfoil, backward inclined or tubular: Near the peak of static efficiency on applications exceeding 1-1/2" total static pressure.
        iii. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.

PART 2 – PRODUCTS

2.1 UNITARY AIR CONDITIONERS WITH INTEGRAL ENERGY RECOVERY CAPABILITY (HRU)

Rooftop or Self-Contained Combination Packaged Unit: Air conditioner shall be a factory packaged combination heating and cooling unit as indicated and shall be suitable for mounting on roof of building or concrete pad on ground. The package shall consist of one or more refrigerant compressors with electric motors, cooling coils, condensers, fans, filters, heating section, control wiring and piping, all factory assembled in a single weatherproof enclosure mounted on a structural steel base ready for field connection to utilities and ducts.

The package unit shall be sufficiently rigid and arranged to permit handling by a crane boom or by helicopter. Provide the unit with remote control panel, roof curbs and flashing, transition plenums and controls as listed here in. Unit shall be provided completely factory assembled, pre-piped, wired and shipped. In one piece, except that a modular unit configuration may be utilized and shipped for field assembly to yield a one-piece arrangement. But in all cases, the manufacturer shall have complete and comprehensive warranty, and functional/capacity responsibility to the OWNER, including controls. The manufacturer shall provide all necessary technical assistance to the CONTRACTOR and OWNER, towards the proper handling, installation, start-up, servicing, maintenance and operation of the entire system. In essence, this system requires one source responsibility and an extended full-service manufacturer's warranty, excluding filter maintenance.

A. Unit Enclosure:

1. The cabinet shall be constructed of G90 weight galvanized metal, with minimum 18-gauge exterior panels, and minimum 22-gauge interior panels for a double wall design. Construct with removable access panels completely weatherized for outside installation, and properly reinforced and braced. Provide panels and access door for inspection and access to all internal parts. Provide enclosure with adequate reinforced points of supports for setting of the unit. Joints shall be air and watertight. Base shall consist of a one-piece welded assembly with 14-gauge members.

2. Furnish and install a steel roof-mounting frame for bottom discharge and return (or horizontal supply and return) air connection, as indicated on Plans. It shall mate to the bottom perimeter of the equipment. When flashed into the roof it shall make a unit mounting curb and provide weatherproof duct connection and entry into the conditioned area. Frame shall be approved by National Roofing Contractors Association. Roof curb shall be minimum 14" high and shall be constructed of minimum 14-gauge galvanized steel. Curb shall provide weather tight installation. Inside of curb and top of roof shall be lined with sound attenuating material furnished by manufacturer. Provide curb of type to match roof design and to match slope of roof such that top of curb is level. See Section *Ductwork Accessories* for Roof Curb information.

3. Vertically mounted condenser coils shall be protected with manufacturer approved louvered panels or neat expanded metal hail coil guards installed a minimum of two (2") inches off face of coil. See detail on Contract Drawings.

4. The unit shall be as a double wall design, with interior sandwiched rigid insulation between inner/outer panels. All access panels and doors shall be of same double wall configuration.

5. Access to compressor(s), controls, filters, blower, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with a quarter turn latch (door fastening screws are not acceptable).

6. Airside service access doors shall be fully gasketed with rain break overhangs.

7. Unit exterior shall be painted with a colored polyurethane paint over a wash

primer and a G90 galvanized steel. Exterior custom colored factory finish shall be as approved by ARCHITECT.

8. Wiring shall be color coded and marked on each end.

9. To guarantee no leakage of conditioned air from the cabinet all of the cabinet under positive pressure downstream from the supply air blower, shall have a separate internal cabinet contained within, and separate from, the exterior cabinet by an air gap. The internal cabinet shall be guaranteed to hold a static pressure of up to 6 inches water column.

10. All openings through the base pan of the unit shall have upturned flanges of at least 1/2" in height around the opening through the base pan.

11. Unit shall have decals and tags to indicate unit lifting - rigging, service areas and caution areas.

12. Wiring diagrams shall be in color and marked to match the color and markings of the wires and shall be both “point-to point” and “ladder” diagrams.

13. Diagrams shall also be laminated in plastic and permanently fixed to the control compartment door.

14. Exterior custom colored factory baked enamel finish shall be as approved by ARCHITECT.

15. Provide a fully gasketed airtight seal between unit and curb.

16. The unit roof design shall be cross-broken and/or sloped to assure drainage.

17. Condenser Hail Coil Guards: On units with condenser coils that are installed within 15º of vertical, provide heavy-duty louvered or approved expanded metal, factory primed and painted to match unit enclosure and mounted in a rigid frame with a minimum of 2” clearance to coils.

B. Insulation:

Minimum one inch (1") thick and 1-1/2 pound density on all exterior unit sandwich casings and on baffles separating differing air streams. Insulation shall meet the requirements of NFPA Standard 90A and be protected against deterioration and delamination from air currents. Insulate stainless steel condensate drain pan with water impervious insulation of sufficient thickness to prevent condensate formation on the exterior at ambient conditions encountered.

C. Evaporator Fan:

Forward curved type (or backward inclined) DWDI Class I centrifugal type specifically designed and suitable for the operating pressure conforming to AMCA 210. Provide adjustable pitch pulley with a minimum rating of 140% of the motor nameplate brake horsepower when the adjustable pulley is at the minimum RPM. Direct drive plenum fans with VFD may be substituted for belt drive assembly. Units shall have permanently lubricated ball bearings. Statically and dynamically balance fan assemblies in the fan housing and final assembly. Fan motors above 1 HP to be isolated with spring isolators. Fan motors and starters shall conform to Section *Electrical Requirements*. Motor starters shall conform to NEMA ICS. Motors shall

have thermal overload and other protection per Section *Electrical Requirements*. Where motors exceed 5 HP, provide soft/start magnetic motor starters. Three phase motors shall have protection from phase loss, phase reversal and high/low voltage. See Section *Electrical Requirements*.

D. Compressors:

1. Provide hermetic scroll type conforming to ARI 520, provided with all minimum standard equipment and accessories listed therein.
2. All units over 7 tons shall have minimum two independent refrigerant circuits.
3. Compressor(s) shall be mounted in an isolated compartment to permit operation of the unit without affecting supply or return/exhaust air flow when the compressor compartment is open.
4. Compressors shall have internal thermal overload protection.
5. Three phase compressors shall have protection from phase loss, phase reversal and high/low voltage with automatic restart capability. See Section *Electrical Requirements*.
6. Compressors shall be mounted on manufacturer's recommended rubber vibration isolators.
7. Compressor(s) shall be isolated from the base pan and supply air to avoid any transmission of noise or vibration from the compressor into the building area or structure.
8. System shall be equipped with thermostatic expansion valve(s) type refrigerant flow control.
9. System shall be equipped with automatic re-set low pressure and manual reset high-pressure refrigerant controls.
10. Unit shall be equipped with Schrader type service fittings on both the high side and low-pressure sides of the system.
11. Unit shall be equipped with refrigerant liquid line driers on all circuits.
12. Unit shall be fully factory charged with refrigerant R-22.
13. All circuits shall be provided with hot gas by-pass (factory installed).
14. All circuits shall be equipped with liquid line sight glasses.
15. Unit shall be equipped with low limit temperature, a five (5) minute anti-short cycle delay timer for each compressor and automatic restart controls.
16. Unit shall be equipped with 20-second-between-stage delay adjustable timer for each compressor/circuit.
17. Three phase compressors and motor loads shall be protected from over and under voltage and phase loss with automatic restart capability.
18. Unit shall be equipped with a refrigerant condenser reheat coil in the discharge air stream, a proportional modulating hot gas reheat valve, and a complete microprocessor based control system including an adjustable set point temperature controller for duct mounting and sensing.

19. Individual compressor isolation valves shall be provided where compressors are installed in tandem arrangement on the same refrigerant circuit.

E. Coils:

1. Refrigerant and water heating, condenser and cooling coils shall be copper type with aluminum fins and conform to ARI 410 and be tested for 425 p.s.i.g. Evaporator coils shall be minimum 6-row high latent capacity design; multi circuit evaporators shall be split face configuration.

2. Condensing Coils for Multi Compressors: Provide a separate air cooled condenser circuit for each compressor in multi compressor installations. If compressors are paralleled, provide not less than two independent circuits. A common housing may be used, but each coil must be provided with separate controls to operate individual fans for each coil. All coils shall be sized for a minimum of 10 degrees sub-cooling. The air cooled condenser coil shall be extended surface fin and tube with seamless copper tubes with aluminum fins. The coils shall be tested for 425 psi. In the event one compressor fails, the other compressor(s) shall continue to operate on the other independent circuit.

3. Provide insulated stainless steel drain pan under all cooling coils with positive slope to single outlet per ASHRAE 62-2001.

4. A manufacturer's non-prorated parts and labor warranty on the refrigeration system is required when microchannel condenser coils are utilized.

F. Filter Section:

Provide filter boxes with hinged access doors for supply and return/exhaust sections. Provide adjustable setpoint differential pressure sensors and annunciate to control panel specified hereafter. Filters shall be of the high velocity two inch (2") thick, replaceable type to serve the airflow capacity indicated on Contract Drawings. See Section *Air Cleaning/Treatment*.

G. Mixing Boxes:

Physical size shall match the basic unit and include equal sized flanged openings, each sized to handle full airflow. Provide outside air, exhaust air and bypass modulating airfoil parallel blade motorized dampers with spring returns on each. Provide weather hood to protect ventilation intake and exhaust discharge, both with heavy duty expanded aluminum bird screen cover.

H. Heating Section:

1. Primary heating capacity for supplemental and dehumidification application shall be in re-heat position.

2. Primary heating shall be electric resistance heating in reheat position, downstream of primary heat source in direction of air flow and shall be controlled by unit integral temperature and humidity controls. This is supplemental to what is provided by enthalpy heat wheel and refrigerant reheat.

I. Outside and Exhaust Air Capacity/Capability:

(HRU) Heat Recovery Unit shall be up to 100% with a motor operated modulating outside air and exhaust air damper constructed of extruded aluminum hollow core, air foil blade with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 25 CFM of leakage per square foot of damper area when subjected to 2" WG air pressure differential across the damper. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure. Provide damper position verification controls.

J. Heat Recovery Control/Capability:

1. The rooftop unit shall have a factory mounted and tested enthalpy heat wheel. The heat wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. These components will form a cassette, which shall be removable from the unit without the use of tools.

2. The energy recovery cassette shall contain a total energy recovery heat wheel constructed of a lightweight polymer material with permanently bonded desiccant coating. The energy recovery wheel media shall be capable of removal from the cassette and replacement without the use of tools. Wheel media shall be cleanable using hot water or light detergent without degrading the latent efficiency. See schedule on Drawings for other capacity and capability requirements.

K. Power Safety and Auxiliary Electric Controls and Accessories:

1. Unit shall be provided with a factory installed and wired internal disconnect switch with fusing. Unit shall be provided with phase reversal and brown-out protection to shut down all motors in the unit if the phases are more than 10% out of balance on voltage, reversed or the voltage is more than 10% under design voltage. These electrical controls shall include automatic restart capability. Unit shall be provided with a factory installed and wired 115 volt, 15 amp ground fault service receptacle.

2. A NEMA 3R fused disconnect switch shall be factory installed and unit mounted for single point connection.

L. Controls:

1. Dehumidification and Thermostatic Control:

a. Duct and Remote Sensor Type:

Temperature and humidity sensors shall be factory provided and field remotely mounted where shown and factory recommended to accomplish specified control sequence and performance. Mount all other controls including motor starters and safety controls inside the enclosure. All wiring inside enclosure shall be accomplished at the factory. Control panel shall include magnetic contactors for compressor, evaporator and condenser fan motors, three leg compressor overloads high and low pressure cutouts, oil pressure cutouts, non-recycling pump down and reset relay.

b. Factory automatic heating/cooling temperature changeover and humidity controls shall be capable of maintaining within +/- 3 degrees F. and 3% R.H., of ENGINEER specified set point. Relative humidity sensor shall be self-calibrating and have a range of 5-100%, non-condensing and be accurate within +/-3% RH of set point. Set point shall vary seasonally with automatic controls as hereafter specified.

c. It is intended that systems provide active upper limit humidity sensing and control during all periods. Thermostatic control shall include discharge air temperature sensing and control during facility occupied periods and space temperature sensing and control during facility unoccupied periods.

2. Condenser Controls:

Provide head pressure control with variable speed condenser fans to insure condensing temperature for proper system operation at all ambient temperatures down to 0 degrees F. Condenser fans to be heavy duty permanently lubricated ball bearing type with built in thermal overload protection.

3. Condenser Start Up Control:

Provide condenser with a startup control package which permits startup of compressor at ambient temperature of 0 degrees F. Package shall temporarily by pass system low pressure start to permit start up whenever minimum ambient temperature is below design evaporator coil suction temperature.

4. Remote Control/Monitoring Panel:

a. General:

Each unit shall have a control/monitoring panel unit mounted.

b. Alarm functions:

i. The control/monitoring panel shall be capable of annunciating alarm conditions through the use of either a minimum 1" red pilot light or audible device. If an audible alarm is utilized, the alarm shall be capable of being silenced upon the OWNER'S acknowledgement of the alarm. If a pilot light is utilized, the pilot light shall be located in building.

ii. The following minimum alarms shall be set up for each individual unit:

(1) Fan Failure – this shall be accomplished through the use of either an air pressure switch or current switch.

(2) Filter Maintenance – this shall be accomplished through the use of a clogged filter switch. Provide an alarm for each and every air filter bank.

(3) Compressor Maintenance – this shall be accomplished through the use of a duct mounted

relative humidity sensor in the outside air duct discharge from the unit. This alarm feature shall only be available when the cooling is energized and shall be initially set at 70% R.H. (adjustable).

(4) Heating Mode Low Limit Temperature – this shall be accomplished through custom programming of the duct mounted discharge air temperature sensor, and initially set to 40 degrees F.

(5) Heating Mode High Limit Temperature – this shall be accomplished through custom programming of the duct mounted discharge air temperature sensor, and initially set to 85 degrees F.

(6) High Limit Zone Relative Humidity – this shall provide both audible and visible annunciation and shall be initially set to annunciate upon a rise in relative humidity above 70% RH.

5. Hot Gas Bypass Controls:

The unit shall be equipped with hot gas by-pass controls on all refrigerant circuits to protect against evaporator frosting at low air volume, low ambient, and suction pressure.

6. Refrigerant Circuits:

Dehydrate entire refrigerant circuit, purge, and charge with refrigerant and oil at factory. Factory oil charge shall be the full amount required for operation. Factory charge for refrigerant shall be the full amount required for operation, if within limits permitted by Interstate Commerce Commission, otherwise furnish a holding charge of the type refrigerant to be used.

7. General Control Requirements:

In general factory controls shall be comprehensive, except for time of day and/or normally unoccupied period automatic override controls and sequencing. All temperature and humidity controls for unit sequencing shall be factory provided and unit mounted, except for minor duct and/or space specified sensors, and remote control panels etc. CONTRACTOR shall provide all other controls, interlocking control wiring, labor and installations not factory provided or mounted. Damper status/position verification switches shall be included for fan safety “startups”.

1. CONTROL SEQUENCE FOR HRU’S

UNIT MANUFACTURER SHALL FURNISH AND INSTALL NEW ELECTRIC/ELECTRONIC CONTROLS, COMPLETE WITH SENSORS, TRANSMITTERS, CONTROLLERS, SWITCHES, AND ALL ASSOCIATED INTERLOCKS, WIRING IN METALLIC CONDUIT, ETC., FOR COMPLETE AND FUNCTIONAL SYSTEMS. DUCT MOUNTED SMOKE DETECTORS PROVIDED AND INSTALLED BY CONTRACTOR WITH INTERLOCKS FOR FIRE ALARM SAFETY UNIT SHUT DOWN. CONTROLS ARE TO BE STAND ALONE FOR EACH AIR SYSTEM. SEE SPECIFICATION

SECTION *CONTROLS AND INSTRUMENTATION* FOR OTHER REMOTE ANNUNCIATION, MONITORING AND CONTROL CAPABILITIES.

REMOTE AND DUCT MOUNTED CONTROLS, SENSORS, ETC., SHALL BE FACTORY PROVIDED AND CONTRACTOR INSTALLED. ALL FIELD CONTROL/INTERLOCK WIRING OF FACTORY AND/OR FIELD SUPPLIED PANELS, SENSORS, ETC., BY CONTRACTOR, INCLUDING MOUNTING OF CONTROL PANELS, SENSORS, ETC., FURNISHED WITH UNIT.

CONTROL SEQUENCE:

HEAT RECOVERY UNIT BLOWER MOTOR(S)/FAN(S), REFRIGERATION, HEATING, TEMPERATURE AND HUMIDITY CONTROLS SHALL BE ENERGIZED BY UNIT CONTROLLER WHEN FAN STARTER "HAND-OFF-AUTO" SWITCHES ARE IN "AUTO" POSITION. CONTROLS OF HEAT RECOVERY UNIT AND FANS SHALL BE DE-ENERGIZED FOR THE FOLLOWING:

a. BY EITHER OR BOTH SMOKE DETECTORS DUCT MOUNTED NEAR UNIT.

b. FIRE ALARM ANNUNCIATION SERVING SAME ZONE(S) SERVED BY SAME HEAT RECOVERY UNIT. CONTRACTOR SHALL PROVIDE WIRING BETWEEN FIRE ALARM PANEL AND HEAT RECOVERY UNIT TO ACCOMPLISH THIS REQUIREMENT.

OCCUPIED MODE:

DURING OCCUPIED MODE AS SENSED BY UNIT CONTROLLER, HEAT RECOVERY UNIT CONTROLS SHALL BE ENERGIZED AND SEQUENCE OUTSIDE AND BYPASS/EXHAUST AIR MOTORIZED DAMPERS MD1 AND MD2 OPEN. OUTSIDE AND BYPASS/EXHAUST AIR DAMPERS SHALL BE OPENED AS NEEDED TO PROVIDE THE SCHEDULED AMOUNT OF SUPPLY, RETURN AND EXHAUST AS SCHEDULED ON CONTRACT DRAWINGS (COORDINATE SETPOINTS WITH TAB AGENCY). AFTER MOTORIZED DAMPERS ARE VERIFIED TO BE OPEN, SUPPLY AND EXHAUST BLOWERS SHALL BE ENERGIZED AND RUN CONTINUOUSLY.

THE ROTARY HEAT WHEEL SHALL ROTATE CONTINUOUSLY DURING OCCUPIED MODE UNLESS ONE ON THE FOLLOWING CONDITIONS OCCURS:

1. THE SPACE THERMOSTAT CALLS FOR COOLING AND THE OUTSIDE AMBIENT TEMPERATURE IS BELOW THE SPACE THERMOSTAT COOLING SETPOINT.
2. THE SPACE THERMOSTAT CALLS FOR HEATING AND THE OUTSIDE AMBIENT TEMPERATURE IS ABOVE THE SPACE THERMOSTAT COOLING SETPOINT.

THE SPACE AUTOMATIC CHANGEOVER THERMOSTAT SHALL CYCLE COOLING, PRIMARY MODULATING HOT GAS REHEAT VALVE AND SECONDARY ELECTRIC HEATER SECTION AS REQUIRED TO

MAINTAIN OCCUPIED SPACE TEMPERATURE SETPOINTS (INITIALLY SET AT 75° F COOLING, 72° F HEATING).

ON A CALL FOR COOLING FROM THE SPACE THERMOSTAT, MECHANICAL DX COOLING SHALL BE ENERGIZED BASED UPON A RISE IN SPACE TEMPERATURE ABOVE THE COOLING SETPOINT AS SENSED BY THE SPACE THERMOSTAT. PROVIDE TIME DELAY CONTROLS AND COOLING ANTICIPATION TO PREVENT COMPRESSORS FROM SHORT-CYCLING OR STAGING ON TOO QUICKLY RESULTING IN RAPID TEMPERATURE SWINGS.

ON A CALL FOR HEATING FROM THE SPACE THERMOSTAT, THE SECONDARY ELECTRIC HEATER SECTION SHALL BE ENERGIZED BASED UPON A FALL IN SPACE TEMPERATURE BELOW THE HEATING SETPOINT AS SENSED BY THE SPACE THERMOSTAT. PROVIDE TIME DELAY CONTROLS AND HEATING ANTICIPATION TO PREVENT STAGES OF HEATING FROM SHORT-CYCLING OR STAGING ON TOO QUICKLY RESULTING IN RAPID TEMPERATURE SWINGS.

HIGH LIMIT HUMIDITY OVERRIDE OPERATION:

IF THE SPACE HIGH LIMIT HUMIDITY SENSOR IS ACTIVATED, THE HEAT RECOVERY UNIT CONTROLS SHALL DE-ENERGIZE THE SECONDARY ELECTRIC HEATER SECTION IF IT IS CURRENTLY RUNNING. AFTER DE-ENERGIZING SECONDARY ELECTRIC HEATER SECTION, HEAT RECOVERY UNIT CONTROLS SHALL ENERGIZE THE MECHANICAL DX COOLING. IN ADDITION, THE PRIMARY HEATING MODULATING HOT GAS REHEAT VALVE SHALL BE MODULATED AS NEEDED TO SATISFY THE SPACE THERMOSTAT SETPOINT. MECHANICAL DX COOLING SHALL REMAIN ENERGIZED UNTIL SPACE HIGH LIMIT HUMIDISTAT IS SATISFIED. FURTHERMORE, IF SPACE HIGH LIMIT HUMIDISTAT IS NOT SATISFIED WITHIN 60 MINUTES (ADJUSTABLE), NEXT STAGE OF MECHANICAL DX COOLING SHALL BE ENERGIZED.

UNOCCUPIED MODE:

DURING UNOCCUPIED MODE AS SENSED BY UNIT CONTROLLER, BYPASS/EXHAUST AIR DAMPER SHALL BE OPENED. COOLING, PRIMARY MODULATING HOT GAS REHEAT VALVE AND SECONDARY ELECTRIC HEATER SECTION SHALL BE CONTROLLED TO MAINTAIN MINIMUM ZONE CONDITIONS BASED UPON A CALL FOR COOLING, DEHUMIDIFICATION OR HEATING AS DESCRIBED HEREAFTER.

a. IF ZONE RELATIVE HUMIDITY RISES ABOVE 60% R.H. (ADJUSTABLE) AS SENSED BY ZONE HIGH LIMIT HUMIDISTAT, HEAT RECOVERY UNIT CONTROLS SHALL ENERGIZE COOLING AND MODULATING HOT GAS REHEAT VALVE AS NECESSARY TO MAINTAIN NORMALLY OCCUPIED THERMOSTAT SETPOINTS. MECHANICAL DX COOLING SHALL REMAIN ENERGIZED UNTIL SPACE HIGH LIMIT HUMIDISTAT IS SATISFIED. FURTHERMORE, IF SPACE HIGH LIMIT HUMIDISTAT IS NOT SATISFIED WITHIN 60 MINUTES

(ADJUSTABLE), NEXT STAGE OF MECHANICAL DX COOLING SHALL BE ENERGIZED.

b. IF ZONE TEMPERATURE FALLS BELOW 50º F. (ADJUSTABLE) AS SENSED BY ZONE TEMPERATURE SENSOR, HEAT RECOVERY UNIT CONTROLS SHALL ELECTRIC HEATER SECTION AS NEEDED TO MAINTAIN MINIMUM ZONE CONDITIONS. ELECTRIC HEATER SHALL BE DE-ENERGIZED WHEN ZONE LOW LIMIT TEMPERATURE SENSOR IS SATISFIED.

c. IF ZONE TEMPERATURE RISES ABOVE 85º F. (ADJUSTABLE), AS SENSED BY ZONE TEMPERATURE SENSOR, HEAT RECOVERY UNIT CONTROLS SHALL ENERGIZE MECHANICAL DX COOLING. MECHANICAL DX COOLING SHALL REMAIN ENERGIZED UNTIL ZONE TEMPERATURE SENSOR IS SATISFIED. FURTHERMORE, IF ZONE TEMPERATURE IS NOT SATISFIED WITHIN 60 MINUTES (ADJUSTABLE), NEXT STAGE OF MECHANICAL DX COOLING SHALL BE ENERGIZED.

M. Warranty – See Section *Mechanical Systems and Equipment Warranties*.

PART 3 – EXECUTION

3.1 INSTALLATION

Handle and install units and accessories in accordance with the manufacturer's printed instructions. Unit shall be started up and checked out by a factory service representative. CONTRACTOR shall furnish PROFESSIONAL completed start-up report covering unit operation and start-up. A copy of same shall be included in Close-out Documents. See Section MECHANICAL CLOSE-OUT REQUIREMENTS.

3.2 TESTS

Perform tests and make reports in accordance with Section *Basic Mechanical Materials and Methods* and *Testing, Adjusting and Balancing*.

3.3 TESTING, ADJUSTING, AND BALANCING COORDINATION

CONTRACTOR shall coordinate with unit manufacturer to have a factory representative present on the day(s) the TAB Agency performs scope of work described in Section Testing, Adjusting and Balancing in order to assist TAB Agency in testing all functions of units including controls, sequence of operation, safeties, alarms, etc.

3.4 UNIT CAPACITY

Characteristics and capacity of systems shall be as indicated on Contract Drawings.

3.5 CONTROLS:

All systems will be provided with factory comprehensive DDC/electronic controls. Provide auxiliary time clocks or setup/setback thermostats and dehumidistats, etc., as required to provide specified control sequence.

END OF SECTION

SECTION 230830 - HEATING/COOLING TERMINAL UNITS

PART 1 – GENERAL

1.1 SCOPE

Unit heaters, electric ceiling and duct heaters or Gas-fire radiant tube heaters

PART 2 – PRODUCTS

2.1 ELECTRIC CEILING HEATERS

Use Lay-in or recessed semi-concealed unit, with forced air vertical discharge with fan and matching low voltage wall single-stage heating thermostat, as Markel Series 3480.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Handle and install units in accordance with manufacturer's written instructions.

B. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and mal-operation of units cannot occur.

C. Provide adequate vibration isolation as indicated or necessary.

D. Provide complete and operational controls, including low voltage thermostats, relays, transformer, etc. with all wiring in approved conduit. See *Division 26* specifications.

END OF SECTION

SECTION 230860 - FANS

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Work included: Fans for heating, ventilating and air conditioning.

C. Product Definitions: AMCA Publication 99, Standard 1-66.

1.2 APPLICABLE STANDARDS

A. Fans and power ventilators shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.

B. Operating Limits for Centrifugal Fans: AMCA 99 (Class 1, 11, and 111).

C. Fans and power ventilators shall comply with the following standards:

1. Testing and Rating: AMCA 210.

2. Sound Rating: AMCA 300.

D. Performance Criteria:

1. The fan schedule shows CFM and design static pressure. Scheduled fan motors, ½ horsepower and larger, are to be sized for design CFM at 110 percent design static pressure, but not to exceed ¾-inch additional pressure.

2. Provide fans and motors capable of stable operation at design conditions and at 110 percent pressure as stated above.

3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation, a smaller motor may be approved in the interest of energy conservation.

4. Select fan operating point as follows:

a. Forward curved and axial fans: Right hand side of peak pressure point.

b. Airfoil, backward inclined or tubular: Near the peak of static efficiency.

E. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.

PART 2 – PRODUCTS

2.1 CENTRIFUGAL FANS

A. General:

1. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.

2. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.

a. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide screens for fan inlets without duct connections.

b. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.

c. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.

d. Bearings: Heavy-duty ball or roller type sized to produce a B10 life of not less than 40,000 hours, and an average fatigue life of 200,000 hours. Extend lubrication tubes for interior bearings or ducted units to outside of housing.

e. Painting: AMCA Standard preparation for coating 2601-66-1E33, followed by manufacturer's standard rust resistant baked enamel colored coating inside and out.

3. See Section *Electrical Requirements* for motor and starter requirements.

4. See Detail on Drawings for roof curb construction requirements.

B. Exhaust Air Fans

1. Direct Drive Above Ceiling Type:

a. Fan shall be mounted above ceiling and vent routed as indicated. Fan shall have forward curved wheel constructed of aluminum. Fan motor shall be of the shaded pole type. Housing shall be of the steel construction with baked enamel finish. Grille mounted in ceiling shall be of extruded aluminum.

b. Capacity and characteristics shall be as indicated on Contract Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fan, motor and drive in accordance with manufacturer's instructions.

B. Align fan and motor sheaves to allow belts to run true and straight.

C. Bolt equipment to curbs with galvanized lag bolts, number and location per manufacturer’s instructions.

3.2 PRE OPERATION MAINTENANCE

A. Grease bearings and install maintenance notation chart per Section *Basic Mechanical Materials and Methods*.

B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

3.3 START UP AND INSTRUCTIONS

Check vibration and correct as necessary for air balance work.

3.4 ACCESSORIES

Provide all accessories including roof curbs, solid state speed controllers, wall mounting collars, insect and/or bird screen, OSHA approved motor and inlet/outlet protecting guards, back draft damper (motorized or manual as indicated), thermostats, vibration isolators and starters with pilots, etc., as indicated or required.

END OF SECTION

SECTION 230885 - AIR CLEANING/TREATMENT

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Descriptions:

1. Air filters for Heating, Ventilating and Air Conditioning.

2. Needlepoint Bipolar Ionization Devices for HVAC Systems.

3. Definitions: Refer to newest edition of ASHRAE 52.2 for definitions of face velocity, net effective filtering area, media velocity, resistance (pressure drop), minimum efficiency reporting value (MERV), etc.

1.2 APPLICABLE STANDARDS

A. Air Filter Performance Report for Extended Surface Filters:

1. Submit a test report for each type of filter being offered. The report shall be less than two years old and have been prepared by an independent testing laboratory using test equipment, method and duct section as specified by ASHRAE Standard 52.2-1999 for type filter under test and acceptable to ENGINEER, indicating that filters comply with the requirements of this specification. Test for 500 fpm will be accepted for lower velocity filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.

a. Selection procedures for manufacturer's standard products: All filters tested shall have been procured by the independent testing laboratory from the open market independent of manufacturer of these filters and a statement to this effect must accompany test report.

b. Selection procedures for new products not available on open market: Testing laboratory will certify that filters are not available in areas remote from manufacturer’s facilities. For each required test the independent Testing Laboratory shall select from the manufacturer's stock or production the number of samples required. The samples selected shall be representative of standard production considering media utilized and manufacturing locations. These test reports shall be less than six months old.

2. Filter Supplier Warranty for Extended Surface Filters: Guarantee the filters against leaks, blow-outs, and other deficiencies during their normal useful life. Defective filters shall be replaced at no cost to the Owner.

3. Identification: Each filter shall bear markings indicating manufacturer's name, filter size, and MERV & MERV-A ratings per ASHRAE Standard 52.2.

4. Definitions and Abbreviations

a. Spares: Filter(s) in sets to be turned over to the OWNER at the end

of the project for the OWNER'S use after the project or any portion thereof, is complete.

b. Construction Period: This term generally includes the time period beginning with the OWNER'S notice-to-proceed and ending with the OWNER'S final acceptance of a project, or any phase of a project.

c. Temporary: A term generally depicting the use of air filters for use during the construction period.

d. Filter Grille: An inlet device connected to an HVAC system where an air filter is to be installed and maintained during construction and permanently after project is completed.

e. Pleated Filters: An extended surface filter with folds of air filtration media.

f. Filter or Filter Set: Air filter(s) in sizes as recommended by equipment or supplier manufacturer to prevent air bypass and to provide the maximum face size and minimum velocity to promote longer filter life expectancy.

g. F/G: fiberglass

1.3 RESPONSIBILITY

A. The CONTRACTOR is responsible for providing, monitoring and maintaining all air filtration specified provisions during the construction period.

B. The CONTRACTOR is also responsible for providing spare sets of air filter(s) to the OWNER, labeled and in boxes for storage, for the OWNER'S use after the project is complete and at which time the OWNER assumes control of operation and maintenance functions for the systems. One of the filter spare sets shall be installed on the day of the final inspection by the PROFESSIONAL.

1.4 AIR FILTRATION PROTECTION REQUIRED

The following systems and installations shall be provided with proper air filtration prior to startup or use of the facilities new HVAC systems and existing or renovated HVAC systems in the area(s) affected by this project.

A. All new air handling systems, including up-flow/horizontal furnaces, roof top packaged systems, outdoor air and heat recovery systems, blower coil, central station and built-up air handling system with water, or refrigerant coils.

B. Filter grilles or registers.

C. Ducted return air systems: Provide temporary air filtration over all return air grilles, registers and filter grilles (in addition to filters in frame of filter grille).

1.5 TYPE OF AIR FILTRATION REQUIRED

The following is a listing of generic equipment and installation air filtration requirements. The CONTRACTOR may submit alternate filter thickness(es) to match specific applications but shall not be less than that listed, for PROFESSIONAL'S approval. The CONTRACTOR shall verify size, including thickness matched to CONTRACTOR supplied equipment and air distribution device accessory.

AIR FILTRATION REQUIREMENTS					
GENERAL INFORMATION			CONSTRUCTION PERIOD FILTRATION	SPARES (PROJECT COMPLETION FILTRATION)	
FILTER FUNCTION/ LOCATION	FILTER TYPE	NOMINAL FILTER DEPTH/ THICKNESS	MINIMUM MERV & MERV-A RATINGS	MINIMUM MERV & MERV-A RATINGS	NUMBER OF SETS REQUIRED
RETURN AIR GRILLES/ REGISTERS	PLEATED	1”	11	N/A	N/A
HEAT RECOVERY UNITS (HRU’S)	PLEATED	2”	8	8	3
DUCTLESS MINI-SPLIT, (DSS)	WASHABLE	-	4	4	1

1.6 NEEDLEPOINT BIPOLAR IONIZATION DEVICES

A. The Air Purification System shall be a product of an established manufacturer within the USA.

B. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

C. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. “Plasma” particulate filters shall not be acceptable.

D. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations.

E. The Air Purification System shall have been tested by UL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. All manufacturers shall submit their independent UL 867 test data with ozone results for the products supplied.

F. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 5 PPB. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner’s output shall be no more than 5 PPB. Manufacturers with ozone output exceeding these ozone values and therefore not being compliant to UL 2998, shall not be acceptable.

G. UL 2998 “Ozone Free” certification is required. No exceptions.

PART 2 – PRODUCTS

2.1 EXTENDED SURFACE AIR FILTERS

A. Filter shall be pleated, disposable type. Filter shall consist of non-woven cotton and synthetic fabric media, media support grid and enclosing frame.

B. The filter shall be listed by Underwriters Laboratories as Class 2.

C. The media support shall be a welded wire grid with an effective open area of not less than 96%. The welded wire grid shall be bonded to the filter media to eliminate the possibility of media oscillation and media pull away.

D. The enclosing frame shall be constructed of a rigid, heavy-duty beverage board with diagonal support members bonded to each side of the filter to insure pleat stability. The inside periphery of the enclosing frame shall be bonded to the filter pack to eliminate possibility of air bypass.

E. Filter Characteristics

MINIMUM EFFICIENCY REPORTING VALUE (MERV & MERV-A)	FILTER DEPTH/ THICKNESS	PRESSURE DROP (IN. W.G. @ 350 F.P.M.)		PRESSURE DROP (IN. W.G. @ 500 F.P.M.)	
		INITIAL	FINAL	INITIAL	FINAL
8	1”	0.23	0.5	-	-
8	2”	-	-	0.29	0.75
11	1”	0.30	0.50	-	-
11	2”	-	-	0.35	0.75

2.2 NEEDLEPOINT BIPOLAR IONIZATION DEVICES

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Needlepoint Bipolar Ionization unit with output as described here within. See Schedule on Drawings for more information.

B. Electrodes shall be carbon fiber. Metal needles are not acceptable due to corrosion, oxidation and dulling. Carbon fiber clusters shall contain a minimum of 45,000 needles.

C. Ionization enclosures shall be manufactured from non-metallic materials for corrosion prevention and thermal bridging.

D. Ion systems shall have needlepoint electrodes that are field replaceable in the event they are damaged during installation or shipment. Under normal operation, the electrodes shall not deteriorate or require replacement from normal use or the mechanical friction during the cleaning cycle.

E. Units shall operate from 24VAC to 240VAC without the use of an external power supply or transformer. The primary voltage may vary in the range of 24-240VAC and the high voltage output shall be regulated to less than 1% variance.

F. Ionization units shall be provided with rare earth magnets for ease of mounting.

G. Ionization output shall be a minimum of 300M ions/cc from each device. The

system ionization output shall be a minimum of 80,000 ions/cc per CFM. Manufacturers showing ion output in ions/cc/sec shall convert to ions/cc as measured one inch from the electrodes without airflow and provide that data in their submittal. Ion meters measure in ions/cc not ions/cc/sec and this value is required for field verification during startup.

PART 3 – EXECUTION

3.1 AIR FILTERS

A. Installation:

1. Install supports, filters and gages in accordance with manufacturer's instructions.

2. At end of project, provide list of all HVAC air handling equipment and filter grilles, with size and quantity of air filters and MERV rating for each, and submit for Owner's future use and maintenance record. Furthermore, submit a letter signed by the OWNER acknowledging receipt of all spare sets of air filters outlined above. All boxes of air filters shall be labeled to match the individual HVAC system or return air filter grille location for which the filters are to be utilized.

B. Start-Up and Temporary Use:

1. Clean and vacuum air handling units and plenums to the satisfaction of the ENGINEER prior to starting air-handling systems.

2. Change out replaceable air filters, as filters are 60% loaded during construction use period and just prior to OWNER'S acceptance of project. Filters for use during construction period are in addition to OWNER'S spare sets, as specified herein.

3. Thoroughly wash wall unit filters as filters are 40% loaded during construction period, and just prior to OWNER'S acceptance of project.

3.2 NEEDLEPOINT BIPOLAR IONIZATION DEVICES

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

B. As part of the startup process, the CONTRACTOR shall use an Alpha Labs Air Ion Counter model AIC2 and confirm on installed units that the ion output meets a minimum of 300M ions/cc when both polarities are measured and added together. The measurement shall take place one inch from the electrode without airflow. For each installation, a minimum of 10% of the units shall be randomly tested to confirm compliance. The CONTRACTOR shall submit copies of these test logs as a portion of the Mechanical Close-Out Requirements. Failure of testing of any system shall warrant additional testing.

C. On systems with ionization bars, the ionization output shall be measured one inch away from the electrodes without airflow. The ionization output shall be a minimum of 60M ions/cc per inch of bar.

NEEDLEPOINT BIPOLAR IONIZATION LOG					
DATE	**PROJECT SITE**	**SYSTEM**	**LOCATION OF TEST**	**ION OUTPUT**	**CONTRACTOR'S WITNESS INITIALS**
Note: Turn in all forms filled out with project closeout documentation. Copy this form if more sheets are needed. These forms and/or log shall be kept at jobsite and upon request made available to PROFESSIONAL.					

END OF SECTION

SECTION 230890 - DUCTWORK

PART 1 – GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor, etc., required including all supply, return, outside air, exhaust, and other ductwork and as required for the A/C system, including mains, branches, plenums, mixing boxes, fittings, accessories, and other related sheet metal work for a complete installation as specified herein and/or shown on Drawings.

B. Work under this Section includes but is not necessarily limited to the following items: Ductwork for heating, ventilating and air conditioning systems.

C. Construct ductwork to meet all functional criteria defined in the SMACNA “HVAC Duct Construction Standards - Metal and Flexible” Latest Edition. This shall be subsequently referred to as the SMACNA Manual.

1.2 APPLICABLE STANDARDS

APPLICABLE PUBLICATIONS: The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only.

A. National Fire Protection Association (NFPA):

1. 90A.....Air Conditioning and Ventilating Systems – Latest Edition
2. 90B…….. Warm Air Heating and Air-Conditioning Systems – Latest Edition
3. 96.....Vapor Removal from Cooking Equipment – Latest Edition

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. Low Pressure Duct Construction Standards – Latest Edition
2. Guidelines for Welding Sheet Metal – Latest Edition
3. Duct Liner Application Standard – Latest Edition

1.3 DEFINITIONS

A. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.

B. Exposed Duct: Exposed to view in a finished room or outdoors.

1.4 QUALITY ASSURANCE

A. The CONTRACTOR must comply with the enclosed specification in its entirety.

B. At the discretion of the PROFESSIONAL, sheet metal gauges, reinforcing and sealant may be checked at various times during the construction period to verify all duct construction is in compliance.

C. If during site observations the PROFESSIONAL finds changes have been made without prior approval, the CONTRACTOR will correct deficiencies identified to comply with this specification solely at the CONTRACTOR’s expense.

D. Duct penetrations and/or doors, etc., necessary for the PROFESSIONAL to observe the duct installations, shall be made/installed and repaired, etc. by this CONTRACTOR, in ductwork as selected by PROFESSIONAL, at no additional cost to the OWNER or PROFESSIONAL.

E. All ductwork shall be installed un-insulated (except duct liner), subsequently sealed and observed/approved by PROFESSIONAL prior to insulating.

PART 2 – PRODUCTS

2.1 DUCTWORK PRESSURE CLASS CONSTRUCTION REQUIREMENTS

A. Ductwork shall be constructed to meet or exceed the SMACNA Standards based upon the following table of ductwork type and function.

DUCTWORK FUNCTION	DUCTWORK TYPE	DUCTWORK PRESSURE CLASS (IN. W.G.)
Low Pressure Supply Air	Rectangular	2 (pos.)
Low Pressure Supply Air	Round or Oval	2 (pos.)
Low Pressure Return Air	Rectangular	2 (neg.)
Low Pressure Return Air	Round or Oval	2 (neg.)
Low Pressure Exhaust Air	Rectangular	2 (neg.)
Low Pressure Exhaust Air	Round or Oval	2 (neg.)
Low Pressure Outside Air	Rectangular	2 (pos. or neg.)
Low Pressure Outside Air	Round or Oval	2 (pos. or neg.)

B. Ductwork with the type not specifically indicated on Drawings shall be constructed to 2 in. w.g. unless upstream of terminal units (variable air volume boxes) which shall be constructed to 4 in. w.g.

2.2 RECTANGULAR DUCTWORK

A. General Requirements

1. Construct all rectangular ductwork with approved new prime G-90 or better galvanized steel sheet ASTM S27 (LFQ) with chemical treatment or as specified, with careful, neat, and accurate workmanship and with all joints and seams air tight. Longitudinal seams, transverse joints and bracing, sheet metal gauges and other construction details shall be as recommended in the latest edition of the ASHRAE Guide and SMACNA "HVAC Duct Construction Standards – Metal and Flexible", and as specified below.

2. **The rectangular duct sizes as indicated on the Drawings are inside dimensions, or net free area.** All necessary allowances should be made in the sizes shown on the Drawings to accommodate internal insulation or acoustic lining.

3. All ductwork shall be provided with any re-enforcements factory installed to meet the SMACNA pressure classifications listed in paragraph 2.01.

4. Transitions shall have a ratio of at least 4 to 1 except where prevented by job conditions. In such case the transition shall be made as gradual as possible.

5. All duct transitions from square to round shall be smooth square-to-round transitions. Spin-in fittings at the end of capped ducts are not acceptable.

6. Flanged (TDC or TDF) ductwork with reinforced gasketed joints shall be installed in the following applications:

   a. Indoor ductwork with any dimension greater than 30 inches.

   b. All indoor ductwork exposed to view regardless of size.

   c. All outdoor ductwork regardless of size.

7. Rectangular ductwork exposed to weather shall be crowned to shed water.

B. Low Pressure Ductwork

1. Elbows shall be either mitered or radius type for 90 degree turns and radius only for all turns less than 90 degrees as indicated on the Drawings.

2. Mitered elbows shall be constructed using turning vanes in each mitered 90 degree turn. Turning vanes shall be galvanized steel of double-wall air foil design. Where ductwork is greater than or equal to 12” in the plane of the turn, install turning vanes with 4" minimum radius of curvature on a maximum of 4" centers. Where ductwork less than 12” in the plane of the turn, install turning vanes with 2" minimum radius of curvature on a maximum of 2" centers.

3. Curved elbows shall have a centerline radius of 1-1/2 times the cross-sectional dimension of the duct in the plane of the turn.

4. All rectangular branch connections to rectangular ducts shall be a lateral or radius type and include an externally adjustable factory fabricated air turning vane assembly. Where lateral types are installed, the length of the lateral shall be equal to one quarter of the duct width but in no case less than 4”. Where radius types are installed, the centerline radius shall be 1-1/2 times the branch duct dimension in the plane of the turn.

2.3 INTERNAL INSULATION (DUCT LINER) FOR RECTANGULAR DUCTWORK

A. Duct liner shall meet all of the following requirements and include independent testing lab verification of conformance with all of the following product characteristics.

1. Duct liner shall be made of spun or flame attenuated fiberglass with a factory-applied edge coating and of thickness and density based upon the application listed below.

   a. Indoor applications – 1” thick, 1-1/2 pcf density.

   b. Outdoor applications – 1-1/2” thick, 1-1/2 pcf density.

2. The thermal conductivity shall be equal to or less than 0.25 at 75 degree F. mean temperature.

3. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B and shall not support microbial growth as tested in accordance with ASTM G21 and G22.

4. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than 0.70 as tested per ASTM C 423 using a Type "A" mounting.

B. Comparable Products

1. Knauf “Ductliner EM”
2. CertainTeed “Toughgard”
3. Johns Manville “Linacoustic RC”.

2.4 LONGITUDINAL SEAM ROUND LOW PRESSURE DUCTWORK

A. Concealed round ductwork shall be constructed with SMACNA minimum pressure classification of 2" w.g.

B. Snap lock pipe is acceptable as long as all longitudinal and circumferential seams are sealed and screws as indicated in Part 3 - Execution.

C. All elbows and fittings shall be factory fabricated items by the same manufacturer as ductwork. Wye and laterals at diffusers take-offs shall be factory fabricated.

2.5 SPIRAL DUCTWORK

A. General Requirements

1. Provide all ductwork as indicated Drawings.
2. All ductwork shall be provided with any re-enforcements factory installed to meet the SMACNA pressure classifications listed in paragraph 2.01.
3. All exposed to view ductwork indicated to be painted shall include a factory paint grip finish.
4. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant paint.
5. All duct and fittings shall be manufactured by the same company. Said company shall have been in the business of manufacturing spiral ductwork for at least ten years.
6. Manufacturer shall furnish ENGINEER certified copies of test data made by an independent laboratory covering all pipe and fittings.

B. Single Wall Circular and/or Flat Oval Type:

1. Spiral pipe shall have locked seams so made as to eliminate any leakage under the pressures for which the system shall be subjected.
2. Longitudinal seam duct shall have a fusion welded butt seam.
3. All fittings shall have continuous welds along all seams. All divided flow fittings shall be manufactured as separate fittings, not as tap collars welded into spiral duct sections.
4. Transitions shall have a ratio of at least 4 to 1 except where prevented by job conditions. In such case the transition shall be made as gradual as possible.

5. Elbows shall be fabricated to a center-line radius of 1.5 times the cross-section diameter. Elbows in diameters 3" through 12" shall be die stamped true radius type. All other elbows shall be gored construction with all seams continuously welded.

6. All 90 degree tees and 45 degree laterals shall have a radius entrance into the tap, produced by machine or press forming. The entrance shall be free of weld build-up, burrs or irregularities.

7. Pipe to pipe and pipe to fitting joints shall be by the use of fully welded angle/flanged connections. Bolt hole spacing for angle rings shall not exceed 6-inches. Neoprene gaskets or other suitable sealant shall be employed in the joining method.

C. Insulated Double Wall Circular and/or Flat Oval type:

1. The outer pressure sheet and the inner liner shall be manufactured from galvanized steel meeting ASTM A-527-67, separated by spaces.

2. The inner liner of all ductwork and fittings shall be perforated.

3. The construction is to include minimum insulation sandwiched between outer shell and inner liner to provide a thermal conductivity "K" factor of 0.27B/HR/sq.ft./in./degrees F. at 75 degrees mean temperature.

4. The construction shall have means to maintain positive concentricity of liner with shell and mechanical means to retain insulation against dislocation by assembly process. Adhesives of any type are prohibited unless the flame spread, smoke developed and sound attenuation tests were performed with the adhesives as used.

5. The insulation shall include a matte face to provide positive protection against the possibility of fiber entrainment and microorganism growth with independent test lab certification of compliance with ASTM G21 and G22.

6. Spacers shall be included between inner and outer sheet metal members to prevent liner insulation compression.

7. Outer wall construction shall meet or exceed all of the requirements listed herein for single wall round oval ductwork.

2.6 FLEXIBLE AIR DUCTWORK

A. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.16 (R=6) at 75 degrees F. mean temperature, encased with a low permeability moisture barrier metalized outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall be not less than 3db per foot of straight duct, at 500 Hz, based on 6-inch duct, air velocity at 2500 fpm.

B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 8-inches diameter shall be Class 1. Ducts 8-inches in diameter and smaller may be Class 1 or Class 2.

C. Minimum working pressure for low and medium pressure systems: 6 inches w.g. positive, 2 inches w.g. negative.

D. Duct Clamps

1. Stainless steel strap with cadmium plated worm gear tightening device.

2. Nylon tie wrap minimum ¼" wide.

2.7 FLEXIBLE DUCTWORK ELBOW SUPPORTS

Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6" – 16". Elbow supports shall be UL listed for use in return air plenum spaces. Flexible ductwork elbow supports equal to Thermaflex FlexFlow Elbow.

2.8 JOINT SEALING

A. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork. Use products as recommended by the manufacturer for low, medium or high-pressure metal duct systems.

B. Tape/Gaskets in flanged joints such as TDC or TDF: Soft butyl rubber/elastomeric composition equal to Sticky Tape manufactured by Ductmate.

2.9 SPECIAL DUCTWORK:

A. Commercial clothes dryer ductwork shall be size duct constructed of minimum 18 ga. long seam welded galvanized steel duct. The ends of ducts and fittings shall be made utilizing integral rolled 1/2" minimum flanges fastened by being banded or bolted together. No edges, screws, etc. are allowed on the interior. All elbows shall be minimum 1-1/2 times the duct diameter centerline radius single piece die-stamped construction.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Comply with provisions of Section, *BASIC MECHANICAL MATERIALS AND METHODS*, particularly regarding coordination with other trades.

B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards and manufacturer's printed instructions.

C. Fabricate ductwork based on field measurements of space available. Sizes on plans may be altered by the CONTRACTOR, when approved by the ENGINEER, to other dimensions without increasing air pressure friction losses where necessary to avoid interferences and clearance difficulties.

D. All ductwork located outdoors shall be sealed water tight on all seams and connections.

E. Provide duct transitions, offsets and connections to dampers, coils, and other equipment.

F. Weld sheet metal in accordance with SMACNA, Guidelines for Welding Sheet Metal. Repair damaged galvanized areas with galvanizing repair compound.

G. Each collar for outlet and intake devices on exposed ducts shall be flanged inward at the device mounting end, and the outside dimensions of the collar shall not be less than the overall flange dimensions of the devices attached thereto.

H. At each location where exposed ductwork passes through finished walls, floors, or ceiling, install a neat sheet metal collar completely covering the rough opening in the building construction secured to ductwork with sheet metal screws.

I. Provide UL approved flexible connectors per Section *Mechanical Sound and Vibration Control*.

J. Construct casings, eliminators, and pipe penetrations in accordance with applicable SMACNA Standards. Design casing access doors to swing against air pressure so the pressure helps to maintain a tight seal.

K. Install fire, smoke and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.

L. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, or items and other installations above the ceiling through plenum grilles, paint the inside of the duct or above ceiling installations, with flat black paint to reduce visibility.

M. Protection and Cleaning

1. Adequately protect ductwork and equipment against physical damage and entry of foreign matter to the inside at all times both prior to and after installation into project.

2. Cap open ends of ducts and equipment when not in operation.

3. Clean ductwork and equipment prior to painting. See PAINTING section for specific requirements pertaining to surface preparation.

4. Both the inside and outside of all ductwork and equipment shall be clean and free of dust, debris, foreign material, etc. prior to final acceptance of the project.

5. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by PROFESSIONAL.

N. Control Damper Installation:

1. Provide necessary transitions required to install dampers which do not match the duct size indicated.

2. Assemble multiple section dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

3.2 INTERNAL INSULATION (DUCT LINER) FOR RECTANGULAR DUCTWORK

A. The following rectangular ductwork shall be interior acoustically lined:

1. Ductwork within ten (10) feet of any supply or return fan for HVAC applications, except built-up R/A plenums.

2. Ductwork within ten (10) feet of exhaust fans.
3. Ductwork exposed to view indoors.
4. Supply and Return ductwork located outdoors.
5. Supply and Exhaust Ductwork within ten (10) feet of Heat Recovery Units.
6. Supply and Exhaust Ductwork serving Heat Recovery Units when located outdoors.
7. Where specifically indicated on Drawings.

B. The duct liner shall be applied to the flat sheet with 100% coverage of adhesive with the black matte surface facing the air stream.

C. Ducts with the sides or bottom dimension exceeding 20" shall have the liner additionally secured with welded pins and speed clips or "Gripnails" on a maximum of 12" centers and within 3” of edges. Pins shall be cut close to the speed clips.

D. Provide sheet metal nosing on all liner, where liner terminates and ductwork continues.

E. All seams, exposed edges and leading edges of all longitudinal and cross-joints of the liner shall be coated with an approved white sealant "butter".

F. Wet butter shall also be applied to duct to duct seams and connections simultaneously with the jobsite installation.

3.3 LONGITUDINAL SEAM ROUND LOW PRESSURE DUCTWORK

A. Screws shall be installed every 18" O.C. along longitudinal seams and minimum 6” from end connections

B. Screws shall be installed every 4" on center, but not less than 4 equally spaced, on circumferential ductwork and fitting joints.

C. All elbows and fittings shall be factory fabricated items by the same manufacturer as ductwork. Wye and laterals at diffusers take-offs shall be factory fabricated.

D. No dovetail field joints or fittings are allowed.

3.4 SPIRAL DUCTWORK

A. Spun bell mouth connections shall be installed at each round take off from rectangular ductwork and/or plenums.

B. Duct sealer shall be applied to the male end of the couplings and fittings. After the joint is slipped together, sheet metal screws shall be placed ½-inch from the joint head for mechanical strength. Sealer shall be applied to the outside of joint extending 3" on each side of the joint head and covering the screw heads.

3.5 FLEXIBLE AIR DUCTWORK

A. Flexible ducts shall be installed with stainless steel strap or nylon tie wraps with sealant and as approved for UL 181, Class 1 installation. A “tightening gun” shall be utilized when installing nylon tie wraps.

B. Flexible ducts shall not penetrate any wall, floor, partition or ceiling.

C. Flexible duct shall be installed in continuous single pieces not over five (5') feet long,

as straight and short as feasible, adequately supported.

D. Centerline radius of bends shall be not less than two duct diameters.

E. Flexible ductwork shall be suspended on 36" centers with a minimum 1-1/4-inch wide flat banding material.

3.6 JOINT SEALING

A. **All ductwork joints and longitudinal seams shall be sealed airtight.** Sealant shall be visibly sealed on the exterior of duct, including all factory fittings, all connections, both longitudinal and circumferential.

B. Duct tape (gray or foil type) shall NOT be utilized as a ductwork sealer.

C. Elastomeric or hard cast duct sealer shall NOT be utilized on fire damper sleeve to duct connections.

D. Utilize flanged style ductwork joining system in conjunction with tape/gasket for sealing breakaway joints and connections to fire, smoke and/or combination fire/smoke dampers.

3.7 DUCT LEAKAGE TESTS AND REPAIR

A. ALL ductwork shall be sealed airtight, as specified herein. Designated ductwork, as hereafter identified, shall be field pressure tested and proven tight. Other ductwork, not specified to be field tested may be randomly inspected by PROFESSIONAL; any or all ductwork not found to be comprehensively sealed (by visual inspection) may be thereafter required to be field pressure tested, solely at PROFESSIONAL'S discretion, to prove air tightness to specified tolerances.

B. The following ductwork shall be tested by the CONTRACTOR and witnessed and logged by a representative of the TAB Agency performing the work identified in Section *Testing, Adjusting and Balancing*. This includes all supply, return, exhaust, outside air, etc. trunk and all branch ducts, and plenums excluding flexible duct run-outs to individual air distribution devices, shall be tested and proven tight within specified tolerances.

1. All Low Pressure Ductwork.

a. Test pressure shall be at pressure class construction requirements identified in Part 2 of this specification.

C. Measured air quantity leakage test

1. The CONTRACTOR shall use recently calibrated orifice run, manometers and portable blower as recommended by AABC.

2. Instruments used for testing and balancing of system shall have been calibrated within six months preceding tests and checked for accuracy prior to start of work.

3. Instruments shall be of a type normally recognized as adequate and accurate for the test contemplated. List type of instrument, manufacturer, serial number and latest calibration date as a part of the submitted test data.

4. Allowable Leakage

a. Low Pressure Ductwork shall have a maximum leakage of five (5) percent of design flow rate (cfm) for complete system or portions thereof. Summation of leakage for all sections shall not exceed the total allowable for a single system.

5. Verification: By TAB Agency. See attached Duct Test Log.

DUCT TEST LOG						
DATE	**SYSTEM**	**LOCATION OF TEST**	**TEST PRESSURE**	**ACTUAL LEAKAGE (CFM)**	**RESULTS % OF LEAKAGE**	**TAB WITNESSED (INITIALS)**
Remarks: (Include Narrative of Procedure, List of Instrumentation, Last Calibration Date, etc.)						
Note: Turn in all forms filled out with project closeout documentation. Copy this form if more sheets are needed. These forms and/or log shall be kept at jobsite and upon request made available to ARCHITECT and/or PROFESSIONAL.						

I certify that the data listed above is accurate and was witnessed by myself or qualified employees of the TAB Agency.

_____ _____

TAB Agent Date

END OF SECTION

SECTION 230910 - DUCTWORK ACCESSORIES

PART 1 – GENERAL

1.1 SCOPE

Ductwork accessories for HVAC including supply air, return air, outside air, transfer air and general exhaust systems.

1.2 APPLICABLE STANDARDS

A. Refer to Paragraph, QUALITY ASSURANCE, in Section *BASIC METHODS AND REQUIREMENTS* (MECHANICAL).

B. Fire Safety Code: Comply with NFPA 90A

C. Duct System Construction: Referenced SMACNA Standards are the minimum acceptable quality.

D. Duct accessories exposed to the air stream, such as dampers turning vanes, extractors, etc. and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.3 DEFINITIONS

A. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.

B. SMACNA duct pressure classification for Low Pressure: Static pressure rating up to 2 inches wg (water gauge), positive or negative, for rectangular ducts, and 1 inch wg for round ductwork.

PART 2 – PRODUCTS

2.1 TAKE-OFF FITTINGS

A. Round ductwork take-offs shall be conical/bellmouth type or 45 deg lateral (shoe-tap) type. Provide take-offs with volume damper including continuous shaft, locking quadrant handle, nylon bushings and stand-off bracket. Located where indicated and accessible.

B. Conical take-off fittings shall be equal to Flexmaster model CBD SOG with B03 option.

C. 45 deg lateral (shoe-tap) take-off fittings shall be equal to Flexmaster model STOD with B03 option.

2.2 DAMPERS

A. Rectangular Volume Dampers: Opposed blade, multi-louver type. Provide end bearing for all dampers. Quadrant or other operator for externally insulated duct shall have stand-off mount so operation is clear of the insulation.

B. Backdraft Dampers: Self-operating, multi-blade damper to open fully on 0.06 inch wg pressure difference and close by gravity. Aluminum, 16 gauge frame, 0.023 inch blades of airfoil or elliptical shape, with tie-bar to connect blades for parallel operation. Provide resilient gasket for air seal and quiet operation. Blade pivots shall be in nylon bushings. Provide adjustable counter-balance weight(s) where

indicated or required to achieve specified performance.

2.3 DUCT ACCESS DOORS, PANELS AND SECTIONS

A. Provide access doors, sized and located for maintenance work, upstream where possible, in the following locations:

1. Each fire damper (for link service), fire/smoke damper, smoke damper and automatic control damper.

2. Each duct mounted smoke detector.

3. Each duct mounted coil.

4. Each turn in grease ducts.

B. Openings shall be as large as feasible in small ducts, 8” diameter minimum, with round spin-in access door and sash lock(s). Access sections in insulated ducts shall be double wall, insulated.

1. For low and medium pressure rectangular ducts, provide Flexmaster Model SDSM with R6 insulation option, flange with stick on gasket and cable door retention accessories.

2. For round and flat oval ducts provide Ruskin Model ADR.

2.4 WALL INTAKE/EXHAUST LOUVERS

A. See Schedule on Drawings for more information.

2.5 AIR DISTRIBUTION DEVICES

A. Including supply, return, transfer and exhaust ceiling, floor and sidewall installation, aluminum gasketed construction as indicated. Provide steel construction and matching UL Listed ceiling radiation damper on applications in fire rated ceiling assemblies.

B. All inside ceiling units shall have factory finish, white color unless otherwise noted.

C. All soffit outdoor units shall have factory finish, color to match soffit. Submit color chart to ARCHITECT for custom color selection.

D. See Schedule on Drawings for more information.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Comply with provisions of Section *BASIC MECHANICAL MATERIALS AND METHODS*, particularly regarding coordination with other trades.

B. Construct casings, eliminators, and pipe penetrations in accordance with LPDS, Chapter 3. Design casing access doors to swing against air pressure so the pressure helps to maintain a tight seal.

C. Install duct hangers and supports in accordance with SMACNA, LPDS, Chapter 5, and HPDS, Chapter 6, in concealed applications.

D. Install life safety dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install multiple access doors to provide access to all damper linkages/fusible links of multiple section life safety

dampers.

E. Seal openings around duct penetrations of fire rated ceilings and partitions with fire stop material as required by NFPA 90A. See Section *Basic Mechanical Materials and Methods*. Provide sound sealant around duct penetrations in wall indicated as sound and/or full height walls.

F. Provide primary and secondary balance dampers on all supply distribution devices. Provide a supply air duct damper and air extractor off main ductwork to branch ductwork of the types as listed below:

1. Round Ductwork: Provide conical or lateral type taps with integral butterfly damper. Submit information for approval.

2. Rectangular Ductwork: Provide radius or lateral elbow tap, as indicated with air extractor assembly and opposed blade multi-blade damper.

3. Provide exterior duct damper and extractor controller arm assemblies that extend past proposed ductwork installation for accessible operation.

G. When splitter dampers occur above other than lay-in ceiling, provide damper assembly complete with supports, bearings, chromium plated ceiling escutcheons and adjustable regulator, as Young Models No. 1 and No. 890-A.

END OF SECTION

SECTION 230980 - CONTROLS AND INSTRUMENTATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Provide complete HVAC controls and instrumentation for the following items:

1. Air Handling Systems Including:
    a. Exhaust Fans
    b. Direct Expansion Systems
    c. Packaged Heat Recovery Systems (HRU's)
2. Miscellaneous
    a. Ceiling Heaters

B. Definitions:

1. Deviations: The difference between the controller set point and the value of the controlled variable (such as room temperature) at any instant.
2. Dead band: A temperature range over which no heating or cooling energy is supplied, such as 72-78 degrees F, i.e., as opposed to single point changeover or overlap.
3. Control Wiring: Includes conduit, wire and wiring devices to install complete HVAC control systems including motor control circuits, interlocks, thermostats, switches and like devices.

1.2 QUALITY ASSURANCE

A. Criteria:

1. The maximum deviation of occupied room conditions from the controller set point shall not exceed plus or minus one degree F for temperature, and plus or minus three percent for relative humidity unless the system is operating in the dead band range.

B. Performance tests:

1. Demonstrate to the Owner that all controls are installed, adjusted, and can perform all functions required by the contract drawings and specifications.

1.3 SUBMITTALS

A. Manufacturer's Literature and Data for all components, including the following:

1. Controllers.
2. Relays and switches.
3. Control dampers, control valves and operators.
4. Instrumentation products.

B. Certificates:

1. Compliance with paragraph, QUALITY ASSURANCE.

2. Name and address of a permanent service organization maintained or trained by the manufacturer that will render satisfactory service within eight hours after notification that service is required.

C. Control Drawings: Integrate with flow diagrams; show outlines of HVAC equipment with control devices, schematic one line control piping and wiring, and written sequence of operation and operation instructions. Equipment numbers shall correspond to those shown on the Contract Drawings. Provide three (3) complete sets of blue-line as-built drawings.

D. Operation and Maintenance Manuals:

1. Submit in accordance with Section *Mechanical Close-Out Requirements*.

2. Include the following documentation:

a. General description and specification for all components.

b. Detailed illustrations and complete calibration procedures.

c. Complete trouble shooting procedures and guidelines.

d. Complete operating instructions for all systems.

e. Piping schematic/flow diagrams.

1.4 INSTRUCTIONS

A. Instructions to OWNER Operations Personnel: Perform in accordance with Section *Mechanical Close-Out Requirements*.

B. Training by independent or franchised dealers who are not direct employees of the temperature control company will not be acceptable.

1.5 GUARANTY

Any defects in workmanship or material during the guaranty period shall be corrected by the CONTRACTOR at no cost to the OWNER. Correction of defects shall be accomplished during regular working hours.

PART 2 – PRODUCTS

2.1 SENSORS AND CONTROLLERS

A. Combination heating/cooling thermostat: This remote wall sensor/controller is to be utilized to control split and/or packaged HVAC equipment with heating and cooling capabilities. Thermostats shall be of the low voltage or electronic adjustable type and shall conform to requirements of UL 873. Thermostats for air conditioners shall be provided and shall be combination heating-cooling type with contacts hermetically sealed against moisture, corrosion, lint, dust and foreign materials. Thermostats shall be designed to operate on not more than 1.5 degrees Fahrenheit differential from setpoint to actual temperature, or as noted, and of suitable range calibrated in degrees Fahrenheit. Thermostats shall have adjustable heat anticipation and fixed cooling anticipation. Air conditioning heating/cooling thermostats shall contain two independent temperature sending elements electrically connected to control the heating and cooling operation(s), respectively. The electrical characteristics shall be 24V AC or less. The maximum differential between heating and cooling setpoints shall be 3 degrees Fahrenheit. Automatic

switching for system changeover from heating to cooling or cooling to heating shall be accomplished through the use of a thermostat sub base. Provide all thermostats with visible temperature space read out in degrees Fahrenheit, and adjustable separate setpoint control for heating and cooling functions.

Provide the number of stages of control, with a nominal 3 to 5 degrees Fahrenheit between stages, for heating and cooling functions to match the number of stages scheduled and/or specified. Provide a type thermostat with emergency/auxiliary heat control capability matched to heat pump applications.

Provide 7-day programmable time-clock based with simple push button override of unoccupied schedule, where indicated, as Honeywell Model T7300 series.

B. Humidistat: Low voltage or electronic type sensor/controller capable of minimum 2% relative humidity accuracy, and no more than 1% drift per year temperature compensating, non-condensing, early field calibratable, sensor/controller shall energize humidity control equipment/capability on a rise in space above setpoint. Provide multistage or multiple setpoint humidity sensor/controllers to match equipment scheduled and/or specified capability and/or control.

Space wall mounted humidity sensor/controllers shall be as KELE Series HF/HW-20K-T81 or as approved. Calibration shall be guaranteed for minimum period of two (2) years.

2.2 RELAYS:

A. Provide as required for system functions.

B. Electrical Pilot Duty or Contactor Types: Provide inductive rated contacts for circuits with coils, motors or other inductive devices, minimum 120V, 15A. rating.

2.3 MOTORIZED CONTROL DAMPERS

A. Dampers shall be of the airfoil, ultra low leakage, opposed blade design. Dampers shall be constructed of minimum 16 gauge galvanized steel. Side mounted linkage shall be out of airstream. Blades shall include rubber edge seals for tight seal.

B. Damper actuators shall be two-position normally closed low-voltage type.

C. Design and install control dampers to "fail safe" in either the normally open or normally closed position as required for freeze, moisture, smoke or fire protection.

2.4 FINAL CONTROL ELEMENTS AND OPERATORS

A. Fail Safe Operation: Design and install control valves and dampers to "fail safe" in either the normally open or normally closed position as required for freeze, moisture, smoke or fire protection.

B. Spring Ranges: As required for system sequencing and to provide tight close off.

2.5 WIRING MATERIALS

A. Comply with applicable sections of *Division 26 and 28*. Provide wiring for control devices furnished under this Section, HVAC motor control conduits and interlocks. Color code and number all wires, whether individual or in cables, for identification.

B. A complete wiring system shall be provided for all direct digital control (DDC) and electric controlled apparatus. All wiring shall be installed in a neat, workmanlike

manner, of sufficient size and tested to be continuous and without unnecessary "short".

Wiring shall be as follows:

1. Exposed Areas and Mechanical Equipment Rooms: Wiring shall be routed in metallic conduit per *Division 26 and 28* requirements. Provide flexible conduit connections to rotating equipment.

2. Concealed, Accessible Areas: Wiring may be routed outside in above ceiling accessible spaces conduit, however wiring outside conduit shall be sheathed with plenum rated jacket with maximum rating of 50/25 smoke developed/fire rated per NFPA 90A.

    a. All wiring will be routed in the bar joists and/or roof structure space and supported with tie-straps at maximum 6'-0" on center.

    b. All drops and risers to HVAC equipment, fans, sensors, etc., will have a tie-strap installed directly above each device to insure a vertical support to the device.

    c. Any open wiring that enters a conduit in the walls or drop/rise to connect equipment will have a minimum of 12" of wire looped outside the conduit above the ceiling and will be attached utilizing a tie-strap within 12" of the conduit end or connection.

3. Inaccessible Areas: Same as #1 above - includes wiring in walls, above hard ceilings, in chases, etc.

4. Inside Panels or Unit Enclosures: Wiring may be run outside conduit and neatly tied in bundles for neatness and function.

5. Wiring in exterior and moist environments shall be routed in weatherproof liquid tite conduit with matching fittings and connections.

6. Minimum gauge for low voltage (24VAC or less) control wiring shall be 18 AWG copper solid conductor(s).

2.6 TAMPERPROOF INSTALLATIONS

A. Refer to Drawings for types of covers required for each application.

1. “Clear” covers shall be vented plastic locking type equal to Kenall TG5 series. Provide two (2) keys for each and every cover, to OWNER at end of project.

2. “Opaque” covers shall be vented plastic Kenall TG-1 series with tamper proof screws. Provide OWNER with four (4) tamperproof cover screw tools at completion of project. Mount these devices in a location approved by PROFESSIONAL.

3. “Metal” covers shall be 18 gauge perforated steel with enamel finish equal to White-Rodgers F29 series. Provide two (2) keys for each and every cover, to OWNER at end of project.

B. Relays for all HVAC systems, exhaust fans, and ceiling heaters shall be mounted in large junction boxes with covers above accessible ceilings near individual

equipment.

2.7 IDENTIFICATION/SIGNAGE

A. Provide permanent phenolic labels for all operators, controllers, and sensors. Coordinate with ENGINEER on designations required. Submit Shop Drawing of installation indicating switch location(s) and identification. See Section *Mechanical Identification*.

B. Provide operating instructions, mounted adjacent to equipment controller, as approved by Professional and TAB commissioner, for the following:

1. Heat recovery units

2.8 CONTROL SEQUENCES

Control sequences shall be:

A. HEAT RECOVERY UNITS:

1. UNIT MANUFACTURER'S CONTROL PANEL SHALL ENERGIZE OUTSIDE AIR UNIT MANUFACTURER'S CONTROLS BASED ON OCCUPANCY SCHEDULE DESCRIBED HEREAFTER. UNIT MANUFACTURER'S CONTROLS SHALL STAGE COOLING/HEATING PER SECTION *PACKAGED HEAT RECOVERY EQUIPMENT*. CONTRACTOR SHALL COORDINATE WITH UNIT MANUFACTURER ON ALL FIELD SUPPLIED/INSTALLED/CONNECTED SPACE AND/OR DUCT SENSORS, CONTROLLERS, ETC. IN ORDER TO ACHIEVE SPECIFIED CONTROL SEQUENCE AND CONSISTENT SPACE ENVIRONMENTAL CONDITIONS.

B. DUCTLESS SPLIT SYSTEMS:

1. CONTINUOUS OPERATION. CONTROLLED BY MANUFACTURER'S AUTOMATIC HEATING/COOLING CHANGEOVER THERMOSTATS.

C. FANS:

1. SEE CONTROL SEQUENCE AT SCHEDULE(S) ON DRAWINGS.

D. DOMESTIC WATER RECIRCULATING PUMPS:

1. SHALL BE ENABLED TO RUN DURING OCCUPANCY AS SET BY 7-day programmable time clock. WHEN ENABLED, PUMP SHALL BE ENERGIZED WHEN PIPE MOUNTED AQUASTAT FALLS BELOW SETPOINT.

E. OTHER CONTROLS AND/OR CONTROL FUNCTIONS AS LISTED ON DRAWINGS OR SPECIFIED ELSEWHERE.

PART 3 – EXECUTION

3.1 INSTALLATION AND ADJUSTMENT

A. Install and adjust required control components and systems in accordance with instructions of the manufacturer. Work shall be performed by employees of the manufacturer or an authorized representative.

B. All control wiring shall be routed in accordance with paragraph 2.05 herein. Install control wiring and connections in accordance with applicable Sections of *DIVISION 26 and 28*.

C. Except for short apparatus connections run conduit parallel to or at right angles to the building structure. Conceal conduit in finished spaces.

D. Do not run conduit concealed under insulation or inside ducts. Mount control devices and conduit located on ducts or apparatus with external insulation or stand-off support to avoid interference with insulation.

E. Run wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing. Rack connections bridging a cabinet door along the hinge side and protect from damage. Provide grommets, sleeves or vinyl tape to protect plastic tubing or wires from sharp edges of panels, conduit, and other items.

F. Provide all necessary factory and/or field labor for complete calibration and adjustment of the air flow control components, and be responsible for setting all control set points, operating sequences, and alarm systems contained within the control center to produce the system performance specified.

G. Provide water heater controls, operating instructions, controls and piping schematic in neat laminated displays for mounting in water heater room.

H. CONTRACTOR shall provide all power wiring and connect relays, time clocks, control panels, MCP, etc. which are furnished by CONTRACTOR.

I. Provide permanent identification of panel MCP, time clock, and all controllers, by zone, etc. as per Section *Mechanical Identification* and PROFESSIONAL'S instruction. Submit details of proposed identification along with control schematics and device specifications for PROFESSIONAL'S approval. Submit Drawings, schematics, operating instructions, etc. to be posted, framed, laminated, etc. to PROFESSIONAL for approval.

3.2 FIRE ALARM/SMOKE DETECTION COORDINATION

A. Since no fire alarm system is involved with this project, the CONTRACTOR shall provide and install all specified duct and/or plenum mounted smoke detectors as called for by code, specified, and on Mechanical Drawings, etc. and interlock with individual HVAC systems for shut-down of equipment.

B. In general, all smoke detectors shall annunciate to, and be compatible with the fire alarm system. All fire alarm wiring, annunciators, and adaptation to fire alarm system by the CONTRACTOR. All shutdown and controls to automatically de-energize HVAC systems are by the CONTRACTOR.

C. It is the CONTRACTOR’s responsibility to coordinate these responsibilities for safety and operating controls, for complete and operative HVAC systems.

D. Smoke detectors of proper size and type shall be furnished and properly installed per NFPA and International Electrical and Mechanical codes. The detectors shall be furnished with necessary N.C. and N.O. contacts to accomplish shutdown of HVAC systems.

E. Each detector shall have a remote alarm and test station installed where directed by

ARCHITECT or as shown on Drawings.

F. See *Division 26 and 28* specifications for other requirements. Coordination shall be by this CONTRACTOR.

G. In general, specified CONTRACTOR above shall furnish and install approved smoke detection and shutdown controls for the following HVAC equipment and accessories:

1. HVAC air handling systems with air delivery capacity 2000 cfm or greater.
2. This includes makeup air, exhaust, heat recovery, ventilation and similar HVAC support and auxiliary systems.
3. All HVAC equipment with smoke detectors shall be additionally connected to the fire alarm system such that the equipment shall automatically be de-energized by any fire alarm annunciation from the same zone as is served by the same HVAC equipment.

END OF SECTION

SECTION 230990 - TESTING, ADJUSTING AND BALANCING

PART 1 – GENERAL

1.1 SCOPE

A. The process of Testing, Adjusting and Balancing (TAB) for mechanical HVAC and Plumbing systems is a requirement for this project.

B. Definitions and Abbreviations:

1. TAB: Testing, Adjusting and Balancing. The process of checking and adjusting HVAC and plumbing systems to meet design objectives and performance intent.
2. AABC: Associated Air Balance Council.
3. NEBB: National Environmental Balancing Bureau.
4. Plumbing Systems: Domestic hot water and re-circulating systems.
5. Air Systems: Included all supply air, return air, exhaust air, transfer air and outside air systems.

C. The CONTRACTOR shall provide the services of a qualified independent TAB Agency for testing, adjusting, and balancing as described herein and include same in his bid. CONTRACTOR shall submit TAB AGENCY experience, agenda and associated credentials to PROFESSIONAL for TAB AGENCY and agenda approval.

1.2 APPLICABLE STANDARDS

A. TAB Agency Qualifications: Current membership in AABC or NEBB.

B. Performance Criteria: Work shall be performed in accordance with the approved TAB agenda requirements.

C. Test Equipment Criteria: The basic instrumentation requirements and accuracy/calibration required by AABC (Section Two) or Section II of the NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

D. A factory air test hood, recently calibrated, shall be utilized for ceiling air device CFM measurement.

1.3 APPLICABLE PUBLICATIONS:

The following publications form a part of this Specification to the extent indicated by the reference thereto. In text the publications are referred by to by the initials of the organization.

A. Associated Air Balance Council (AABC):

1. National Standards for Total System Balance, 2002 Edition

B. National Environmental Balancing Bureau (NEBB):

1. Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 8th Edition, 2015
2. Procedural Standards for Measuring Sound and Vibration, 2nd Edition, September 2006

1.4 CORRESPONDENCE

A. Representative of TESTING, ADJUSTING and BALANCING Agency shall report to the CONTRACTOR, during all phases of the test and balance process, any deficiencies that will impair the proper balance and operation of the systems involved. This shall include, but not limited to, reporting balancing valves/dampers, controls, and safety sensors, etc. not installed as called for on the Plans or in the Specifications.

B. The TAB Agency shall submit preliminary reports a minimum seven (7) days prior to scheduled substantial completion for this project or any phase thereof, and including a comprehensive narrative of problems, obstacles, recommendations, and remedial actions for PROFESSIONAL'S review and approval.

C. TAB Agency shall not release any reports to other parties until such has been approved by the PROFESSIONAL.

PART 2 PRODUCTS NOT APPLICABLE

PART 3 – EXECUTION

3.1 GENERAL

A. Coordinate TAB procedures with any phased construction requirements for the project so that usable increments of finished work may be accepted for beneficial occupancy. Systems serving partially occupied phases of the project may require balancing for each phase prior to final balancing and shall required separate TAB effort and reports for each phase and submittal prior to advancing to next phase of project.

B. Allow sufficient time in construction schedule for TAB prior to substantial completion inspection for the project.

C. Conduct final TAB after system has been completed and is in full working order. Put all HVAC systems into full operation and continue operation of the systems during each working day of TAB. Accomplish TAB in accordance with the CONTRACTOR provided Agenda approved by PROFESSIONAL.

D. Substantial Completion: Substantial Completion of mechanical systems shall not be given without TAB Agency's written certification that the mechanical systems and controls have been thoroughly tested and are safely performing as intended. See certification required herein. No other certification will be acceptable.

E. Preparation of Equipment and Systems for Testing and Balancing:

1. The CONTRACTOR shall, upon completion of items or work required by this contract, thoroughly clean all dirt and debris from equipment, ducts, piping systems, strainers, accessories, etc. All bearings, gear boxes, wearing surfaces, or other equipment components requiring lubrication shall be properly serviced as recommended by the equipment manufacturer and shall be tagged with the date of service and type of lubricant used. All specified cleaning and protective devices shall then be installed in equipment, piping, plenums, ductwork, etc., and systems shall be placed in continuous operation. All fans shall have been in operation for at least twenty-four (24) hours prior to the start of testing and balancing so that initial

stretch of drive belts will have taken place, and all other mechanical equipment including all temperature and operating control devices will have been adjusted and calibrated for complete and functional operating service.

F. System balancing and performance testing:

1. The CONTRACTOR shall secure copies of all report forms, data sheets, and instrumentation to be used by the agency in the performance of their services and submit the same for approval. This submittal data shall include a tabulation of instruments and devices to be utilized in the performance of testing and balancing operations and shall include the name of the manufacturer of the instrument of devices, model number, range, degree of accuracy, date of last calibration, or the other pertinent information that may be required to determine the utility of the instrument of device. As a minimum requirement, the following instrumentation shall be employed in the performance of balancing and testing of mechanical system: swinging vane or hot wire type anemometer, low ran (0-0.25 in. water column) inclined tube manometer, high range (0-20 in. water column) U-tube manometer, pilot tube, ammeter, volt-meter, self-timing tachometer (maximum scale Division 2 rpm) pyrometer, powered psychrometer, vibration meter, other instruments, tools, and devices as required to accurately balance and test mechanical systems and components.

G. It is the responsibility of this section to make certain that all the submitted and/or existing equipment has proper motor size, sheave size, belt size, etc.

3.2 AIR BALANCE

A. Place all interactive systems in operation with all filters installed and automatic control systems completed and operating. Artificially load air filters by partial blanking or other means to provide air pressure drop midway between the clean and dirty condition. Set/reset room thermostats and humidistat, and/or equipment controls as necessary to check heating and cooling functions, and air flow rates for air distribution devices and adjust units if not within specified tolerances.

B. Balance systems to design ratings. Adjust fan speeds to provide design flows, including system diversities, at actual system pressures. Belt drives, including sheaves, belts, etc. shall be adjusted and/or replaced as required to safely obtain specified performance.

C. Make pitot tube traverses of all trunk lines and major branches when required to determine proper proportioning of air flows. Airflow measuring devices, where installed, may be utilized for this purpose. Seal duct access holes with snap in plugs.

D. Record pressure drop readings across all major system components and significant drops within duct systems such as air filters, coils, heaters, etc.

E. Make flow and pressure measurements at each terminal device, and each supply, return, or exhaust diffuser. Adjust each air outlet unit within plus or minus 10 percent of design requirements, but total air for each system shall be not less than shown unless otherwise approved by PROFESSIONAL. Adjust grilles and diffusers to minimize drafts in all areas. Mark permanently all damper quadrants at final set points. Total differentials between ventilation and exhaust for the purpose of proper

pressurization, shall be maintained.

F. Adjust exhaust systems to indicated CFM requirements (+/- 10%).

3.3 VIBRATION TESTING

Check for excessive vibration of rotating equipment.

3.4 SOUND TESTING

Check for excessive noise from equipment, air distribution devices, etc. and notify PROFESSIONAL of any objectionable noise levels. Perform noise/sound measurement and provide noise level calculations/results in rooms and areas requested by PROFESSIONAL.

3.5 DUCT LEAKAGE TESTS

See Section *Ductwork* for duct testing requirements.

3.6 BUILDING/ZONE PRESSURIZATION:

The Tab Agency shall test the building pressurization and report same to PROFESSIONAL. These tests shall include various simulations between maximum and minimum ventilation capacities, to assure proper relief capability and pressurization per current ASHRAE recommendations.

3.7 MINIMUM TAB DATA REQUIRED

Approved TAB Agency shall furnish all labor and materials to balance the following new and/or modified equipment and systems: The following minimum information shall be provided:

A. Heat Recovery Units: All information/data shall be gathered within a 90 minute period. TAB Agency shall coordinate with CONTRACTOR and unit manufacturer's representative to be present on day(s) of testing these systems.

1. Supply/O/A

a. CFM - (one (1) reading with bypass closed and one (1) reading with bypass open)

b. Enthalpy Wheel E.A.T. Db/Wb –

c. Enthalpy Wheel L.A.T. Db/Wb –

d. Cooling Coil L.A.T. Db/Wb (Cooling) - (first stage only) –

e. Cooling Coil L.A.T. Db/Wb (Cooling) - (first and second stages together) –

f. Unit L.A.T. Db/Wb (Heating) - (1st (Enthalpy Wheel) & 2nd gas furnace) stages together) –

g. External Static Pressure –

h. Fan RPM –

i. Fan Motor F.L.A. - rated vs. actual –

j. Fan Motor Horsepower and Service Factor –

k. Size, Type, Efficiency and Relative Condition of all Air Filters –

2. Return/Exhaust
    a. CFM
    b. Enthalpy Wheel E.A.T. Db/Wb –
    c. Enthalpy Wheel L.A.T. Db/Wb –
    d. External Static Pressure –
    e. Fan RPM –
    f. Fan Motor F.L.A. - rated vs. actual –
    g. Fan Motor Horsepower and Service Factor –
    h. Size, Type, Efficiency and Relative Condition of all Air Filters –

B. Fans:
    1. CFM –
    2. Voltage –
    3. F.L.A. –
    4. External Static Pressure –

C. Pump (Domestic Hot Water):
    1. GPM
    2. F.L.A.

D. Electric Ceiling Heaters (CH):
    1. kW –
    2. Voltage/Phase –
    3. Ambient air temperature (ºF) –
    4. Heated air discharge temperature (ºF) –
    5. Fan CFM –

E. TAB Agency shall test and report the domestic hot water temperature at all Shower Area equipment and fixtures, which have hot water or “tepid” capability. Test all re-circulating potable hot water systems near the end of pump runs to ensure proper temperature. CONTRACTOR shall make any adjustments required of domestic water heaters, mixing valves, etc., in order to achieve scheduled domestic hot water temperature shown on Plumbing Fixture Rough-in Schedule on Contract Drawings (+/- 5º F). The flow from re-circulating pumps through mixing/tempering valves shall be balanced to provide the minimum flow as specified by the mixing valve manufacturer for safe operation in all load conditions.

F. Balance all S.A., E.A. and O.A. air distribution devices to within 10% of specified C.F.M., yet main area pressurization and differentials.

G. Mark all flow C.F.M., balance valve set points, etc. on an 11”x17” reduced scale set of working drawings and submit to PROFESSIONAL with TAB report prior to completion of work.

H. Submit list of equipment with excessive vibration.

I. Submit the Test and Balance report as indicated above, along with the working drawing to PROFESSIONAL for approval prior to completion and substantial completion inspection to job.

J. Verify that all mechanical system controls, safety and shutdown interlock and sequence of operation is as specified. TAB Agency shall provide written certification that he has verified same and/or note any and all discrepancies. See paragraph 3.11 for specific certification.

3.8 TAB SITE VISIT COORDINATION

A. The TAB Agency shall inform the PROFESSIONAL, in writing seven (7) calendar days prior to his site visit for final TAB of systems such that PROFESSIONAL may be present to witness same, at PROFESSIONAL'S sole discretion. Changes to schedule shall be coordinated with and approved by PROFESSIONAL, with sufficient advance notice. TAB Agency shall be required to coordinate with PROFESSIONAL'S office representative, date of final inspection, and provide random tests and verification of TAB report information, at PROFESSIONAL'S selection.

B. It shall also be the responsibility of the TAB agency to include the cost of any opposite season check-out of all system components which might be required and modify air distribution delivery and/or temperature to any room, area, or zone which may require adjustment during the first year of system operation.

3.9 SYSTEM CHANGES

A. Final balancing changes shall be approved by the CONTRACTOR'S who installed the equipment. Changes may encompass, but not be restricted to, changing the pulleys, belts, dampers or adding dampers, balancing valves, etc.

B. The TAB Agency shall coordinate with the CONTRACTOR any changes required including belts, sheaves, etc. to balance systems within specified tolerances. All cost of any modifications is the responsibility of the CONTRACTOR.

3.10 VERIFICATION / INSPECTION

A. After the final TAB report is submitted and reviewed by the PROFESSIONAL, he will soon afterward schedule a verification inspection with the TAB Agency. At this inspection, the TAB Agency will test airflow flows, water flows, sound levels, control operation and sequence, for random air distribution grilles, fans, AHU's, equipment, piping, etc., as selected by PROFESSIONAL.

B. This inspection will last no longer than four (4) hours for each completed phase of the project. Should this verification information exceed the specified tolerance, the TAB Agency may be required to retest and balance the entire system(s) to these tolerances, solely at the PROFESSIONAL's discretion. A follow-up verification inspection shall then be required, and the procedure will begin again. The cost of these inspections, re-inspections, TAB and reports shall be borne by the CONTRACTOR.

3.11 CERTIFICATION

The TAB Agency shall provide the following written TAB certification within the final TAB

report (see also Section *Mechanical Submittals and Shop Drawings*):

> "The Testing, Adjusting and Balancing (TAB) Agency certifies that the HVAC air and plumbing water systems and controls have had a full range of tests and checks carried out by the TAB Agency, to determine if all components, sub-systems, systems and interfaces between systems operate in accordance with the Contract Documents. This includes all modes and sequences of control operation, interlocks and conditional and specified control responses to abnormal, safety and emergency conditions. The (TAB) Agency had provided to the OWNER the specified training and documentation on the operation of these systems such that these systems can be safely and efficiently operated in line with design requirements."

3.12 OWNER EDUCATION REQUIREMENTS AND INVOLVEMENT

See Section *Mechanical Close-out Requirements* for Owner Education requirements.

END OF SECTION

SECTION 31 23 14 – STRIPPING EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stripping Excavation for paving, roads, and parking areas.
   2. Stripping Excavation for site structures.

B. Related Sections:
   1. Excavation 31 23 16

1.2 REFERENCES

A. *Mississippi Standard Specifications for State Aid Road and Bridge Construction,* 2004 Edition.

1.3 SUBMITTALS

A. None

PART 2 EXECUTION

2.1 PREPARATION

A. Call Local Utility Line Information service at 811 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

2.2 CONSTRUCTION REQUIREMENTS

A. Contractor's operations and activities associated with Stripping Excavation shall meet the requirements of Section S-203.02.9 of the *Mississippi Standard Specifications for State Aid Road and Bridge Construction, 2004 Edition.*

2.3 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 31 23 14

SECTION 31 23 23.33 - FLOWABLE FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flowable fill.
2. Mixes.

B. Related Requirements:

1. None

1.2 DEFINITIONS

A. Excavatable Flowable Fill: A type of lean cement concrete fill used where future excavation may be required, such as utility trenches, bridge abutments, and culverts.

B. Utility: A buried pipe, duct, conduit, manhole, tank, or cable.

1.3 SUBMITTALS

A. Product Data: For flowable fill, LCCF, and mixes.

B. Shop Drawings:

1. Include placement methods, volumes, and stages; methods of verifying placement; and batching.
2. Include formwork arrangement, location of gauges to monitor pressures, and methods to determine density in the field.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Submit manufacturer's specifications, catalog cuts, and other engineering data needed to demonstrate compliance with specified requirements.

1. Submit mix designs, test reports, and complete descriptions of equipment, methods, and schedules of placement, showing compliance with specified properties. Include source, brand, and type of cement, foaming agents, and admixtures.
2. List and describe all equipment to be used for batching, mixing, and installing flowable fill.
3. Submit site plan, at scale, showing location of mixing plant and alignment of pump lines, if used to place flowable fill.

4. Submit manufacturer's literature and specifications for compression testing machine package to determine strength of flowable fill. The literature must detail testing machine features, including all required accessories to perform compression strength test of flowable fill according to ASTM C495/C495M or LCCF according to ASTM C796/C796M.
5. Submit test report for proposed flowable fill mix design, verifying that mix design conforms to specified flowable fill properties.

    a. Test proposed flowable fill mix according to these specifications and ASTM requirements specified herein.
    b. Furnish certification that flowable fill material fully conforms to specification requirements.
    c. Include, at minimum, the following information in test report for proposed flowable fill mix:

        1) Total gallons of water per cubic yard.
        2) Brand, type, composition, and quantity of cement.
        3) Brand, type, ASTM designation, lot number, and quantity of foaming agent.
        4) Cast wet density.
        5) Oven dry density.
        6) Water absorption, percent of volume.
        7) Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture, when used.
        8) Foam volume for LCCF.
        9) Compressive strength based on 7-day and 28-day compression tests.
        10) Water-cement ratio.
        11) Freeze-thaw resistance.
        12) Coefficient of permeability at confining stresses of 2 psi and 8 psi.
        13) Loss of air during pumping and air content before and after pumping.
        14) Density of preformed foam.
        15) Foam generation and other equipment used and foam discharge rate.
        16) Mixing times and temperature of water used.

6. Furnish certification by foaming agent manufacturer that proposed material, equipment, application procedures, installers, and setup are acceptable before production is initiated.
7. Submit calibration records and maintenance reports on all mixing equipment.
8. Submit procedures to place flowable fill below standing water and during extremes in temperatures.
9. Submit daily field reports and all test results of flowable fill.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Product Certificates:

1. For the source and origin for salvaged and reused portland cement, foaming agent, admixtures, and aggregate materials.
2. For the source for regional fine- and coarse-aggregate materials, portland cement, foaming agent, admixtures, and distance from Project Site.

B. Recycled Content of Materials: Use materials with recycled content such that the entire quantity of the flowable fill has the following minimum recycled content standards:

1. Fly ash, 30 percent, OR.
2. Ground granulated blast furnace, 40 percent, OR.
3. Silica fume, 4 percent, OR.
4. Metakaolin (clay based pozzolan), 10 percent.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

C. Licensed Professionals Qualifications: Professional engineer experienced in design of specified Work and licensed in State of Mississippi.

D. Furnish portland cement, foaming agent, and each fine- aggregate material from single source throughout Work.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F (4 degrees C).

1.7 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Mississippi Department of Transportation standards.

2.2 FLOWABLE FILL

A. Provide excavatable type and non-excavatable type consisting of the following material and admixture components:

1. Portland Cement: ASTM C150/C150M Type I - Normal. Other types of cement, including blended cements conforming to ASTM C595/C595M or performance cements conforming to ASTM C1157/C1157M, can be used if prior testing indicates acceptable results.
2. Fine Aggregates: Inert natural sand conforming to the requirements of ASTM C33/C33M.
3. Water: Potable and free from deleterious amounts of alkali, acid, and organic materials that would adversely affect setting time or strength of LCCF.
4. Admixtures:

    a. Manufacturers:

        1) BASF.
        2) Euclid Chemical Company.
        3) GCP Applied Technologies.
        4) Sika Corporation.
        5) W.R. Meadows.

    b. Air Entrainment: ASTM C260/C260M.
    c. Chemical Admixture: ASTM C494/C494M.

        1) Type A - Water reducing.
        2) Type B - Retarding.
        3) Type C - Accelerating.
        4) Type D - Water reducing and retarding.
        5) Type E - Water reducing and accelerating.
        6) Type F - Water reducing, high range.
        7) Type G - Water reducing, high range, and retarding.

    d. Fly Ash: According to ASTM C618 Class C or F and obtained from residue of electric generating plant using ground or powdered coal.
    e. Plasticizers: Provide high-range water reducing admixtures for flowable fill utilizing polycarboxylate technology. Based on manufacturer's recommended dosage, provide 1 to 3 fl. oz. per 100 lb. (65 to 196 mL per 100 kg) of cementitious materials to meet the requirements of ASTM C494 Type A water-reducing admixture and 4 to 26 fl. oz. (260 to 1 695 mL) for Type F high-range water-reducing admixture.

2.3 LIGHTWEIGHT CELLULAR CONCRETE FILL (LCCF)

A. LCCF is a mixture of portland cement and water slurry, combined with preformed foam to create air voids, that provides a strong, lightweight, durable, and inexpensive alternative to soil or fill replacement for geotechnical applications.

1. Foaming Agent:

    a. Provide foaming agent conforming to ASTM C869/C869M when tested according to ASTM C796/C796M.

b. Manufacturers:

1) BASF.
2) Cell-Crete Corporation.
3) GeoFill Cellular Concrete.
4) Innospec.
5) MixOnSite Cellular Concrete.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94/C94M, Option C.

B. Flowable Fill Design Mix:

1. Cement Content:

a. Excavatable: 40 to 100 lb./cu. yd (24 to 59 kg/cu. m).
b. Non-excavatable: 100 to 200 lb./cu. yd (59.3 to 119 kg/cu. m).

2. Fine Aggregate:

a. Excavatable: None.
b. Non-excavatable: 2,500 to 3,500 lb./cu. yd (1 483 to 2 076 kg/cu. m).

3. Fly Ash Content:

a. Excavatable: 0 to 600 lb./cu. yd (0 to 356 kg/cu. m).
b. Non-excavatable: 250 to 600 lb./cu. yd (148 to 356 kg/cu. m).

4. Water Content:

a. Excavatable: As required.
b. Non-excavatable: As required.

5. Air Entrainment:

a. Excavatable: 5 to 35 percent.
b. Non-excavatable: 5 to 15 percent.

6. 28-Day Compressive Strength:

a. Excavatable: Maximum 100 psi (690 kPa).
b. Non-excavatable: Minimum 125 psi (860 kPa).

7. Unit Mass (Wet):

a. Excavatable: 36 to 70 pcf (577 to 1 121 kg/cu. m).
b. Non-excavatable: 100 to 125 pcf (1 600 to 2 000 kg/cu. m).

8. Temperature, Minimum, at Point of Delivery:

    a. Excavatable: 50 degrees F (10 degrees C).
    b. Non-excavatable: 50 degrees F (10 degrees C).

C. LCCF Mix Designs: Provide an LCCF mix that meets the following requirements:

1. Maximum cast density of 24 to 30 pcf (385 to 480 kg/cu. m), minimum compressive strength at 28 days of 40 psi (275 kPa), bearing capacity of 2.9 tons/sq. ft (0.28 MPa).
2. Maximum cast density of 30 to 36 pcf (480 to 575 kg/cu. m), minimum compressive strength at 28 days of 80 psi (551 kPa), bearing capacity of 5.8 tons/sq. ft (0.56 MPa).
3. Maximum cast density of 36 to 42 pcf (575 to 675 kg/cu. m), minimum compressive strength at 28 days of 120 psi (827 kPa), bearing capacity of 8.6 tons/sq. ft (0.82 MPa).
4. Maximum cast density of 42 to 50 pcf (675 to 800 kg/cu. m), minimum compressive strength at 28 days of 160 psi (1 103 kPa), bearing capacity of 11.5 tons/sq. ft (1.10 MPa).

D. Provide adequate water content in design mix to produce self-leveling, flowable fill material at time of placement.

E. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Testing: Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.
2. Aggregate: ASTM C33/C33M for material properties and gradation.
3. Properties of plastic flowable fill design mix including:

    a. Temperature.
    b. Slump.
    c. Air entrainment.
    d. Wet unit mass.
    e. Yield.
    f. Cement factor.
    g. Foam content.

4. Properties of hardened flowable fill design mix including:

    a. One-day, seven-day, and 28-day compressive strength. Report compressive strength of each specimen and average specimen compressive strength.
    b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

B. Prepare delivery tickets containing the following information:

1. Project designation.
2. Date.
3. Time.
4. Class and quantity of flowable fill.
5. Actual batch proportions.
6. Free moisture content of aggregate.
7. Quantity of water withheld.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

3.2 PREPARATION

A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION OF FILL FOR ABANDONED UTILITIES

A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.

C. Place flowable fill using the following methods to ensure there are no voids:

1. Fill pipes and conduits from high end.
2. Fill manholes, tanks, and other structures from grade level access points.

D. After filling pipes and conduits, seal both ends.

3.4 FIELD QUALITY CONTROL

A. Perform inspection and testing according to ASTM C94/C94M.

1. Take samples for tests for every 150 cu. yd. (115 cu. m) of flowable fill, or fraction thereof, installed each day.
2. Sample, prepare, and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at three days, one at seven days, and two at 28 days.
3. Measure temperature at point of delivery when samples are prepared.
4. Perform in-place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill according to ASTM C403.
5. Perform tests at locations as directed by Architect/Engineer the manufacturer.

B. Defective Flowable Fill or LCCF: Either fill type failing to meet the following test requirements or fill delivered without the following documentation:

1. Test Requirements:

   a. Minimum temperature at point of delivery.
   b. Compressive strength requirements for each type of fill.

2. Documentation: Duplicate delivery tickets.

3.5 CLEANING

A. Remove spilled and excess flowable fill from Project Site.

B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION – 31 23 23.33

SECTION 32 01 19 – SOIL LIME WATER MIXING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Lime or Soil Cement.
   2. Mixing.
   3. Watering.
   4. Shaping.
   5. Compacting.
   6. Grading.

B. Related Sections:
   1. None

1.2 REFERENCES

A. Mississippi Department of Transportation:
   1. *Mississippi Standard Specifications for State Aid Road and Bridge Construction, 2004 Edition.*

1.3 DESIGN REQUIREMENTS

A. Per Section S-308 of the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition.*

1.4 SUBMITTALS

A. None

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Per Section S-308 of the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition.*

1.6 COORDINATION

A. Protect existing utilities and above ground amenities to remain in place.

PART 2 PRODUCTS

2.1 MATERIALS

A. Per Section S-308 of the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition.*

2.2 SOURCE QUALITY CONTROL AND TESTS

A. Per Section S-308 of the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition.*

PART 3 EXECUTION

3.1 Construction Requirements:

A. Per Section S-308 of the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition*.

3.2 ERECTION TOLERANCES

A. Per Section S-308 of the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition.*

END OF SECTION - 32 01 19

SECTION 32 91 20 – SITE RESTORATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Re-locating items moved during construction to their pre-construction location and condition.
2. Includes fine grading, placing, leveling, and compacting topsoil materials, providing and placing fertilizer, providing and placing seed, providing and placing sod, providing and placing erosion control items.

B. Related Sections:
1. Section 31 23 16 - Excavation.

1.2 QUALITY ASSURANCE

A. Furnish each material from single source throughout the Work.

B. Perform Work in accordance with State of Mississippi Highways standard.

PART 2 PRODUCTS

2.1 MATERIAL

A. Commercial Fertilizer: Per Section 32 92 01 – Commercial Fertilizer

B. Ammonium Nitrate: Per Section 32 92 02 – Ammonium Nitrate

C. Seeding: Per Section 32 92 19 - Seeding

D. Vegetative Materials for Mulch: Per Section 32 92 20 – Vegetative Materials for Mulch

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify original location of items.

B. Verify and restore items to their pre-construction condition.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 GENERAL CLEANUP

A. Remove all trash and construction debris.

3.4 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.5 PROTECTION OF INSTALLED WORK

A. Prohibit construction traffic over topsoil.

3.6 SCHEDULES

A. Compacted topsoil thicknesses:
   1. Seeded Grass: 6 inches.
   2. Sod: 4 inches.

END OF SECTION - 32 91 20

SECTION 32 92 01 – COMMERCIAL FERTILIZER

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fertilizing.

B. Related Sections:
1. None

1.2 REFERENCES

A. *Mississippi Standard Specifications for State Aid Road and Bridge Construction, 2004 Edition.*

1.3 SUBMITTALS

A. See requirements listed in the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition.*

PART 2 PRODUCTS

2.1 COMMERCIAL FERTILIZER

A. Commercial Fertilizer (13-13-13) shall comply with the fertilizer laws of the State of Mississippi in effect on the date of the letting and Section S-715.02 of the *Mississippi Standard Specification for State Aid Road and Bridge Construction, 2004 Edition.*

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.

END OF SECTION - 32 92 01

SECTION 32 92 19 - SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Maintenance.

B. Related Sections:
1. Section 31 23 14 – Stripping Excavation
2. Section 31 23 16 - Excavation

1.2 REFERENCES

A. ASTM International:

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

A. Product Data: Submit data for seed mix, fertilizer, mulch,, and other accessories.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

    a. Certify source for regional materials and distance from Project site.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.7 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Perform Work according to State of Mississippi Highways standards.

C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for two cuttings.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials according to State of Mississippi Highways standards.

2.2 SUSTAINABILITY CHARACTERISTICS

A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.3 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil as indicated in analysis.

C. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

E. Erosion Fabric: Jute matting, open weave.

F. Herbicide.

G. Stakes: Softwood lumber, chisel pointed.

H. String: Inorganic fiber.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.

B. Apply fertilizer at application rate recommended by soil analysis.

C. Apply after smooth raking of topsoil and prior to roller compaction.

D. Do not apply fertilizer at same time or with same machine used to apply seed.

E. Mix fertilizer thoroughly into upper 2 inches of topsoil.

F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed at rate per the recommendation of the manufacturer evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

D. Roll seeded area with roller not exceeding 112 lbs/linear foot.

E. Immediately following seeding and compacting, apply mulch to thickness of 1/8 inches. Maintain clear of shrubs and trees.

F. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.4 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate per the direction of the manufacturer evenly in one pass.

B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.5 SEED PROTECTION

A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.6 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.

I. Protect seeded areas with warning signs during maintenance period.

3.7 SCHEDULE

A. Front Seeded Area: Grass seed mixture specified, 3 inch top soil.

B. Rear Seeded Area: Grass seed mixture specified except substitute Clover for Kentucky Blue Grass, 2 inch top soil.

END OF SECTION - 32 92 19

SECTION 32 92 20 – VEGETATIVE MATERIALS FOR MULCH

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vegetative material for mulch

B. Related Sections:
   1. None

1.2 REFERENCES

A. *Mississippi Standard Specifications for State Aid Road and Bridge Construction, 2004 Edition*.

1.3 SUBMITTALS

A. See the *Mississippi Standard Specifications for State Aid Road and Bridge Construction, 2004 Edition* for submittal requirements.

PART 2 PRODUCTS

2.1 MATERIAL

A. Unless otherwise permitted in writing by the Engineer, Type I shall be furnished and used.

B. Type I consists of approved baled straw of wheat, oat, rye grain, or rice or broomsage or bahia grass (with seed heads) which has reached maturity prior to cutting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 CONSTRUCTION REQUIREMENTS

A. Other operations and activities associated with seeding shall meet the applicable requirements of Section S-214 of the *Mississippi Standard Specifications for State Aid Road and Bridge Construction, 2004 Edition.*

END OF SECTION - 32 92 20

SECTION 33 12 16 - WATER DISTRIBUTION GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valves.
   2. Valve boxes.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   2. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
   3. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
   4. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:
   1. NSF 61 - Drinking Water System Components - Health Effects

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Provide Operation and Maintenance Data for valves.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with the Jones County School District's public work's standards and the local water service provider's public work's standard.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation Meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Prepare valves and accessories for shipment according to AWWA Standards and seal valve and ends to prevent entry of foreign matter into product body.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with Jones County School District's public work's standards local water service provider's public work's standard.

1.11 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Furnish one tee wrench to Owner; required length.

PART 2 PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:
   1. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.2 RESILIENT WEDGE GATE VALVES

A. Manufacturers:
   1. Mueller or an approved equal.

B. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.
   1. Resilient seats.
   2. Stem: Non-rising bronze stem.
   3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
   4. Ends: Flanged, mechanical joint or bell end connections.
   5. Coating: AWWA C550; interior/exterior.
   6. Sizes 12 inch diameter and smaller: 200 psig.
   7. Sizes 16 inch diameter and larger: 150 psig.

2.3 VALVE BOXES

A. 12 inch diameter Valves and Smaller: Domestic cast iron, two-piece, screw type.

B. Valves Larger than 12 inch diameter: Domestic cast iron, three-piece, screw type; round base.

C. Cast iron lid, marked "Water".

2.4 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 32 16 23.

B. Valve Box Aligner: High-strength, plastic device designed to automatically center valve box base and prevent valve box base from shifting off center during backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Determine exact location and size of valves from Drawings; obtain clarification and directions from Architect/Engineer prior to execution of work.

C. Verify invert elevations prior to excavation and installation of valves.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
   1. Notify Architect/Engineer not less than five working days in advance of proposed utility interruption.
   2. Do not proceed without written permission from the Architect/Engineer.

D. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 16.

3.3 INSTALLATION

A. Install valves in conjunction with pipe laying; set valves plumb.

B. Provide buried valves with valve boxes installed flush with finished grade.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform pressure test on domestic site water distribution system in accordance with AWWA C600.

END OF SECTION -33 12 16

SECTION 33 31 11 - PUBLIC SANITARY SEWERAGE GRAVITY PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewerage piping.
2. Connection to existing manholes.
3. Wye branches and tees.
4. Sanitary laterals.
5. Bedding and cover materials.

B. Related Requirements:
1. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this Section.
2. Section 33 05 61 - Concrete Manholes: Manholes for sanitary sewerage piping.

1.2 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

C. EPDM: Ethylene-propylene-diene terpolymer.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.

7. AWWA C153 - Ductile-Iron Compact Fittings.

C. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A123/.
3. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
4. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).
5. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).
7. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
8. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
9. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
10. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
11. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals (Metric).
12. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
13. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
14. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
15. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
16. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
17. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
18. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
19. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
21. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
22. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

23. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
24. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with the Jones County School District's Director of Maintenance.

C. Notify affected utility companies at least 72 hours prior to construction.

1.5 PREINSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum four weeks prior to commencing Work of this Section.

C. Attendance Roster: Include the Jones County School District's director of maintenance, the project architect, and the civil engineer.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.

E. Manufacturer Instructions:

1. Indicate special procedures required to install specified products.
2. Submit detailed description of procedures for connecting new sewer to existing sewer line and directional drilling installation.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:

1. Submit qualifications for manufacturer and installer.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and cleanouts.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 QUALITY ASSURANCE

A. Perform Work according to Jones County School District’s Maintenance Department’s standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Store valves in shipping containers with labeling in place.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

A. Plastic Pipe:

1. Material: PVC.
2. Comply with ASTM D3034, SDR- 26.
3. Inside Nominal Diameter: as shown on the drawings.
4. End Connections: Bell-and-spigot style, with rubber-ring-sealed gasket joint.
5. Fittings: PVC.
6. Joints:

a. Elastomeric gaskets.
b. Comply with ASTM F477.

2.2 MANHOLES

A. As specified in Section 330561 - Concrete Manholes.

2.3 FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

A. Manufacturers:

1. Kor-N-Seal.
2. Substitutions: Approved Equal.

B. Description:

1. Material: EPDM.
2. Comply with ASTM C923.
3. Attachment: Series-300 stainless-steel clamp and hardware.

2.4 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 03 30 00 - Cast-in-Place Concrete.
2. Strength: 4,000 psi at 28 days.
3. Air entrained.
4. Finish: Rough troweled.

B. Concrete Reinforcement: As specified in Section 03 20 00 - Concrete Reinforcing.

2.5 MATERIALS

A. Coarse Aggregate:

1. Type 57: Conforming to *Mississippi Standard Specifications for State Aid Road and Bridge Construction, Latest Edition*.

2. Crushed Limestone Size #610: Conforming to *Mississippi Standard Specifications for State Aid Road and Bridge Construction, Latest Edition*

B. Select Bedding:

1. No native trench excavation allowed. Imported blended 50/50 mixture of sand and coarse aggregate free of silt, clay, loam, friable or soluble materials, and organic matter with following gradation:

Sieve Size	Percent Passing
3/8”	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	10 - 30
No. 100	2 - 10

C. Select Backfill:

1. Trench Excavated: Material free of large clods, rocks, or foreign matter that might damage pipe, suitable for compaction, and meeting Engineer’s approval.

2. Imported: Blend of natural or blended aggregate, sand, silt, and clay free or large clods, rocks, or foreign matter that might damage pipe. PI not less than 10 or greater than 20. Liquid Limit less than 30.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that trench cut or the excavation base is ready to receive Work of this Section.

C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Correct over-excavation with coarse aggregate.

C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

D. Protect and support existing sewer lines, utilities, and appurtenances.

E. Utilities:

1. Maintain profiles of utilities.
2. Coordinate with other utilities to eliminate interference.
3. Notify Architect/Engineer if crossing conflicts occur.

3.3 INSTALLATION

A. Trenching

1. Remove existing paved surfaces where necessary. Pavement shall be sawcut at trench limits. Any pavement damaged outside of trench limits shall be replaced at the expense of the contractor.
2. Excavate subsoil required for utilities.
3. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume.
4. Perform excavation within 24 inches of existing utility service or in accordance with utility's requirements.
5. Do not advance open trench more than 200 feet ahead of installed pipe.
6. Cut trenches to width of pipe O.D. plus 24” on either side of pipe. Remove water or materials that interfere with Work.

7. Excavate trenches to depth indicated on Drawings, or as required to accommodate installation of encasement.. Provide uniform and continuous bearing and support for bedding material and pipe.
8. Do not interfere with 45 degree bearing splay of foundations.
9. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
10. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer.
11. Cut out soft areas of subgrade not capable of compaction in place. Backfill with material approved by Engineer and compact to density equal to or greater than requirements for subsequent backfill material.
12. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
13. Remove excess subsoil not intended for reuse, from site.
14. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.

B. Sheeting and Shoring

1. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
2. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
3. Design sheeting and shoring to be removed at completion of excavation work.
4. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
5. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

C. Piping:

1. Install pipe, fittings, and accessories according to ASTM D2321, and seal joints watertight.
2. Lay pipe to slope gradients as indicated on Drawings.
3. Begin at downstream end of system and progress upstream.
4. Bedding: As indicated on Drawings.
5. Lay bell-and-spigot pipe with bells upstream.
6. PE Pipe Encasement: Comply with AWWA C105, Method A.
7. Backfill and compact as specified in Section 31 23 16.13 - Trenching.
8. Do not displace or damage pipe when compacting.
9. Connect pipe to existing sewer system at existing manhole.

D. Manholes: As specified in Section 330561 - Concrete Manholes.

E. Connections to Existing Manholes:

1. Drilling:

a. Core drill existing manhole to clean opening.
b. Use of pneumatic hammers, chipping guns, sledge hammers are not permitted.

2. Install watertight neoprene gasket and seal with nonshrink concrete grout.
3. Encasement:

a. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint.
b. Use epoxy binder between new and existing concrete.

4. Prevent construction debris from entering existing sewer line when making connection.

F. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.
2. Use standard fittings of same material and joint type as sewer main.
3. Maintain minimum 5-foot separation distance between wye connection and manhole.
4. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.
5. Mount saddles with solvent cement or gasket and secure with metal bands.
6. Lay out holes with template, and cut holes with mechanical cutter.

G. Sanitary Laterals:

1. Construct laterals from wye branch to terminal point at right-of-way.
2. Where depth of main pipeline warrants, construct riser-type laterals from wye branch.
3. Minimum Depth of Cover over Piping: 2 feet.
4. Minimum Separation Distance between Laterals: 3 feet.
5. Install watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral.
6. Marker Stake:

a. Install temporary marker stake extending from end of lateral to 12 inches above finished grade.
b. Paint top 6 inches of stake with fluorescent orange paint.

H. Backfilling:

1. Backfill trenches to contours and elevations with unfrozen fill materials.
2. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
3. Place material in continuous layers as follows:
   a. Place bedding material at trench bottom.
      i. Class A-1: Plain or reinforced concrete cradle. No compaction required.
      ii. Class A-II: Maximum 8-inch loose lifts. Compact to 95 percent of maximum density.
      iii. Class B: Maximum 8-inch loose lifts. Compact to 95 percent of maximum density.

iv. Class C: Maximum 8-inch loose lifts. Compact to 95 percent of maximum density.

b. Select Backfill under other improvements: Maximum 8 inches compacted depth.

c. General Backfill: Machine place and densify.

4. Employ placement method that does not disturb or damage, utilities in trench.
5. Maintain optimum moisture content of fill materials to attain required compaction density.
6. Do not leave trench open at end of working day.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

A. Request inspection by Engineer prior to and immediately after placing bedding.

B. Pressure Test: Pressure lines to 4 PSIG, let stabilize 3.5 – 4.0 PSIG, measure time to reach 2.5 PSIG. When elapsed time exceeds allowable times in table, repair and retest.

ALLOWABLE SECONDS FOR PRESSURE TO DROP TO 2.5 PSIG
(Based on 0.003 cfm per sq. ft. and 2.0 cfm)

Length of Test Section (LF)	Pipe Diameter (Inches)						
	4	6	8	10	12	15	18
25	4	16	22	28	93	62	89
50	10	33	43	55	158	124	178
75	19	49	66	83	240	186	89
100	30	66	87	95	305	248	178
125	41	82	109	110	349	372	267
150	60	98	131	132	381	455	375
175	79	115	153	154	413	575	510
200	86	131	174	176	436	575	610
225	95	147	196	294	459	575	610
250	109	164	218	338	459	575	610
275	113	189	240	382	459	575	610
300	122	19	262	382	459	575	610
350	131	213	306	382	459	575	610
400	139	230	306	382	459	575	610
450	147	246	306	382	459	575	610

C. Infiltration Test: Visible leakage not allowed.

D. Deflection Test (PVC): Mandrel test in accordance with Uni-Bell Plastic Pipe Association "go, no go" recommendations. Mandrel sized so that will not pass when deflection exceeds 5%. Testing performed no sooner than 30 days after installation. Mandrel diameter sizes listed below.

Nominal Size	Average I.D.	Base I.D.	Mandrel Diameter
6	5.764	5.612	5.33
8	7.715	7.488	7.11
10	9.644	9.342	8.87
12	11.480	11.102	10.55
15	14.053	13.575	12.89

E. Vertical Alignment: Constructed line exceeding planned elevations or slopes by 0.10 feet and/or 0.02% slope are not acceptable.

F. Internal CCTV Inspection: May be requested by Owner/Engineer and shall be accomplished with Contractor's assistance.

G. Request inspection prior to and immediately after placing bedding.

H. Compaction Testing: In accordance with ASTM D1557, ASTM D698, AASHTO T180 ,ASTM D2922, and ASTM D3017.

I. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

END OF SECTION - 33 31 11

SECTION 33 31 23 - SANITARY SEWERAGE FORCE MAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Force mains.
2. Bedding and cover materials.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

C. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
3. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
4. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
5. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
6. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 COORDINATION

A. Coordinate Work of this Section with connection to existing municipal sewer utility service.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer information indicating pipe material used, pipe accessories, valves.

B. Shop Drawings:

1. Indicate piping piece numbers and locations.
2. Indicate restrained joint locations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained joints, including establishing lengths of restrained joint piping required.

E. Manufacturer Instructions: Submit special procedures required to install specified products.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statement:

1. Submit qualifications for manufacturer, installer, and licensed professional.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record invert elevations and actual locations of pipe runs and connections.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work according to MDEQ standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Do not place materials on private property without written permission of property owner.
3. Do not stack pipe higher than recommended by pipe manufacturer.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.
3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 FORCE MAIN PIPE

A. HDPE Pressure Sewer Pipe (SDR 11) and Fittings, 12-Inch Nominal Size and Smaller:

1. Comply with ASTM D3035.
2. SDR: 11.

2.2 MATERIALS

A. Bedding and Cover:

1. Bedding: 610 Crushed Stone
2. Cover: Fill Type: CL Material
3. Soil Backfill from above Pipe to Finish Grade: Native
4. Subsoil: No rocks more than 6 inches in diameter, frozen earth, or foreign matter.

2.3 ACCESSORIES

A. Pipe Location Tracer Wire: 10 Guage Tracer Wire

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive Work.

B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Correct over-excavation with fine aggregate.

B. Remove large stones or other hard matter capable of damaging pipe or of impeding consistent backfilling or compaction.

3.3 INSTALLATION

A. Bedding:
1. Place bedding material at trench bottom.
2. Level materials in continuous layers not exceeding 8 inches in depth.
3. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Install pipe, fittings, and accessories as indicated on Drawings.
2. Route piping in straight line.
3. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches.
4. Backfilling and Compacting:
   a. Do not displace or damage pipe while compacting.

5. Connect to municipal sewer system as shown on the drawings.

C. Thrust Restraints:

1. Provide pressure pipeline with restrained joints or concrete thrust blocking at pumps, bends, tees, and changes in direction.

D. Cradles and Encasements: Provide concrete cradles and encasements for pipelines where indicated on Drawings.

3.4 FIELD QUALITY CONTROL

A. Inspections: Request inspection by Architect/Engineer prior to and immediately after placing bedding.

B. Pressure Testing:

1. Pressure:

a. Not less than 150 psi in excess of maximum static pressure, whichever is greater.
b. Maintain pressure within plus or minus 5 psi of test pressure.

2. Time: Conduct test for minimum of two hours.
3. Initial Procedure:

a. Install corporation cocks at high points.
b. Slowly fill section to be tested with water, expelling air from piping at high points from air vents and by opening corporation cocks.
c. Close air vents and corporation cocks after air is expelled.
d. Raise pressure to specified test pressure.

4. Testing:

a. Observe joints, fittings, and valves under test.
b. Remove and replace cracked pipes, joints, fittings, and valves showing visible leakage.
c. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.

5. Leakage:

a. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
b. Maximum Allowable Leakage:

1) $L = SD \times \sqrt{P}/C$.
2) L = testing allowance, gph.
3) S = length of pipe tested, feet.
4) D = nominal diameter of pipe, inches.
5) P = average test pressure during hydrostatic test, psig.
6) C = 148,000.

c. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
d. If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
e. Correct visible leaks regardless of quantity of leakage.

C. Compaction Testing:

1. Comply with ASTM D698.

3.5 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION – 33 31 23

GENERAL NOTES:

1. THE CONTRACTOR SHALL FOLLOW ALL FEDERAL, STATE, AND LOCAL ORDINANCES AT ALL TIMES.
2. THE CONTRACTOR SHALL CHECK PLANS FOR CONFLICTS AND DISCREPANCIES PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS BEFORE PERFORMING ANY WORK IN THE AFFECTED AREA.
3. THE CONTRACTOR IS REQUIRED TO NOTIFY MISSISSIPPI ONE CALL PRIOR TO BEGINNING CONSTRUCTION. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR NOTIFYING ALL UTILITY COMPANIES AT A MINIMUM OF 48 HOURS PRIOR TO COMMENCING WORK IN THE PROJECT AREA AND TO COORDINATE HIS WORK WITH THE INVOLVED UTILITIES.
4. LOCATIONS, ELEVATIONS, AND DIMENSIONS OF EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES ARE SHOWN ACCORDING TO THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARING THESE PLANS. CONTRACTOR SHALL VERIFY THE LOCATIONS, ELEVATIONS, AND DIMENSIONS OF ALL EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES AFFECTING THIS WORK PRIOR TO CONSTRUCTION AND COORDINATE WITH THE APPROPRIATE UTILITY COMPANY. ALL NECESSARY FIELD REVISIONS ARE SUBJECT TO REVIEW AND APPROVAL BY THE ENGINEER PRIOR TO CONSTRUCTION.
5. THE CONTRACTOR SHALL BEAR FULL RESPONSIBILITY FOR THE PROTECTION OF ALL PRIVATE AND PUBLIC UTILITIES EVEN THOUGH THEY MAY NOT BE SHOWN ON THE PLANS. ANY UTILITY THAT IS DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE UTILITY OWNER BY THE CONTRACTOR. IT IS ALSO THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE HIS WORK WITH ALL LOCAL UTILITY COMPANIES.
6. THE CONTRACTOR SHALL PROVIDE ACCESS TO THE SITE FOR ANY UTILITY COMPANY FOR THE PURPOSE OF MAINTENANCE AND RELOCATION.
7. THE CONTRACTOR SHALL NOT COMMENCE WITH ANY FORM OF CONSTRUCTION WITHOUT NOTIFYING THE ENGINEER AT LEAST 48 HOURS IN ADVANCE TO ALLOW FOR FIELD REPRESENTATIVE ARRANGEMENT.
8. THE CONTRACTOR SHALL MAINTAIN LOCAL TRAFFIC AT ALL TIMES. CONTRACTOR IS RESPONSIBLE FOR SAFELY STAGING CONSTRUCTION MATERIALS IN THE RIGHTS-OF-WAY OR PRIVATE EASEMENTS WHILE ALSO KEEPING ROADS OPEN FOR SAFE TRAVEL. CONTRACTOR SHALL PROVIDE ALL SIGNAGE, FLAGMEN, BARRICADES, ETC. TO PROVIDE A SAFE CONSTRUCTION STAGING AREA.
9. THE CONTRACTOR SHALL VERIFY MINIMUM SEPARATION BETWEEN POTABLE WATER LINES AND SANITARY SEWER LINES IN AREAS WHERE NEW SANITARY SEWER IS BEING INSTALLED.
10. ALL PROPOSED WATER LINES, SEWER LINES, AND FORCE MAINS SHALL HAVE A MINIMUM COVER OF 36" FROM THE FINAL GRADING PLAN.
11. ALL PROPOSED WATER LINES, SEWER LINES, FORCE MAINS, AND ALL SERVICE CONNECTIONS SHALL HAVE TRACER WIRE INSTALLED IN THE TRENCH PER THE MANUFACTURER'S SPECIFICATIONS.
12. IN THE EVENT THAT UTILITY SHUT DOWN IS NECESSARY TO COMPLETE CONSTRUCTION, CONTRACTOR SHALL COORDINATE ALL ACTIVITY WITH ENGINEER AND UTILITY OWNER.
13. ALL UTILITIES THAT ARE TO BE REMOVED SHALL BE CAPPED AT THE PROPERTY LINE PER THE UTILITY OWNER'S SPECIFICATIONS.
14. THE EROSION CONTROL DEVICES REFERENCED IN THESE PLANS ARE A MINIMUM REQUIREMENT. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT SILT DOES NOT LEAVE THE RIGHT OF WAY OR CONTAMINATE WATERS OF THE U.S. DURING CONSTRUCTION.
15. THE CONTRACTOR SHALL USE CARE IN WORKING NEAR ANY AND ALL EXISTING ITEMS WHICH ARE NOT TO BE REMOVED. ANY DAMAGE DONE TO THESE EXISTING ITEMS BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
16. CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE ON SITE AND SHALL BACKFILL/GRADE AS NECESSARY. RE-GRADE ANY DISTURBED ROADSIDE DITCHES TO RE-ESTABLISH FLOW PATH.
17. ALL GROUNDS DISTURBED BY CONSTRUCTION ARE TO BE RESTORED COMPLETELY TO THE PRE-CONSTRUCTION CONDITION OR BETTER. CONTRACTOR SHALL BE RESPONSIBLE FOR CAREFULLY REMOVING & RESTORING ALL VEGETATION (DECORATIVE SHRUBS, PLANTS, TREES, ETC.) AND OTHER EXISTING STRUCTURES (CONCRETE CURB & GUTTER, PAVEMENT, STRUCTURES AND OTHER OWNER FURNISHINGS, ETC.).
18. CONTRACTOR SHALL KEEP A CLEAN SITE AND SHALL KEEP THE EXISTING ROADS FREE OF EXCESS SOILS AND CONSTRUCTION DEBRIS. CONTRACTOR IS RESPONSIBLE FOR SWEEPING AND WASHING DIRT AS REQUIRED.
19. CONTRACTOR SHALL BE RESPONSIBLE FOR FOR ALL COST OF PROPERLY DISPOSING DEMOLISHED MATERIAL OFF SITE.
20. REFER TO THE STRUCTURAL DRAWINGS FOR BUILDING PAD EXCAVATION DETAILS AND SPECIFICATIONS.
21. SITE RESTORATION IS REQUIRED FOR ALL DISTURBED GROUND THAT WILL NOT BE COVERED BY A BUILDING, SIDEWALK, OR PAVEMENT. THESE AREAS SHALL BE GRASSED AND FERTILIZED PER THE VEGETATION SCHEDULE SHOWN ON THIS SHEET.

VEGETATION SCHEDULE

EROSION CONTROL ITEM		SEASONAL APPLICATIONS – DATES & RATES				
		SPRING & SUMMER		FALL & WINTER		
REQUIRED	DESCRIPTION	RATES	DATES	RATES	DATES	
	TOPSOIL OR SLOPE TREATMENT	4" THICK	MARCH 1 TO SEPTEMBER 1	4" THICK	SEPTEMBER 1 TO MARCH 1	TOPSOIL IS REQUIRED IN AREAS DIRECTED BY THE ENGINEER
	GROUND PREPARATION	PER SQ. YD.	MARCH 1 TO SEPTEMBER 1	PER SQ. YD.	SEPTEMBER 1 TO MARCH 1	GROUND PREPARATION IS REQUIRED ON AREA TO RECEIVE SOLID SODDING OR SEEDING
	AGRICULTURAL LIMESTONE	2 TONS / ACRE	MARCH 1 TO SEPTEMBER 1	2 TONS / ACRE	SEPTEMBER 1 TO MARCH 1	LIMESTONE SHALL BE MECHANICAL SPREAD UNIFORM AND INCORPORATED INTO THE SOIL PRIOR TO PLANTING
X	COMBINATION FERTILIZER (13-13-13)	1000 LBS / ACRE	MARCH 1 TO SEPTEMBER 1	1000 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	FERTILIZER SHALL BE MECHANICAL SPREAD UNIFORM AND INCORPORATED INTO THE SOIL PRIOR TO PLANTING
	SUPERPHOSPHATE	1000 LBS / ACRE	MARCH 1 TO SEPTEMBER 1	1000 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	
X	SEEDING (COMMON BERMUDA GRASS)	20 LBS / ACRE	MARCH 1 TO SEPTEMBER 1	20 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	SEED REQUIRED ON DISTURBED AREAS. UNHULLED SEED MAY BE REQUIRED DURING THE DORMANT SEASON AS DIRECTED.
	SEEDING (BAHIA GRASS)	25 LBS / ACRE	MARCH 1 TO SEPTEMBER 1	25 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	SEED REQUIRED ON DISTURBED AREAS
	SEEDING (TEXOKA BUFFALO GRASS)	30 LBS / ACRE	MARCH 1 TO SEPTEMBER 1	30 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	SEED REQUIRED ON SLOPES STEEPER THAN 3:1
	SEEDING (TALL FESCUE)			20 LBS / ACRE	AUGUST 1 TO APRIL 1	SEED REQUIRED ON DISTURBED AREAS
	SEEDING (CRIMSON CLOVER)			25 LBS / ACRE	AUGUST 1 TO APRIL 1	SEED REQUIRED ON DISTURBED AREAS
X	VEGETATIVE MATERIALS FOR MULCH	2 TONS / ACRE	MARCH 1 TO SEPTEMBER 1	2 TONS / ACRE	SEPTEMBER 1 TO MARCH 1	
	SOLID SODDING	PER SQ. YD.	MARCH 1 TO SEPTEMBER 1	PER SQ. YD.	SEPTEMBER 1 TO MARCH 1	SOLID SOD REQUIRED ON AREAS SPECIFIED IN THE CONTRACT OR BY THE ENGINEER
	WATERING	20 GALS / SY	MARCH 1 TO SEPTEMBER 1	20 GALS / SY	SEPTEMBER 1 TO MARCH 1	REQUIRED ON ALL AREAS RECEIVING SOLID SOD
TEMPORARY EROSION CONTROL MEASURES						
	LIGHT GROUND PREPARATION	PER SQ. YD.		PER SQ. YD.		REQUIRED ON ALL AREAS RECEIVING TEMPORARY GRASSING
	SEEDING (BROW TOP MILLET)	20 LBS / ACRE	MARCH 1 TO SEPTEMBER 1			USE AS DIRECTED BY THE ENGINEER
X	SEEDING (RYE GRASS)			25 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	USE AS DIRECTED BY THE ENGINEER
	SEEDING (OATS)			90 LBS / ACRE	SEPTEMBER 1 TO MARCH 1	USE AS DIRECTED BY THE ENGINEER
X	VEGETATIVE MATERIALS FOR MULCH	2 TONS / ACRE		2 TONS / ACRE		USE AS DIRECTED BY THE ENGINEER
X	COMBINATION FERTILIZER (13-13-13)	500 LBS / ACRE		500 LBS / ACRE		USE AS DIRECTED BY THE ENGINEER

SYMBOLIC LEGEND

FENCE
EXISTING CONTOURS — 291
PROPOSED CONTOURS — 291
LIGHT POLE — LP
POWER POLE — PP
OVERHEAD ELECTRIC — OHE
BURIED POWER — PWR
GAS LINE — GAS
BURIED COMMUNICATION LINE — COMM
EX. WATER LINE — WTR
WATER VALVE — WV
WATER METER — W
UNKNOWN UTILITY — UTL
SANITARY SEWER MANHOLE — S
GRAVITY SEWER — SWR
SANITARY SEWER LIFT STATION — LS
PROPOSED 3" WATER LINE — 3 WL
PROPOSED 2" FORCEMAIN — 2 FM
SILT FENCE — SF

1 C0.00 **GENERAL NOTES**

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PryorMorrow

South Jones High School
Athletic Buildings
Jones County School District
Ellisville, MS

MARK	DATE	DESCRIPTION
	June 25, 2025	Construction Documents
	July 18, 2025	Addendum #1

JACOB A. KEYS — LICENSED PROFESSIONAL ENGINEER — 7/18/2025 — 19179 — STATE OF MISSISSIPPI

PROJECT NO. 2024922
DRAWN BY: JAK
CHECKED BY:

C0.00

NOTES:

1. IF A CONNECTION TO AN EXISTING UTILITY IS REQUIRED, THE CONTRACTOR SHALL FIELD LOCATE AND EXPOSE THE EXISTING UTILITY TO VERIFY ALL MATERIALS AND DIMENSIONS PRIOR TO THE PURCHASE OF ANY MATERIALS AND INSTALLATION OF ANY PROPOSED UTILITIES.
2. REFER TO THE MECHANICAL/PLUMBING DRAWINGS FOR CONNECTING TO THE BUILDING.
3. REFER TO THE ARCHITECTURAL & STRUCTURAL DRAWINGS FOR DETAILS AND DIMENSIONS OF THE BUILDING SLAB AND BUILDING SLAB FOUNDATION DETAILS.
4. ALL SPACING FOR CONCRETE SIDEWALK SHALL NOT EXCEED 5' IN EITHER DIRECTION UNLESS AUTHORIZED BY THE ENGINEER.
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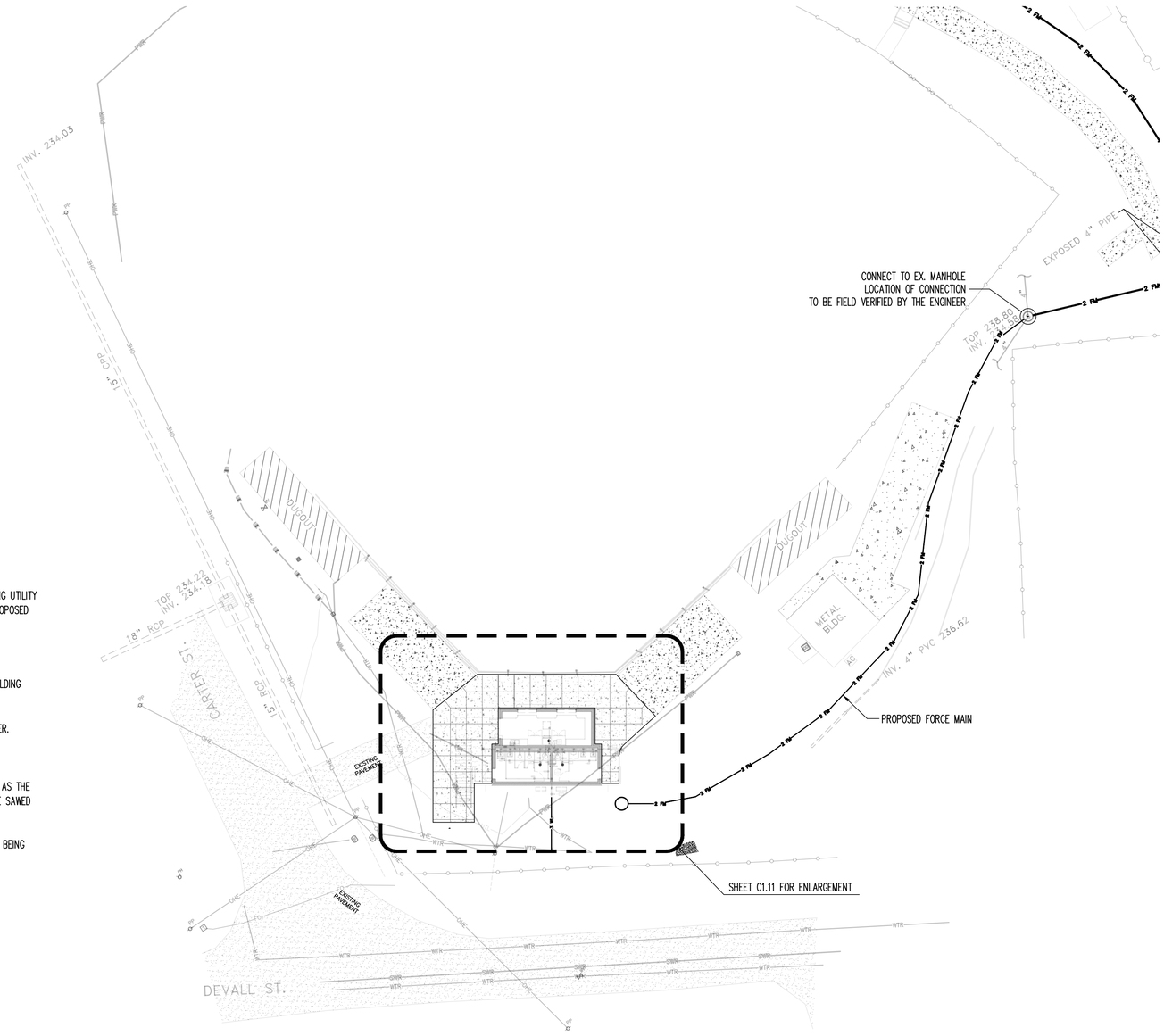

SOFTBALL PRESSBOX SITE PLAN

1 / C1.10

0' 10' 20'
5' 15'

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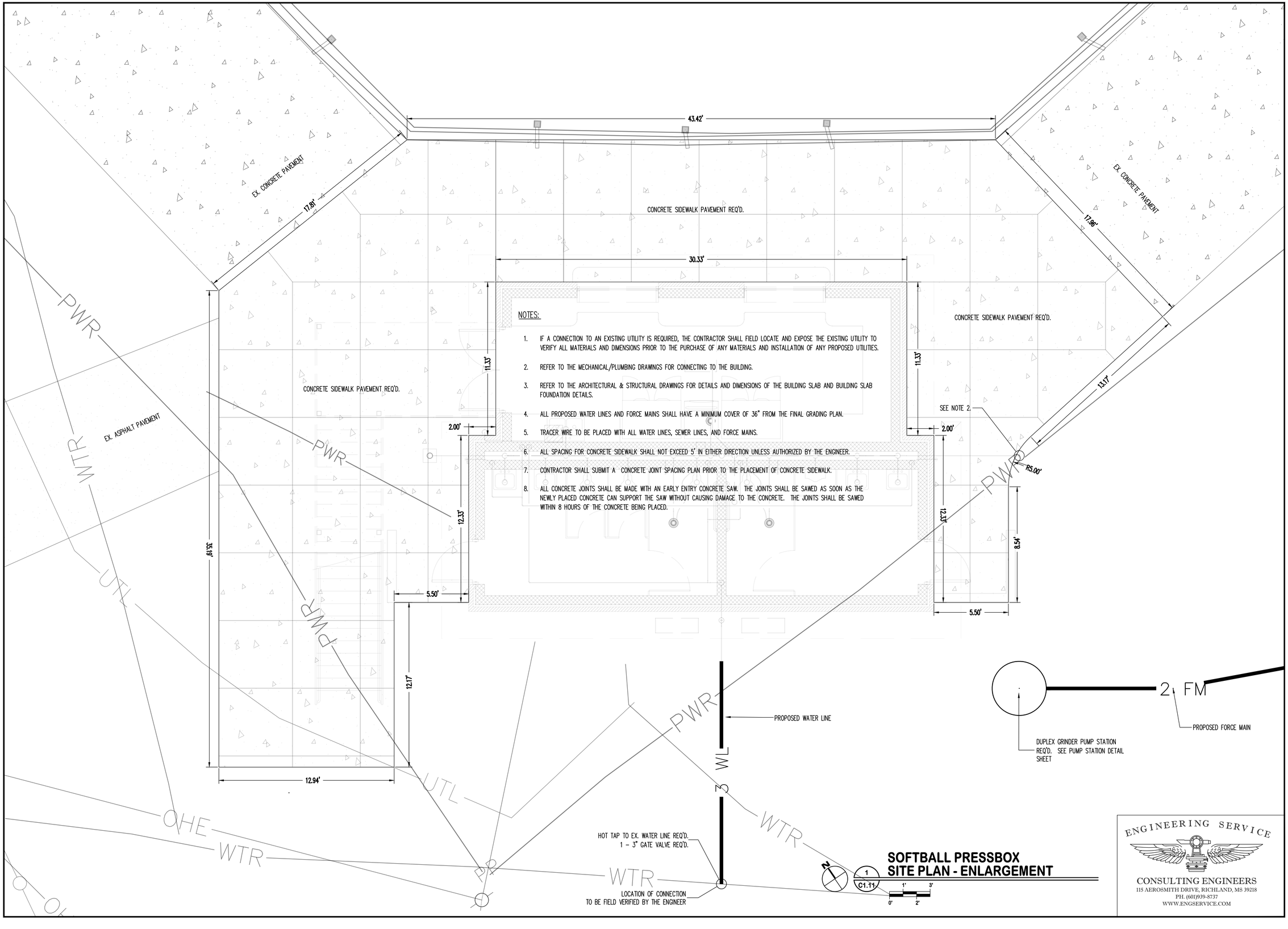

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SOFTBALL PRESSBOX SITE PLAN - ENLARGEMENT

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PROJECT NO. 2024922
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C1.11

FFE = 236.72

EXISTING PAVEMENT

EXISTING PAVEMENT

236.69 236.47 236.37 236.46 236.54 236.64 236.47 236.61 236.24 236.32 236.47 236.69 236.47 236.36 236.47 236.38 236.27 236.23 236.03 236.67 236.47 236.38 236.00 236.72

236.53

SOFTBALL PRESSBOX
GRADING PLAN

2

1
C1.20

1' 3' 5'
0' 2' 4'

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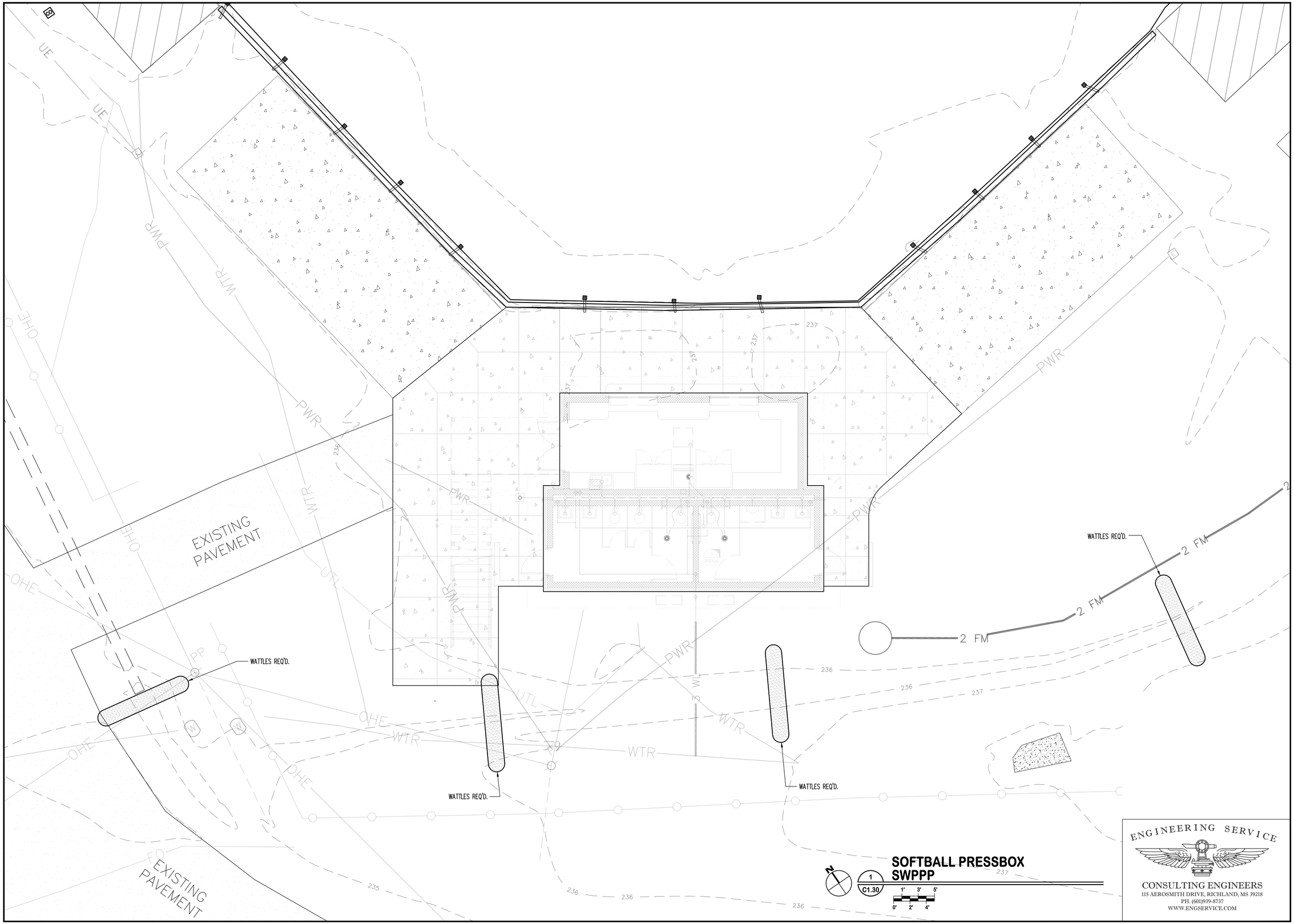

SOFTBALL PRESSBOX SWPPP

1 / C1.30

1" 3" 5"
0' 2' 4'

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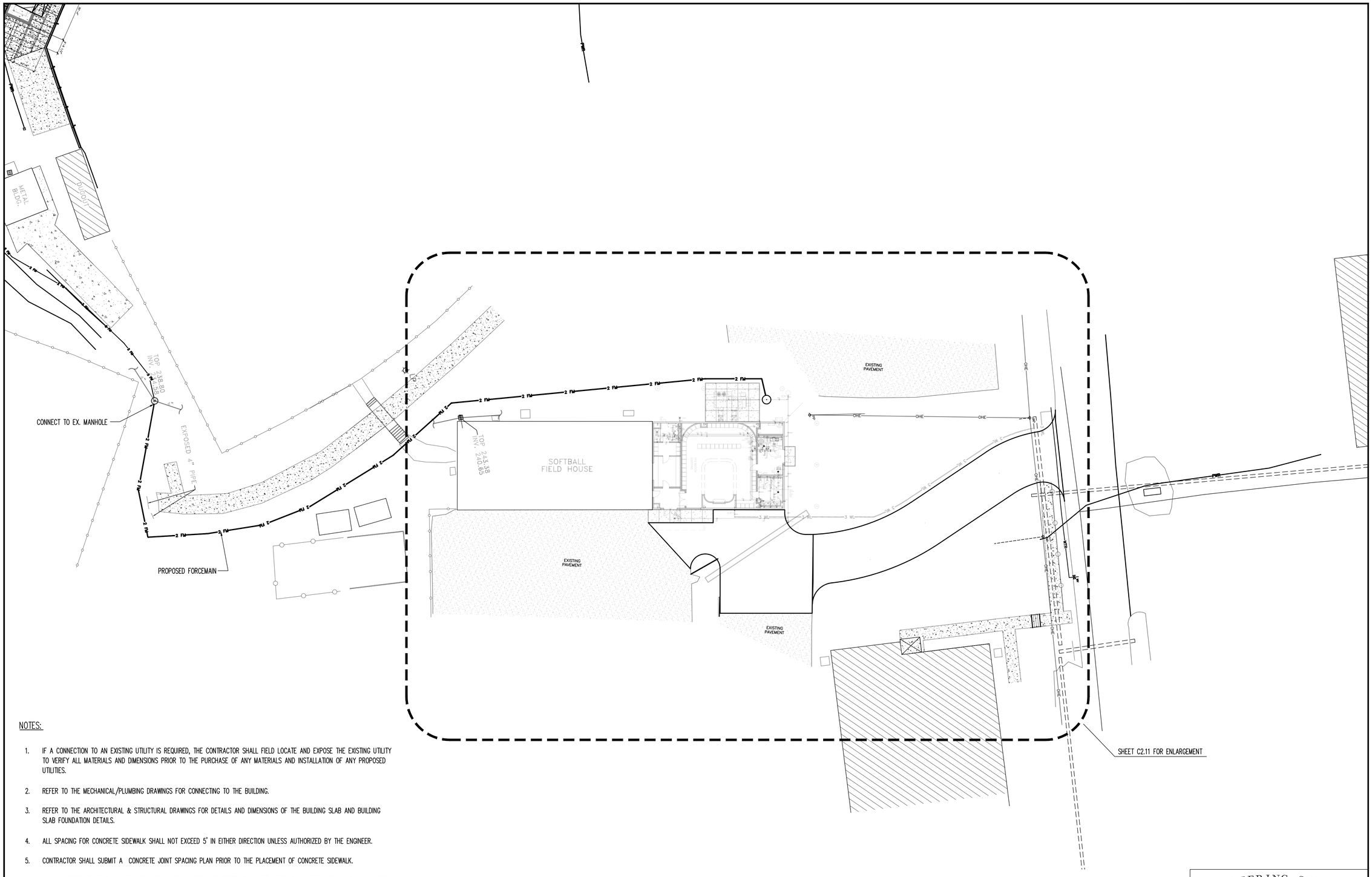

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8. AIR RELEASE VALVE IS REQUIRED. TO BE FIELD LOCATED BY THE ENGINEER.

SOFTBALL FIELDHOUSE SITE PLAN

1 / C2.10

0' 4' 8' 12' 16' 20'

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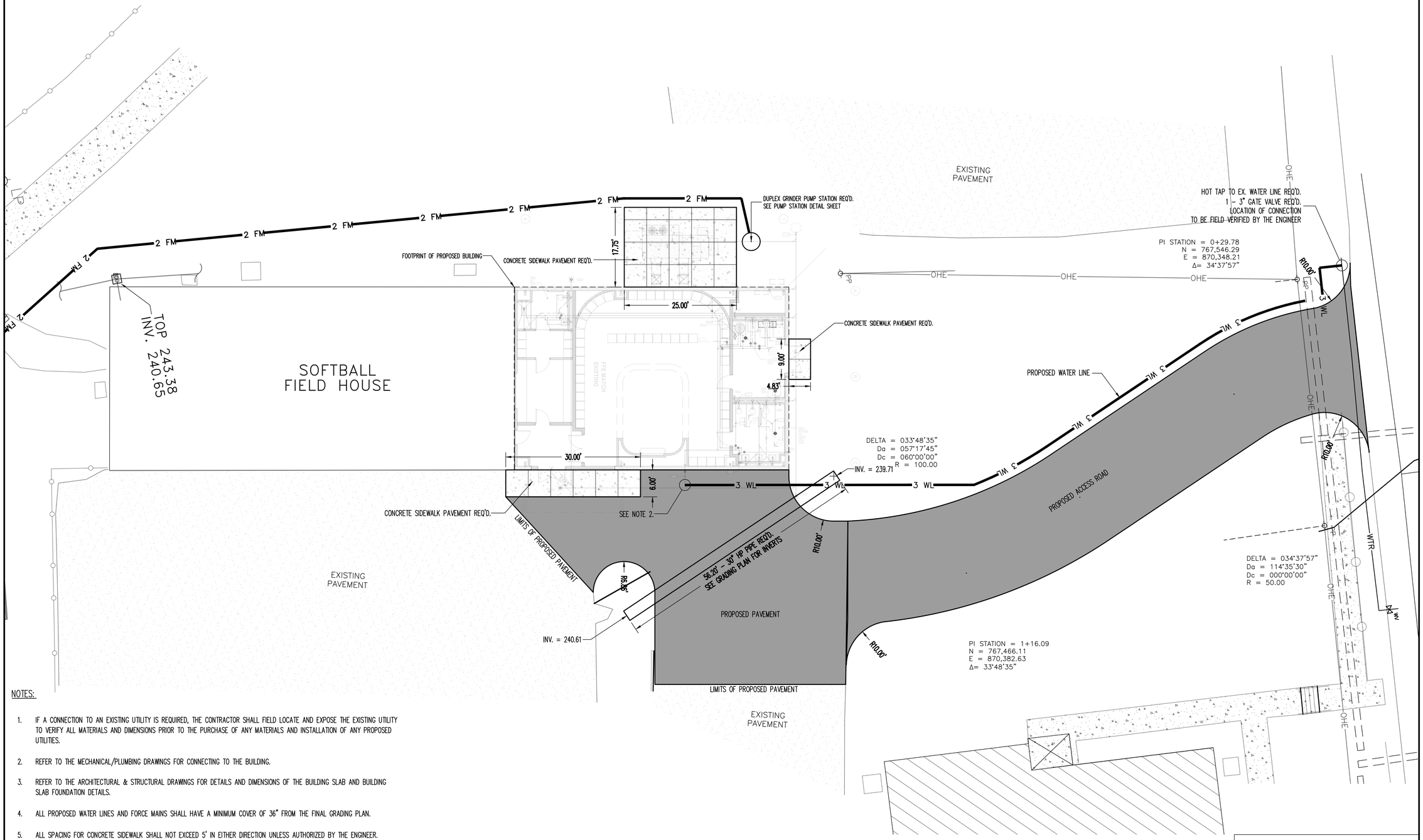
C2.10



NOTES:

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2. REFER TO THE MECHANICAL/PLUMBING DRAWINGS FOR CONNECTING TO THE BUILDING.
3. REFER TO THE ARCHITECTURAL & STRUCTURAL DRAWINGS FOR DETAILS AND DIMENSIONS OF THE BUILDING SLAB AND BUILDING SLAB FOUNDATION DETAILS.
4. ALL PROPOSED WATER LINES AND FORCE MAINS SHALL HAVE A MINIMUM COVER OF 36" FROM THE FINAL GRADING PLAN.
5. ALL SPACING FOR CONCRETE SIDEWALK SHALL NOT EXCEED 5' IN EITHER DIRECTION UNLESS AUTHORIZED BY THE ENGINEER.
6. CONTRACTOR SHALL SUBMIT A CONCRETE JOINT SPACING PLAN PRIOR TO THE PLACEMENT OF CONCRETE SIDEWALK.
7. ALL CONCRETE JOINTS SHALL BE MADE WITH AN EARLY ENTRY CONCRETE SAW. THE JOINTS SHALL BE SAWED AS SOON AS THE NEWLY PLACED CONCRETE CAN SUPPORT THE SAW WITHOUT CAUSING DAMAGE TO THE CONCRETE. THE JOINTS SHALL BE SAWED WITHIN 8 HOURS OF THE CONCRETE BEING PLACED.
8. THE RELOCATED FENCE SHALL MATCH THE TYPE, STYLE, AND INSTALLATION DIMENSIONS OF THE EXISTING FENCE THAT IS BEING REPLACED. SUBMITTAL DATA SHALL BE SUBMITTED AND APPROVED BUY THE ENGINEER PRIOR TO THE PURCHASE AND INSTALLATION OF THE PROPOSED FENCE.

SOFTBALL FIELDHOUSE SITE PLAN - ENLARGEMENT

1 / C2.11

2' 6' 10'
0' 4' 8'

ENGINEERING SERVICE
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PryorMorrow

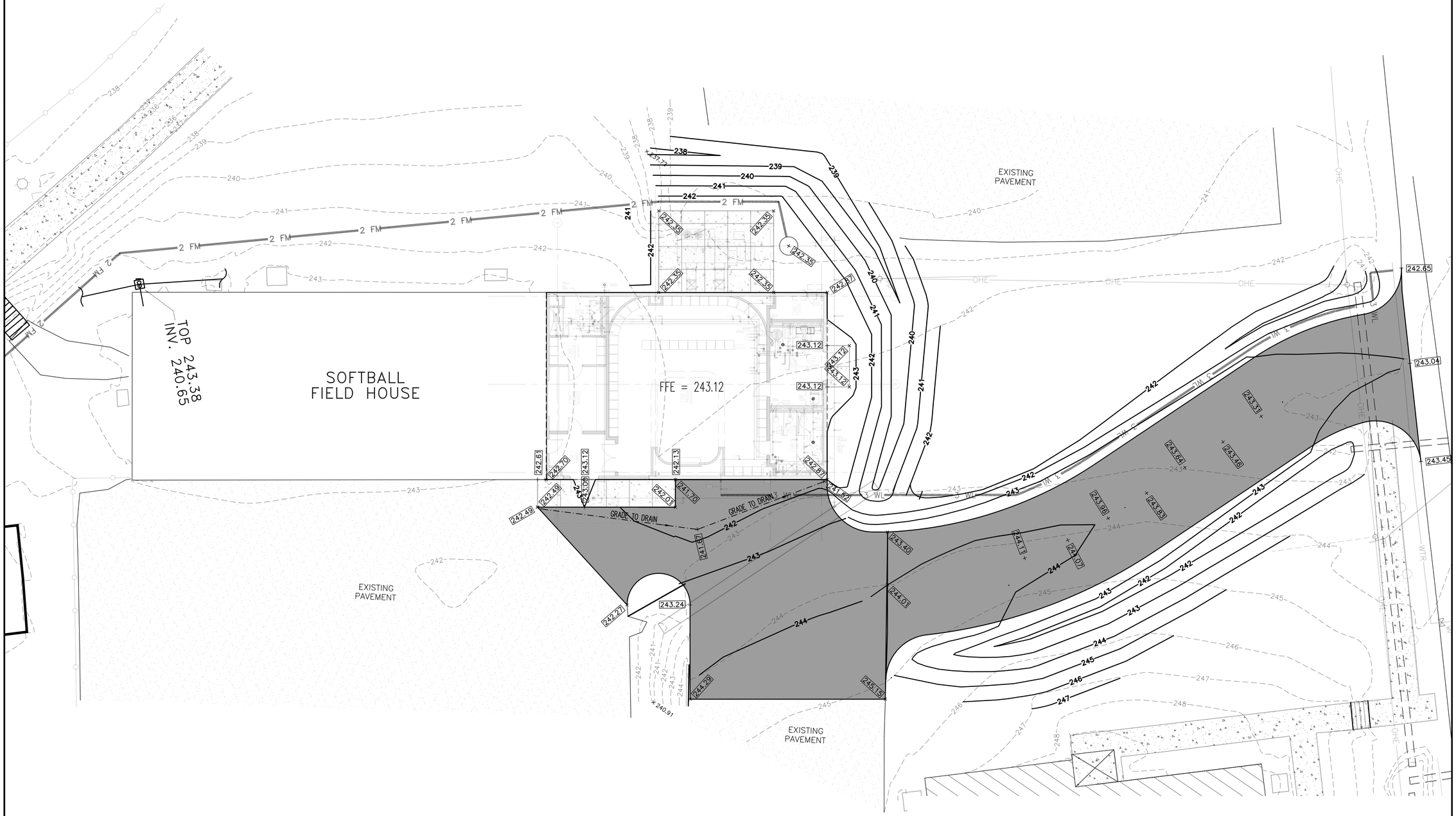
South Jones High School
Athletic Buildings
Jones County School District
Ellisville, MS

MARK	DATE	DISCRIPTION
	June 25, 2025	Construction Documents
	July 18, 2025	Addendum #1

JACOB A KEYS
LICENSED PROFESSIONAL ENGINEER
7/18/2025
19179
STATE OF MISSISSIPPI

PROJECT NO. 2024922
DRAWN BY: JAK
CHECKED BY:

C2.11



SOFTBALL FIELDHOUSE GRADING PLAN

1 / C2.20

2' 6' 10'
0' 4' 8'

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7/18/2025
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PROJECT NO.	2024922
DRAWN BY:	JAK
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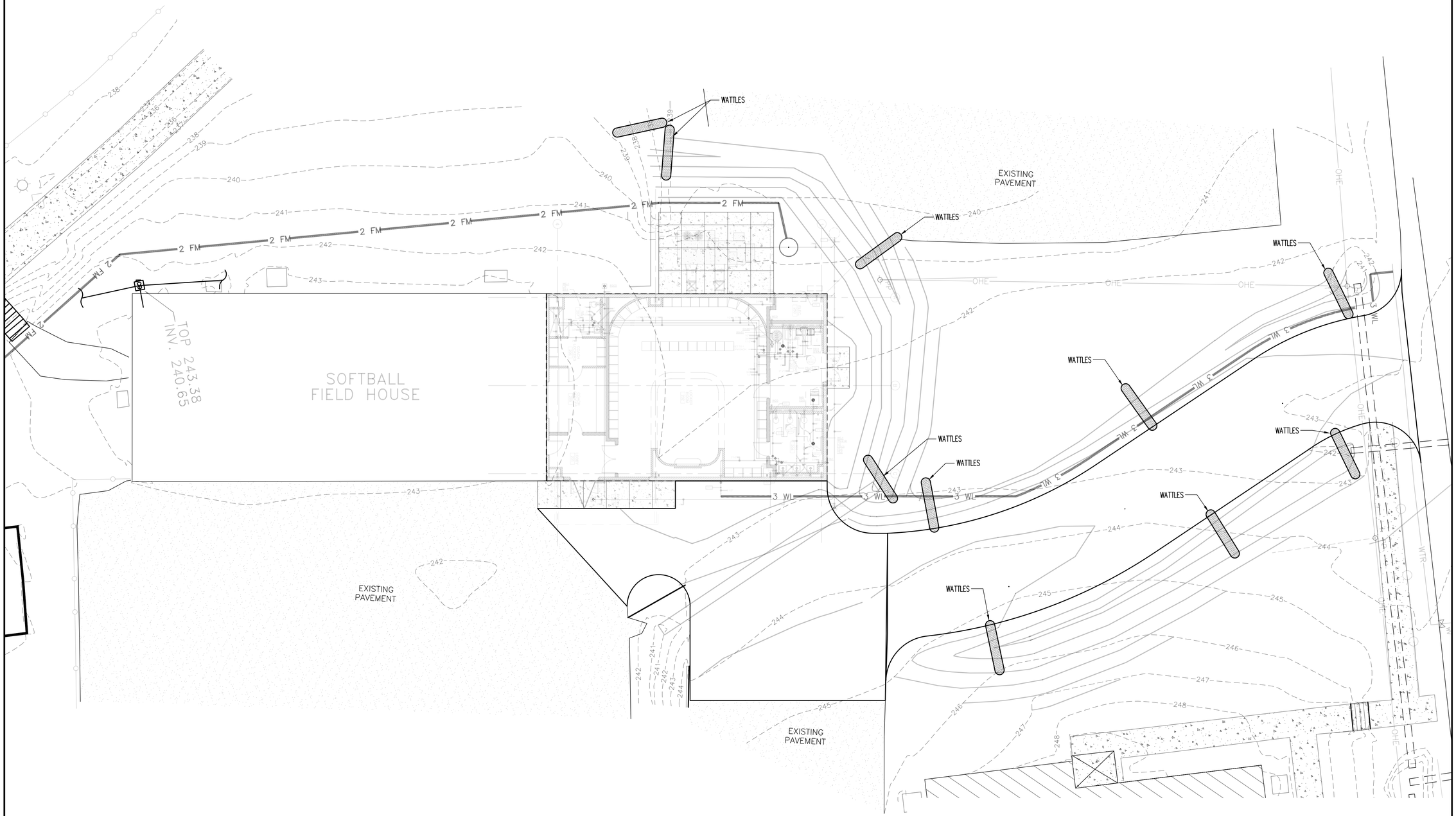

SOFTBALL FIELDHOUSE SWPPP

2 — 1 / C2.30

2' 6' 10'
0' 4' 8'

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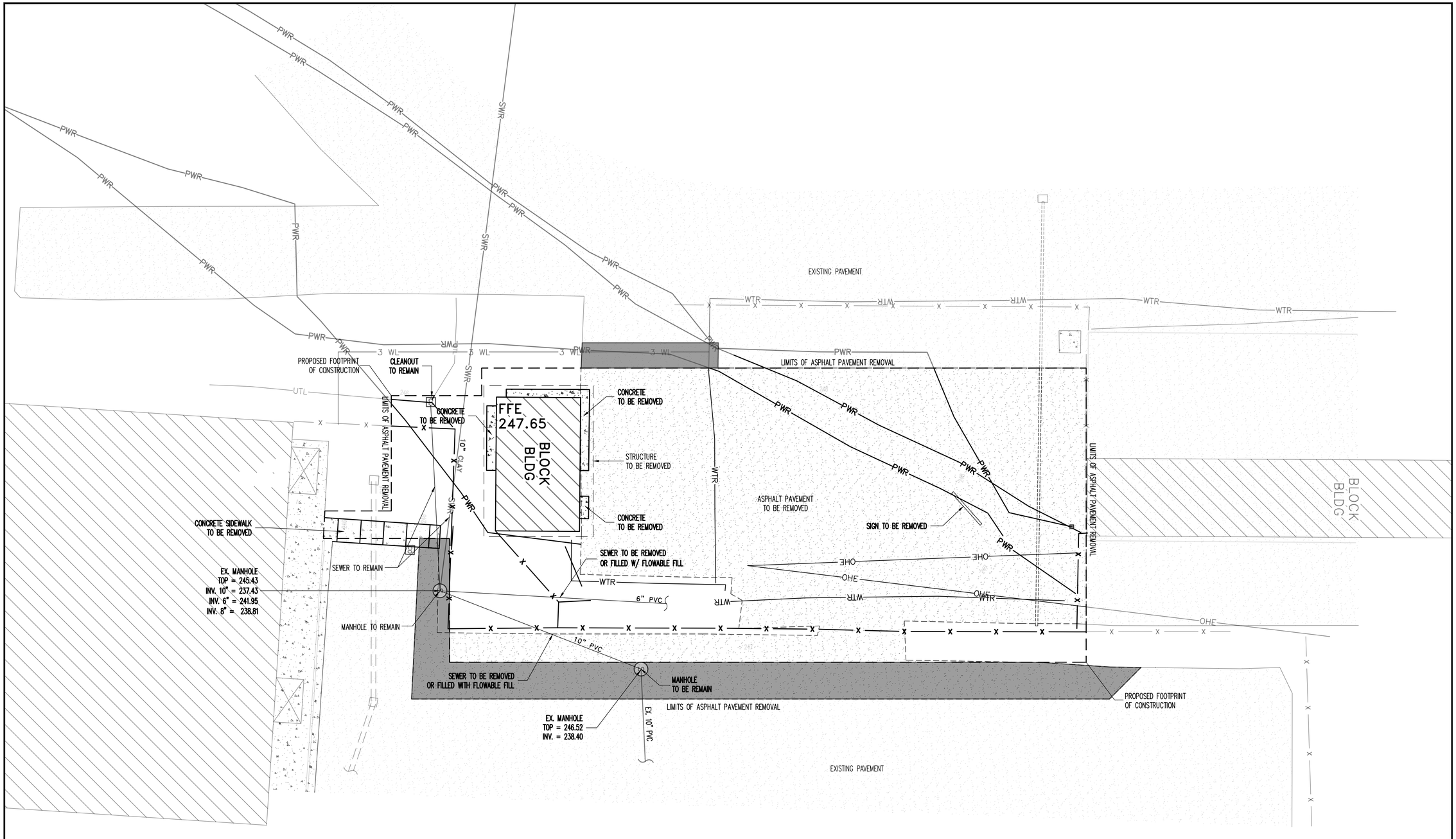

NOTES:

1. ALL UTILITIES LOCATED WITHIN THE PROPOSED FOOTPRINT OF CONSTRUCTION SHALL BE REMOVED AND/OR RELOCATED PER THE DIRECTION OF THE UTILITIES OWNER UNLESS SPECIFIC DETAILS ARE SHOWN.
2. ALL WATER LINES (WITHIN THE PROPOSED FOOTPRINT OF CONSTRUCTION) ARE TO BE REMOVED. THEY ARE TO BE CUT AND CAPPED (PER THE DIRECTION OF THE UTILITY OWNER) OUTSIDE THE PROPOSED FOOTPRINT OF CONSTRUCTION.
3. ALL SEWER LINES (WITHIN THE PROPOSED FOOTPRINT OF CONSTRUCTION)ARE TO BE REMOVED OR FILLED WITH FLOWABLE FILL UNLESS OTHER SPECIFIC DETAILS ARE SHOWN.
4. ALL ASPHALT PAVEMENT WITHIN THE PROPOSED FOOTPRINT OF CONSTRUCTION IS TO BE REMOVED.
5. ALL FENCING WITHIN THE PROPOSED FOOTPRINT OF CONSTRUCTION IS TO BE REMOVED.

N

1 / C3.00

2' 6' 10'
0' 4' 8'

SOCCER/VOLLEYBALL FIELDHOUSE
EXISTING SITE CONDITIONS/DEMOLITION PLAN

ENGINEERING SERVICE
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7/18/2025
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STATE OF MISSISSIPPI

PROJECT NO.	2024922
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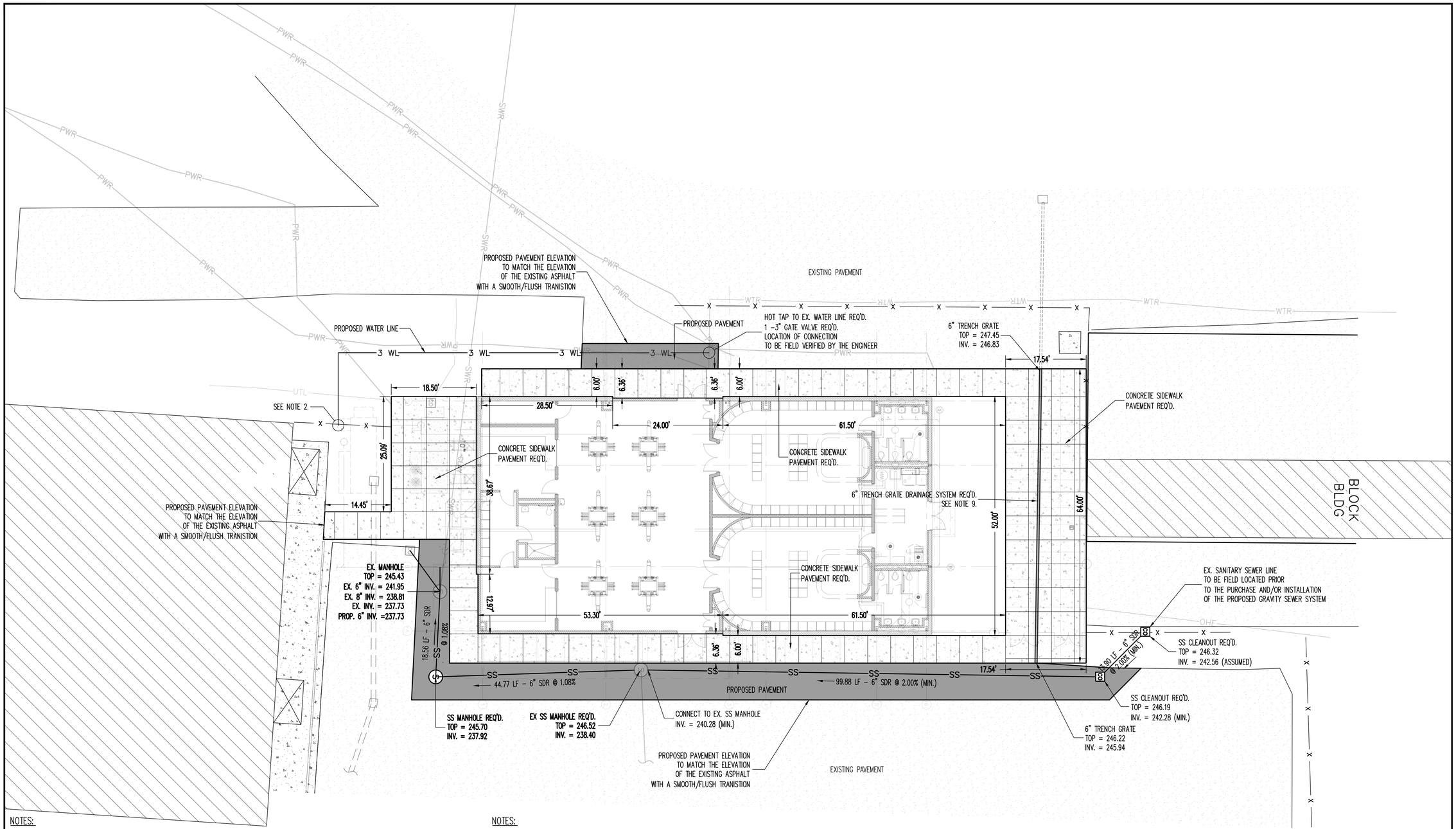
C3.00



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NOTES:

9. 6" TRENCH GRATE DRAINAGE SYSTEM REQ'D. SHALL BE MANUFACTURED BY POLYCAST OR AN APPROVED EQUAL.

N

1 / C3.10

2' 6' 10'
0' 4' 8'

SOCCER/VOLLEYBALL FIELDHOUSE SITE PLAN - ENLARGEMENT

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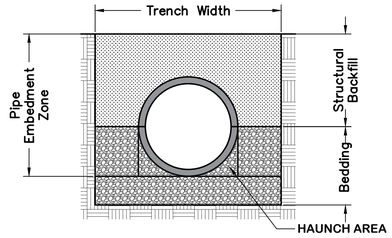


TRENCH CROSS SECTION SHOWING TERMINOLOGY
(not to scale)

TABLE 1: RECOMMENDED TRENCH WIDTH		
DIAMTER (IN.)	O.D. (IN.)	TRENCH WIDTH (IN.)
12	14.45	34
15	17.57	38
18	21.2	44
24	27.8	54
30	35.1	65
36	41.7	75
42	47.7	84
48	53.6	92
THE TRENCH WIDHT MUST BE WIDE ENOUGH TO ACCOMMODATE COMPACTION EQUIPMENT		

TABLE 2			
HP PIPE HEIGHT OF COVER			
NOMINAL DIA. (IN.)	MINIMUM COVER (IN.)	MAXIMUM COVER – FT.	
		UNDER PAVING	SIDE DRAIN
12	12	38	11
15	12	36	12
18	12	35	11
24	12	30	10
30	12	25	9
36	21	29	10
42	21	27	9
48	21	25	8

TABLE 3	
MULTIPLE INSTALLATION OF HP PIPE	
DIAMETER OF PIPE (IN.)	CLEAR DISTANCE BETWEEN PIPES
18	1'–2"
24	1'–5"
30	1'–8"
36	1'–11"
42	2'–2"
48	2'–5"

GENERAL NOTES

I. MATERIALS

A. HP PIPE SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 294, LATEST EDITION. DESIGNATION OF TYPE S: THIS PIPE WILL HAVE A FULL CIRCULAR CROSS SECTION WITH AN OUTER CORRUGATED PIPE WALL AND A SMOOTH INNER LINER.

B. BEDDING MATERIAL AND STRUCTURAL BACKFILL SHALL MEET THE REQUIREMENTS OF THIS DRAWING AND THE SPECIFICATIONS ISSUED FOR THIS PROJECT.

II. JOINTS: JOINTS FOR HP PIPE SHALL MEET THE PERFORMANCE REQUIREMENTS OF WATERTIGHTNESS UNLESS OTHERWISE SPECIFIED. BELL AND SPIGOT PIPE ENDS WITH GASKETS SHALL BE THE ONLY ALLOWABLE JOINT.

III. INSTALLATION:

A. MINIMUM TRENCH WIDTHS SHALL MEET THE REQUIREMENTS OF TABLE 1.

B. THE MIDDLE THIRD OF THE BEDDING MATERIAL UNDER THE PIPE SHOULD BE LOOSELY PLACED, WHILE THE REMAINDER SHALL BE COMPACTED TO A MINIMUM 95% OF MAXIMUM DENSITY PER AASHTO T–99.

C. A MINIMUM OF 4 INCHES OF BEDDING SHALL BE PROVIDED PRIOR TO PLACEMENT OF THE PIPE.

D. STRUCTURAL BACKFILL SHALL BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING A 8" LOOSE LIFT THICKNESS AND BROUGHT UP EVENLY ON BOTH SIDES OF THE PIPE WITH AN ELEVATION MOT LESS THAT 12" ABOVE THE TOP OF THE PIPE, A MINIMUM COMPACTION LEVER OF 95% STANDARD DENSITY PER AASHTO T–99 SHALL BE ACHIEVED. IF THE CONDUIT IS UNDER PAVING THE STRUCTURAL BACKFILL SHALL EXTEND TO THE BOTTOM OF THE PAVING STRUCTURE.

E. MINIMUM COVER REQUIREMENTS SHALL MEET THE REQUIREMENTS OF TABLE 2.

F. FOR MULTIPLE INSTALLATIONS OF POLYETHYLENE PIPES, A CLEAR DISTANCE BETWEEN THE PIPES SHALL MEET THE REQUIREMENTS OF TABLE 4.

IV. CALCULATIONS FOR FILL DEPTHS ARE BASED ON PROPERTIES DEFINED IN AASHTO M294 AND CALCULATION IN AASHTO SEC. 19.

BEDDING AND BACKFILL REQUIREMENTS

BEDDING AND BACKFILL REQUIREMENTS FOR NON–RIGID PIPE IN CROSS DRAIN AND STORM DRAIN APPLICATIONS.

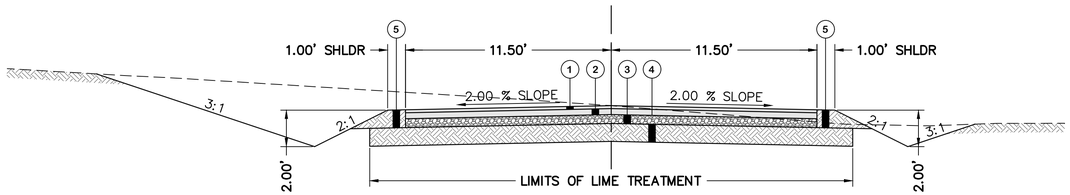
1. BEDDING FOR CROSS DRAINS UNDER PAVING.
   - 1.1. THE CONDUIT SHALL BE BACKFILLED WITH BEDDING MATERIAL TO A DEPTH OF AT LEAST 50% OF THE DIAMETER OF THE PIPE. THE THICKNESS OF THE BEDDING MATERIAL UNDER THE PIPE SHALL BE AT LEAST 6" FOR CONDUIT LESS THAN 30" IN DIAMETER AND 8" FOR CONDUIT 30" IN DIAMETER OR LARGER.
   - 1.2. THE BEDDING MATERIAL SHALL BE CRUSHED STONE AGGREGATE BACKFILL IN ACCORDANCE WITH CLASS 610 SECTION 703.04 OF THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION LATEST EDITION.
   - 1.3. THE LAYER OF BEDDING MATERIAL SHALL BE SHAPED TO FIT THE CONDUIT FOR AT LEAST 15 PERCENT OF THE TOTAL HEIGHT.
   - 1.4. STRUCTURAL BACKFILL SHALL CONFORM TO THE BORROW EXCAVATION SPECIFICATION GIVEN IN THE PROJECT DOCUMENTS. IF NO SPECIFICATIONS IS GIVEN THE MATERIAL WILL MEET THE REQUIREMENTS OF B9–10 AS DESCRIBED IN SECTION 703.21 OF THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2017 EDITION.

2. BEDDING FOR STORM DRAINAGE PIPE NOT UNDER PAVING
   - 1.1. THE CONDUIT SHALL BE BACKFILLED WITH BEDDING TO A DEPTH OF AT LEAST 30% OF THE DIAMETER OF THE PIPE. THE THICKNESS OF THE BEDDING MATERIAL UNDER THE PIPE SHALL BE AT LEAST 4" FOR CONDUIT LESS THAN 30" IN DIAMETER AND 6" FOR CONDUIT 30" IN DIAMETER OR LARGER.
   - 1.2. THE BEDDING MATERIAL SHALL BE SAND OR SELECTED SANDY SOIL, ALL OF WHICH PASSES A ⅜ INCH SIEVE AND NOT MORE THAT 10 PERCENT OF WHICH PASSES A NO. 200 SIEVE. THE LAYER OF BEDDING MATERIAL SHALL BE SHAPED TO FIT THE CONDUIT FOR AT LEAST 15 PERCENT OF THE TOTAL HEIGHT.
   - 1.3. STRUCTURAL BACKFILL BE NATIVE MATERIAL COMPACTED BACK IN PLACE UNLESS THE NATIVE MATERIAL IS A CH MATERIAL WHICH WILL NOT BE ALLOWED AS STRUCTURAL FILL.

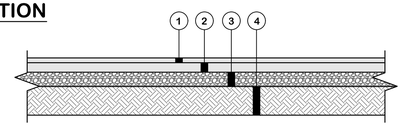
IF FLOWABLE FILL IS UTILIZED, CARE SHALL BE TAKEN TO PREVENT "FLOATING" OF THE PIPE.

THE COST OF FURNISHING AND PLACING THE REQUIRED BEDDING AND BACKFILL MATERIAL INDICATED IN 1 AND 2 SHALL BE INCLUDED IN THE UNIT COST OF THE NON–RIGID PIPE. THERE IS NO SEPARATE PAY ITEM FOR THE NON–RIGID PIPE BEDDING AND BACKFILL MATERIAL.

FLEXIBLE PIPE CULVERT INSTALLATION DETAILS

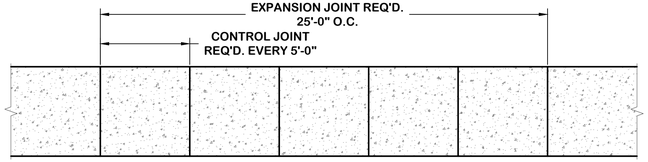


PROPOSED ACCESS ROAD TYPICAL SECTION
(not to scale)

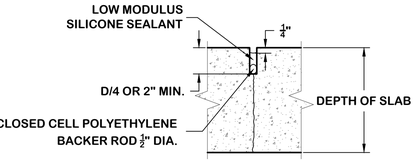


LIGHT DUTY - ASPHALT PAVING TYPICAL SECTION
(not to scale)

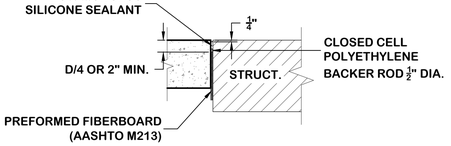
1. 2" - SURFACE COURSE (SC-1, TYPE 8). PER THE MISSISSIPPI STANDARD FOR ROAD AND BRIDGE CONSTRUCTION, 1990 EDITION.
2. 4" - BASE COURSE (BB-1, TYPE 6). PER THE MISSISSIPPI STANDARD FOR ROAD AND BRIDGE CONSTRUCTION, 1990 EDITION.
3. 6" - GRANULAR MATERIAL (610 CRUSHED LIMESTONE). PER THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2024 EDITION.
4. 12" - LIME TREATED SUBGRADE. LIME TREATMENT SHALL 6% HYDRATED LIME BY DRY WEIGHT OF SOIL. THE LIME-TREATED SOILS SHALL BE COMPACTED TO NOT LESS THAN 98 PERCENT OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY (ASTM D 698). THE LIMITS OF THE LIME TREATMENT SHALL EXTEND A MINIMUM OF 2 FT. BEYOND THE BACK OF THE CURB OR THE EDGE OF PAVEMENT. THE LIME TREATMENT SHALL BE IN ACCORDANCE WITH SECTION 307 OF THE 2017 EDITION OF THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION USING THE CLASS C LIME TREATMENT PROCEDURE.
5. NATIVE MATERIAL USED TO BUILD UP SHOULDERS.



CONCRETE SIDEWALK JOINT SPACING PLAN
(not to scale)



CONTROL JOINT DETAIL
(not to scale)



EXPANSION JOINT DETAIL
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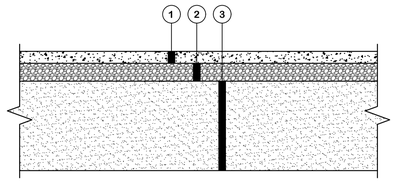
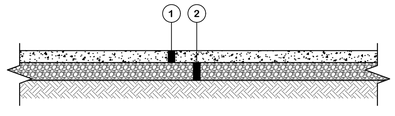


CONCRETE SIDEWALK PAVING (SOFTBALLPRESSBOX) TYPICAL SECTION
(not to scale)

NOTES:
1. MEDIUM BROOM FINISH REQUIRED.



CONCRETE SIDEWALK PAVING (SOFTBALL FIELDHOUSE & SOCCER/VOLLEYBALL FIELDHOUSE) TYPICAL SECTION
(not to scale)

NOTES:
1. MEDIUM BROOM FINISH REQUIRED.

1. 4" - CLASS A CONCRETE (4000 psi) - PER THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 20XX EDITION.
2. 4" - GRANULAR MATERIAL (610 CRUSHED LIMESTONE). PER THE MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2024 EDITION.
3. 30" - SELECT FILL MATERIAL REQUIRED.

1 C4.00 **SITE PLAN DETAILS**

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PryorMorrow

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Jones County School District
Ellisville, MS

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JACOB A KEYS LICENSED PROFESSIONAL ENGINEER 7/18/2025 19179 STATE OF MISSISSIPPI

PROJECT NO. 2024922
DRAWN BY: JAK
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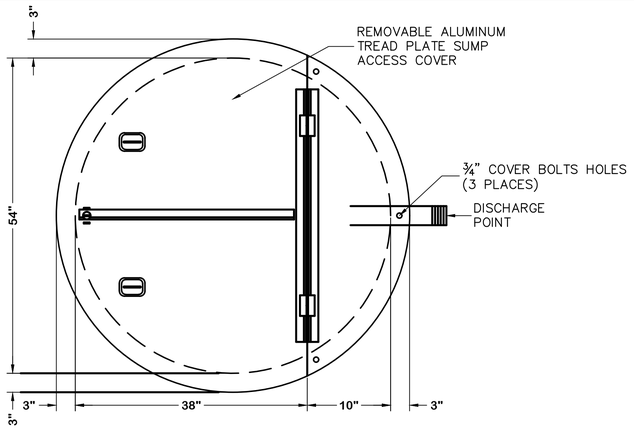
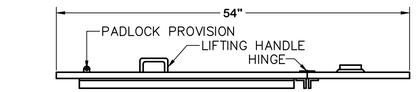
C4.00





BASIN COVER
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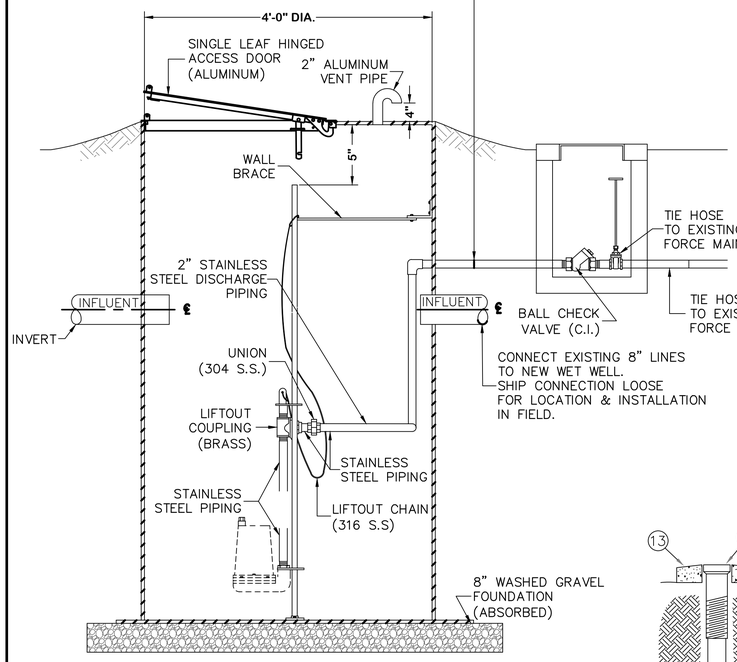
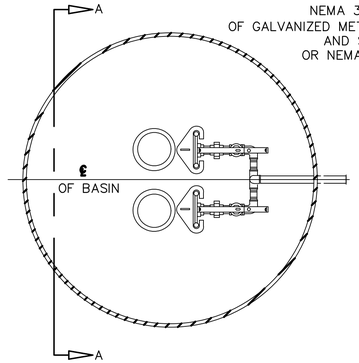
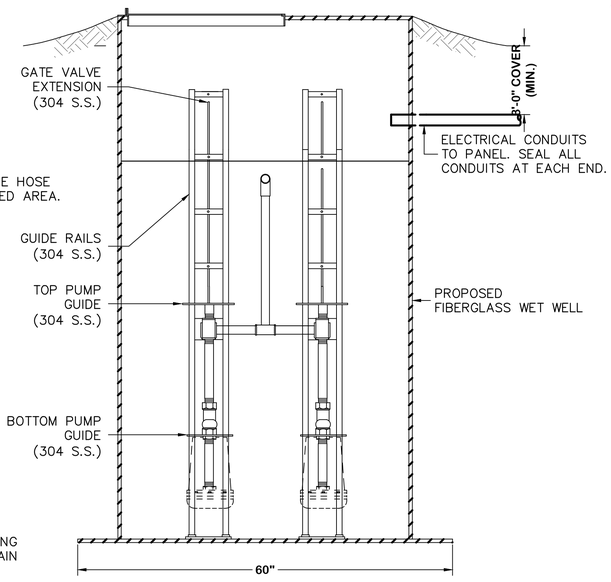


ELEVATION - PUMP STATION
(not to scale)

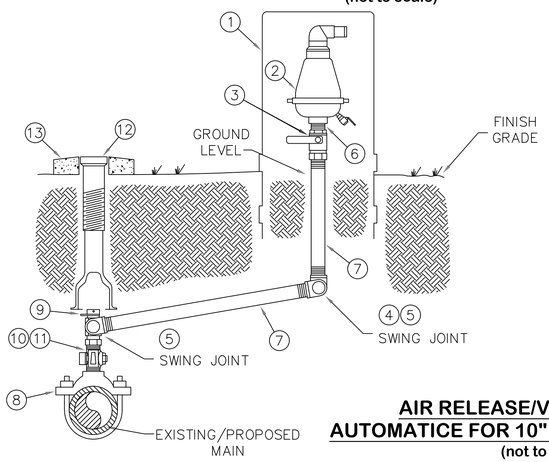
NOTES:

1. **IMMEDIATELY FOLLOWING WETWELL INSTALLATION, CONTACTOR SHALL COMPLETELY PLACE AND COMPACT BACKFILL, INSTALL TOP COVER, FILL WITH WATER, AND ANY OTHEER PRECAUTIONS NECESSARY TO PROTECT WETWELL FROM UPLIFT FORCES.**
2. **CONTROL PANEL, PIPING, ETC. SHALL BE FIELD LOCATED TO BEST FIT SITE AS DIRECTED BY THE ENGINEER AND OWNER.**
3. **SITE TO BE DRESSED AND GRADED TO UNIFORM SLOPES TO DIVERT SURFACE DRAINAGE AWAY FROM WETWELL AND VALVE BOX.**
4. **THE ELVATIONS SHOWN IN THE DESIGN TABLE ARE THE MINIMUM DESIGN REQUIREMENTS. IF MANUFACTURER OF THE PROPOSED PUMP(S) REQUIRE A GREATER DEPTH, THE WETWELL BOTTOM SHALL BE LOWERED AS NECESSARY AT NO ADDITIONAL COST TO THE OWNER.**
5. **8" INLET & OUTLET PIPE CONNECTIONS SHIPPED LOOSE (FOR LOCATION & INSTALLATION BY OTHERS).**





SECTION A-A
(not to scale)

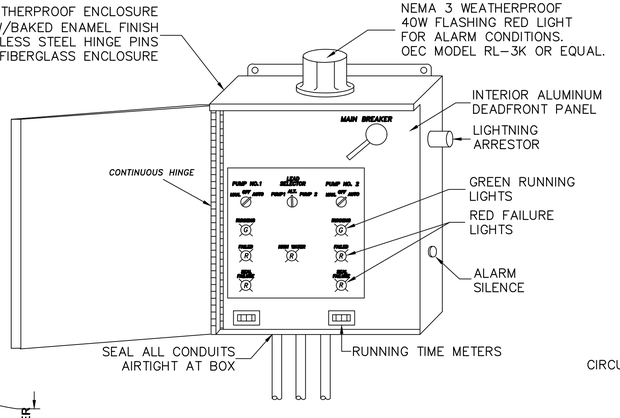


AIR RELEASE/VACUUM VALVE AUTOMATICE FOR 10" AND SMALLER MAINS
(not to scale)

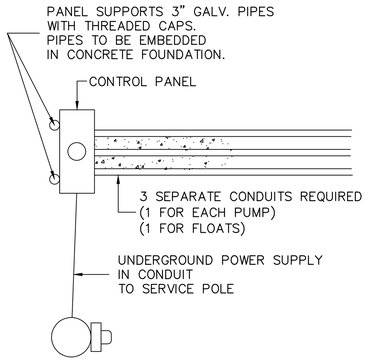
NOTES:

1. IN AS MUCH IS PRACTICAL, NEW FORCE MAINS SHOULD BE INSTALLED SUCH THAT HIGH POINT/ARV LOCATION IS AWAY FROM RESIDENCES OR OTHER SENSITIVE AREAS.
2. IF AN EXISTING HIGH POINT/PROPOSED ARV LOCATIONS IS IN FRONT OF A RESIDENCE OR IN A SENSITIVE AREA, THEN CONSULT WITH THE ENGINEER AS TO BE THE BEST THE BEST ALTERNATIVE LOCATION, PREFERABLY DOWNSTREAM FROM THE HIGH POINT.

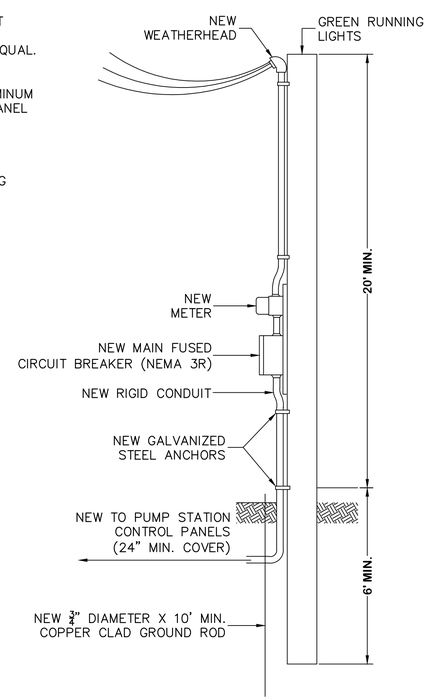
		MATERIALS
1	1	ENCLOSURE, WATER PLUS CORPORATION, MODEL # 131632 GREEN, WITH PIN ALLEN LOCK
2	1	AIR RELEASE VALVE 2" NPT, ARI MODEL D-025P
3	1	2" BALL VALVE, 316 S.S.
4	1	2" STANDARD 90° ELBOW, 316 S.S.
5	2	2" STREET 90° ELBOW, 316 S.S.
6	3	2" SHORT NIPPLE, 316 S.S.
7	2	2" PIPE, 316 S.S. LENGHT AS REQUIRED, 2° ANGLE MIN. (3.5% SLOPE)
8	1	MAIN SIZE X 2" DOUBLE STRAP TAPPING SADDLE, IRON SADDLE WITH 316 S.S. STRAPS
9	1	2" X 90° FIPxFIP ANGLE BALL VALVE FORD PART No. BA11777W
10	1	2" CLOSE NIPPLE, 316 S.S. (EXISTING 2" BRASS CORPORATION STOP) (EXISTING AIR RELEASE VALVE ASSEMBLY INSTALLATION)
11	1	2" BRASS CORPORATION STOP FORD PART FB400-7-NL (NEW AIR RELEASE VALVE ASSEMBLY INSTALLATION)
12	1	VALVE BOX WITH LID LABLED "SEWER"
13	1	CONCRETE VALVE BOX COLLAR



TYPICAL CONTROL PANEL
(not to scale)



CONTROL PANEL PLAN VIEW
(not to scale)



SERVICE POLE
(not to scale)

PUMP STATION DATA

ITEMS OF WORK AND PARAMETERS	UNITS	SOFTBALL PRESSBOX	SOFTBALL FIELD
CAPACITY (min. each pump)	G.P.M.	30	30
SIZE	HP	2	2
MOTOR VOLTAGE	VOLTS	230	230
MOTOR SPEED	R.P.M.	3450	3450
PHASE POWER	N/A	3	3
TOTAL (TDH)	FT	10.74	15.04
WET WELL I.D.	FT	4	4
FORCE MAIN I.D.	IN	2	2
DISCHARGE PIPE / FITTING I.D.	IN	2	2
FORCE MAIN LENGTH	LF	216.06	375.90
ELEVATION TOP	FT	237.03	242.85
ELEVATION FORCE MAIN DISCHARGE	FT	234.58	234.58
ELEVATION LOWEST GRAVITY INVERT	FT	232.93	238.14
ELEVATION ALARM	FT	232.43	237.64
ELEVATION 2ND PUMP START	FT	232.03	237.35
ELEVATION 1ST PUMP START	FT	231.53	236.85
ELEVATION OFF	FT	230.53	235.85
PUMP STATION INVERT	FT	228.53	233.85
TOTAL HEIGHT	FT	8.50	9.00

1 C4.30 PUMP STATION DETAILS

ENGINEERING SERVICE
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115 AEROSMITH DRIVE, RICHLAND, MS 39218
PH. (601)939-8737
WWW.ENGSERVICE.COM

PryorMorrow

South Jones High School Athletic Buildings

Jones County School District
Ellisville, MS

MARK	DATE	DESCRIPTION
	June 25, 2025	Construction Documents
	July 18, 2025	Addendum #1

JACOB A. KEYS LICENSED PROFESSIONAL ENGINEER 7/18/2025 19179 STATE OF MISSISSIPPI

PROJECT NO. 2024922
DRAWN BY: JAK
CHECKED BY:

C4.30