

Office of The Williams County Engineer

Todd J. Roth, P.E., P.S.

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ADDENDUM NO. 1

Date of Addendum: October 15, 2020

KUNKLE WASTEWATER SYSTEM IMPROVEMENTS
DIVISION A: COLLECTION SYSTEM AND PUMP STATION
Project #7-2020

Bid Date: ~~OCTOBER 29, 2020~~ – Revised This Addendum: **NOVEMBER 2, 2020**

TO ALL BIDDERS:

The Following Changes Have Been Made To The Bidding Documents:

1. The Bid Date and Time for Kunkle Wastewater System Improvements Division A Project #7-2020 has been revised. The revised date and time for Bid Opening is:

Monday, November 2, 2020 at 10:30 AM.

Please Note: The time constraints on this project are narrow due to the requirements and timetables of funding sources. It is IMPERATIVE that BIDDERS complete every form and submit their responses with the bidding documents. (Especially those in Item 00101.1 & 00101.2) The OWNER is required to submit the bid package for award approval on or before November 5, 2020. Bids without these items may be determined to be unresponsive and subsequently rejected.

On line documents will be revised on the William County Engineers Web Page at: <http://www.wmscoengineer.com/bidprojects.asp>, and changes will be sent to plan holders via email.

Please advise this office if you have questions concerning these changes.

Thank you.

Respectfully,



Todd J. Roth, P.E., P.S.
Williams County Engineer

(Continued Below)

Office of The Williams County Engineer

Todd J. Roth, P.E., P.S.

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ADDENDUM NO. 2

Date of Addendum: October 22, 2020

KUNKLE WASTEWATER SYSTEM IMPROVEMENTS
DIVISION A: COLLECTION SYSTEM AND PUMP STATION
Project #7-2020
Bid Date: Revised Addendum 1: NOVEMBER 2, 2020

TO ALL BIDDERS:

The Following Changes Have Been Made To The Bidding Documents:

- Reference Sheet 19 of the Drawings. Section View of the Service Connections. Heavy Duty Fittings in addition to those indicated shall also include the Fitting connecting the Service Line to the Main. Heavy Duty Fittings are not required on Service Lines from the Right of Way to the Existing Sanitary Service Connection.
- Attached to this Addendum. Addendum 2 – Exhibit A contains additional specifications required for the pumping station in Division A. The specifications found in Exhibit A are applicable for the Pump Station. In matters of conflict between the remaining bidding documents and specifications and Exhibit A, the remaining bidding documents and specifications shall prevail.

Please Note: The time constraints on this project are narrow due to the requirements and timetables of funding sources. It is IMPERATIVE that BIDDERS complete every form and submit their responses with the bidding documents. (Especially those in Item 00101.1 & 00101.2) The OWNER is required to submit the bid package for award approval on or before November 5, 2020. Bids without these items may be determined to be unresponsive and subsequently rejected.

On line documents will be revised on the William County Engineers Web Page at: <http://www.wmscoengineer.com/bidprojects.asp>, and changes will be sent to plan holders via email.

Please advise this office if you have questions concerning these changes.

Thank you.

Respectfully,



Todd J. Roth, P.E., P.S.
Williams County Engineer

ADDENDUM 2 – EXHIBIT A

KUNKLE WASTEWATER SYSTEM IMPROVEMENTS
DIVISION A: COLLECTION SYSTEM AND PUMP STATION
PROJECT #7-2020

SECTION 02551
PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes furnishing and installing precast concrete structure sections of types and at locations shown on the Drawings and scheduled.
- B. This Section includes removing existing structures, additional excavation to widen and deepen trenches for structures construction, furnishing and installing concrete of indicated strength, portland cement mortar, reinforcing steel, precast concrete integral base sections, bottom riser sections, transition sections, and riser sections, flat slab tops and grade rings, pipe opening with flexible pipe connections, pipe for drop connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, forming channels through bottoms, making watertight connections to new and existing sewers, and other work incidental to construction and testing.
- C. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
 - 1. Shop Drawings for Review:
 - a. Manufacturer's Shop Drawings indicating physical dimensions, joint details, reinforcing steel, and layout for each size and type of structure(s) components furnished for the project.
 - b. Manufacturer's certification indicating that the precast structure components and joints meet specifications for each production run for each size and type furnished.
 - 2. Information for the Record:
 - a. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

PART 2 PRODUCTS**2.01 MATERIALS OR PRODUCTS OR EQUIPMENT**

- A. Precast concrete sections, integral base sections, and flat slab tops shall be designed by an Engineer licensed in the state of the project and conforming to ASTM C913 and ASTM C890. The design shall be adequate to support traffic or non-traffic loads as specified in Part 4.
- B. All joints in the walls and bottom of precast tanks and vaults shall be tongue and groove type with a preformed butyl rubber joint sealant placed in the joint prior to assembly of the joint. This joint material shall provide a permanent flexible non-shrinking watertight seal and shall meet the requirements of ASTM C990. After assembly of the joint, a 12-inch-wide band of permanent flexible water barrier wrap shall be applied to the exterior surfaces centered on all wall joints and any buried top slab joints. This barrier wrap shall meet the requirements of ASTM E1745, C877, and C990. The barrier wrap shall be bonded to the concrete with a brush or roller applied adhesive surface primer formulated for use with the barrier wrap material.
- C. There shall be no opening or penetration within 6 inches of any joint on precast structure. Section heights shall be adjusted as required.
- D. Precast integral base and top sections shall be of monolithic construction.
- E. Holes required in the structure shall be cast and formed during fabrication. Field cutting of holes is not permitted without Engineer's approval.
- F. Additional concrete reinforcing steel and dowels shall be installed as shown on drawings to resist the buoyant forces. Concrete shall be as specified below.

2.02 ACCESSORIES

- A. Manhole Steps - Manhole Steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod. Steps shall be M. A. Industries Model PS-1, or equal.
 - 1. Specified manhole steps shall be factory installed to provide a continuous ladder of 16-inch Center-to-Center rung spacing. Steps shall be placed in the forms and cast in wall or placed immediately after removal from casting and carefully mortared in place with non-shrink mortar to insure a watertight joint. Step installation shall be in compliance with OSHA regulations. If the outer surface of the wall is pierced the patch shall be completely covered with a bituminous sealer.
- B. Mortar:
 - 1. Mortar used for the structures herein specified shall conform to ASTM C270 Type S, containing no masonry cement. The mortar shall be composed of one-part portland cement to two parts sand by volume.

2. Non-shrinking Mortar - Materials for non-shrinking mortar shall be Sauereisen F-100, Five-Star, or equal.
- C. Cast-in-Place Concrete:
 1. All cast-in-place concrete used for forming channels in structure bottoms shall be as specified or shown on the drawings.
- D. Flexible Joints - Joints for precast pipe openings shall be “Res-Seal” type as manufactured by Price Brothers Company, “Kor-n-seal” as manufactured by National Pollution Control Systems, Inc., or equal.
- E. Wall Sleeves shall be used as indicated on the drawings and in conformance with Section 15210.

PART 3 EXECUTION

3.01 COORDINATION

- A. Location and type of precast concrete structure installed shall be as shown on the Drawings or directed.
- B. Construction shall be in conformance with details shown on the Drawings and as specified.
- C. Excavation for structure construction shall be prepared as specified, shown on the Drawings and as directed in Section 02200.

3.02 INSTALLATION OF INTEGRAL BASE SECTIONS

- A. Base sections shall be placed on a minimum 6-inch thick bedding material under the entire area of the structure base. Bottom sections placed on bedding shall be a minimum of 6 inches thick. Base section shall be level and plumb. Structures that are not plumb and level shall be removed and reset as specified.

3.03 FORMING STRUCTURE BOTTOMS

- A. The bottoms of all structures shall be channeled, or fillets placed as shown on the drawings to conduct flow in the planned direction.

3.04 PRECAST CONCRETE RISER SECTIONS

- A. Sections 32 inches in height or less shall be incorporated into the structure immediately below the top.
- B. Structure joints shall be pointed and lifting holes filled with non-shrink nonmetallic mortar.

3.05 INSTALLATION OF CASTING FRAMES AND COVERS

- A. Frames and covers shall be installed to grades shown on the Drawings or as directed.
- B. Adjustment of castings shall be made using specified precast grade rings and portland cement mortar joints or preferred bitumen seals.
- C. Each pressure tight manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.
- D. The maximum depth of adjustment below any manhole casting shall be 16 inches and the minimum depth of adjustment shall be 4 inches.
- E. In concrete pavement, separate frame from pavement with 1/2-inch-thick premolded mastic joint material extending from the base of the frame to the top of the frame.

3.06 FLOOR DOORS

- A. Contractor shall coordinate with precast manufacturer to have floor doors cast as an integral part of the top section with proper coatings at metal/concrete interface. Provide drain piping as needed for floor door channels.

3.07 FIELD QUALITY CONTROL

- A. Field Inspection:
 - 1. Individual sections may be rejected at any time because of defective joints, dimension variations, fractures, cracks, honeycombing, chips, or blisters exceeding the permissible tolerances as set by ASTM C913.
 - 2. Rejected sections shall be so marked with a lumber crayon or paint and shall be removed from the job site before the end of the following work day.
- B. Correction of honeycombing, chips, blisters and filling lifting holes shall not be performed without prior approval from the engineer.
- C. Field cutting of the precast sections shall not be performed without prior approval from engineer.

PART 4 SPECIAL PROVISIONS**4.01 XYPEX ADDITIVE**

- A. Contractor to provide crystalline waterproofing additive to precast concrete structure as indicated on the drawings and as specified herein (Xypex Admix C-500 or C-1000).
- B. Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction and shall protect the concrete from deterioration due to harsh environmental conditions.

- C. The manufacture of the crystalline water proofing shall provide the type of material and the dosage rate for the application. Admix must be added to concrete mix at time of batching. The actual dosage in the mix design shall be certified at the time of application.
- D. Manufacturer shall coordinate with the concrete batch facility and other admixture suppliers to ensure compatibility with the concrete mix design, other admixtures and concrete properties. The addition of the crystalline water proofing shall not reduce the concrete strength or compromise the ASTM specifications or other quality standards governing the concrete mix.
- E. Concrete containing Xypex Admix shall be moist cured in accordance with ACI Reference 308, "Standard Practice for Curing Concrete".

END OF SECTION

**SECTION 11731
SUBMERSIBLE PUMP STATION**

PART 1 GENERAL

1.01 SCOPE

- A. Under this Section, the Contractor shall furnish, install, and place in operation the complete package pump system(s) automatically controlled capable of handling raw unscreened sanitary sewer with influent sewer and force main to the limits as shown on the Drawings.
- B. The section shall include the package pumping station, including but not limited to, pump units, precast concrete manhole sump basin, precast concrete valve manhole and structures, all electrical and controls equipment and wiring, telemetering, discharge force mains with all fittings and valves necessary, influent sewers where required, and any other incidental work implied by the Drawings and/or ordered by the Engineer.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
 - 1. Submittals for Review:
 - a. General arrangement and scaled dimensional Drawings.
 - b. Wiring Diagrams with termination point identification.
 - c. Materials of construction.
 - d. Manufacturer's product literature.
 - e. Manufacturer's Warranty(s).
 - 2. Information for Record:
 - a. Manufacturer's certified test curves, indicating capacity, head, efficiency, brake horsepower and speed. No pump shall be shipped to the job site until the test curves have been submitted and reviewed.
 - b. Manufacturer's certification of installation and operation.
 - c. Manufacturer's certification the equipment is suitable for the intended use.
 - d. Operation and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Manufacturer shall provide affidavit certifying that:
1. Manufacturer has examined the Contract Documents, including but not limited to the Drawings and specifications.
 2. Understand the installation and parameters specified herein and shown on the Drawings.
 3. The equipment specified is suitable for this application.
 4. Notified Owner and Engineer of any modifications required to the system or the equipment in this application.
- B. Each pump shall be shop tested in accordance with standards of the Hydraulic Institute.
- C. All internal components including the pumps, motors, valves, piping, and controls shall be tested as a complete working system at the manufacturer's facility.
1. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed, and horsepower.
 2. Factory operational test shall simulate actual performance anticipated for the complete station by demonstrating varying flows and backpressures within the expected operating ranges in this specification.
- D. The entire package pump station and components shall comply with NFPA classifications.
1. Per NFPA, the wet well shall be classified as a Class 1, Group D, Division 1, environment.
 2. Per NFPA, the area immediately adjacent to a Class1, Group D, Division 1 area shall be Class1, Group D, Division 2.

1.04 WARRANTY

- A. The pump and motor shall be warrantied for 24 month, parts and labor (non-prorated). The warranty period shall commence on the date of Substantial Completion. Under terms of this warranty, the manufacturer shall furnish and install all replacement parts for any defective component at no cost to the Owner. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in the General Conditions of these Specifications.
- B. The package pump station and all components shall be warranted for 24 months, parts and labor (non-prorated). The warranty period shall commence on the date of Substantial Completion. Under terms of this warranty, the manufacturer shall furnish and install all replacement parts for any defective component at no cost to the Owner. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in the General Conditions of these Specifications.

- C. Owner shall have the option to purchase additional manufacturer warranty options and service package plans, for a cost. Contractor shall provide, upon request, the warranty and service plan information and their respective cost. Warranty options should include, but not be limited to:
 - 1. Prorated warranties, terms and conditions, and length of time.
 - 2. A full replacement (non-prorated) warranty, terms and conditions, for time frames up to 5 years.
 - 3. Service package plans.

1.05 PRODUCT HANDLING

- A. Control panels shall be stored in accordance with Sections 01350.
- B. Pumps and appurtenances shall be stored in accordance with Sections 01350, 11050 and per manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. To unify responsibility for the package pump station and proper operation, it is the intent of these Specifications that all system components be furnished by a single source supplier which shall be the pump manufacturer in order to ensure continuity of warranty and operation. The package system shall be warranted by the manufacturer.
- B. The manufacturer of the package pump station shall be:
 - 1. Gorman Rupp with a Keen Grinder Pumping equipment.

2.02 PERFORMANCE

- A. The design has been based upon the characteristics as shown on the Drawings and specified herein. Should the Contractor select substitute or alternate equipment, pipe sizes, materials and appurtenances or if the alignment or profile is changed, the Owner and Engineer shall be notified prior to proceeding with construction. If the changes require a modification to the design, including but not limited to an increase in the size or number of: pump(s), pump station(s), telemetry system, force main(s) and accessories; then the cost shall be borne by the Contractor.

2.03 SUBMERSIBLE PUMP

- A. The pumps shall be capable of handling raw, unscreened wastewater. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65-feet.
- B. Pump components, unless specified otherwise, shall be of gray cast iron, Class 30, with smooth surfaces devoid of blow holes and other irregularities.

1. All mating surfaces shall be watertight, machined and fitted with nitrile rubber O-rings.
 2. All exposed nuts and bolts shall be of AISI Type 304 stainless steel or brass construction.
- C. The junction chamber, containing the terminal board, shall be sealed from the motor by gasket. Connection between the cable conductors and stator leads shall be made with threaded compressed type binding posts permanently affixed to a terminal board and leak proof.
- D. Each unit shall be provided with a cooling system that shall operate while partially submerged without auxiliary cooling during normal continuous operation.
- E. The stator shall be equipped with three thermal switches embedded in the end coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with, and supplemental to, external motor protection, and wired to the control panel.
- F. Each pump shall be provided with a tandem mechanical shaft seal system.
1. The upper of the tandem set of seals shall operate in an oil chamber located just below the stator housing. This set shall contain one stationary tungsten-carbide ring and one positively driven rotating carbon ring and shall function as an independent secondary barrier between the pumped liquid and the stator housing.
 2. The lower of the tandem set of seals functions as the primary barrier between the pumped liquid and the stator housing. This seal shall consist of a stationary ring and a positively driven rotating ring both of which shall be tungsten carbide.
- G. Each pump shall be provided with an oil chamber for the shaft sealing system. Seal lubrication shall require an oil chamber capacity no greater than 11.5 pints (5.44 liters). The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside.
1. The chamber shall have a device to detect water entering the chamber through the lower seals. Water in the chamber shall enable a red indicator light on the control panel but not stop the motor. Light shall remain on until acknowledgment of the seal failure.
- H. The pump shaft shall rotate on two permanently lubricated bearings. The upper bearing shall be a single row roller ball bearing and the lower bearing shall be a two-row angular contact ball bearing.
- I. The impeller shall be gray cast iron, Class 30, stainless steel, or brass, dynamically balanced, double shrouded non-clogging design having a long thrulet without acute turns.
1. The impeller shall be capable of handling solids, fibrous materials, heavy sludge, and other matter found in normal wastewater applications and passing a minimum 3-inch solid sphere.

- J. The volute shall be of a single piece, nonconcentric design, and shall have smooth fluid passages large enough at all points to pass any size solids which can pass through the impeller.
 - 1. The volute shall have a minimum inlet and discharge ports as specified in Part 4.
 - 2. A wear ring shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert which is drive fitted to the volute inlet.

- K. Impeller Design and Grinder
 - 1. Material shall be ASTM® A536 ductile cast iron. ASTM® A48 gray cast iron shall be unacceptable.
 - 2. The design shall be one-piece, 10-vane, vortex flow and dynamically balanced to ISO 1940 G6.3.
 - 3. The impeller shall be designed with pump out vanes on the back shroud of the pump impeller to prevent the pump media from entering the outboard seal cavity.
 - 4. The impeller shall be threaded to the pump shaft. All wetted fasteners shall be of a corrosion resistant stainless steel material.
 - 5. The mass moment of inertia calculations shall be provided by the pump manufacturer upon request.
 - 6. The grinder assembly shall consist of a single rotating grinding cutter and stationary grinding ring secured to the inlet of the volute case.
 - a. The rotating grinding cutter shall be threaded onto the pump shaft and secured with a washer and bolt.
 - b. The stationary grinding ring shall be secured in place with a metal clamping ring.
 - 7. Both the stationary and rotating grinding mechanisms shall be removable without disassembling the pump.
 - 8. No adjustment or shimming grinder assembly shall be necessary.
 - 9. The grinder components shall be constructed of a martensitic AISI 440C stainless

2.04 ELECTRIC PUMP MOTOR

- A. Each pump shall be equipped with submersible explosion proof electric motor, NEMA Design B, connected for operation on a 240V, 3 phase, 60 Hz.
 - 1. Motor horsepower shall be adequate so that no point on the pump performance curve requires more than the nameplate horsepower of the motor.

- B. The cable entry water seal shall preclude specific torque requirements to ensure a watertight and submersible seal.
 - 1. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by stainless steel washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing cable.
 - 2. The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top.
 - 3. Cords shall withstand a pull of 300 pounds.
- C. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing shall be prohibited.
- D. The motor shall be designed for continuous duty, capable of sustaining a minimum of ten starts per hour.
- E. The rotor bars and short circuit rings shall be made of either aluminum or copper.
- F. Provide a hypalon jacketed type SPC cable suitable for submersible pump applications of a length as specified in Part 4. The power cable shall be sized according to NEC and ICEA standards, and also meet with P-MSHA Approval.

2.05 PUMP STATION CONTROLS

- A. The electrical control equipment shall be mounted within a 36"x30"x14" Nema 4X stainless steel, dead front type control enclosure. The enclosure door shall be hinged and sealed with a neoprene gasket. It shall include a removable plated steel back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Operator controls shall be mounted on the enclosure door. The enclosure shall be mounted within the fiberglass valve enclosure. The control panel shall be equipped with vapor emission type corrosion inhibitors.
- B. All control components shall be securely fastened to a removable back panel with screws and lock washers. Switches, indicators and instruments shall be mounted through the control panel door. All control devices and instruments shall be secured to the sub-plate with machine screws and lock washers. Mounting holes shall be drilled and tapped; Self tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks. All control devices shall be clearly labeled to indicate function.
- C. A main terminal block and ground bar shall be furnished for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the pump station loads. The main terminal block shall be

mounted to allow incoming wire bending space in accordance with Article 373 of the National Electrical Code (NEC).

- D. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub panel or control cover shall conform to UL descriptions and procedures.
- E. The control panel shall be equipped with a modular surge arrester to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall utilize thermally protected by heavy duty zinc oxide varistors encapsulated in a non conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. The suppressor shall have a short circuit current rating of 200,000 Amps and a Maximum Discharge current rating of 40,000 Amperes. Nominal discharge current is 20,000 Amperes. Surge arrester according to UL 1449 3rd Edition, Type 2 component assembly.
- F. Pump station shall be supplied with a thermostat which shall monitor interior station temperature. The control shall incorporate an unpowered dry contact wired to terminal blocks for field connection to a remote alarm device. The contact will close in the event that the temperature within the enclosure falls below approximately 35 degrees F.
- G. Motor Branch Components:
 - 1. A properly sized heavy duty air circuit breaker shall be furnished for each pump motor, and shall have a symmetrical RMS interrupting rating of _____ amperes at 240 volts. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.
 - 2. A padlocking operating mechanism shall be installed on each motor circuit breaker. Operator handles for the mechanisms shall be located on the door, with interlocks which permit the door to be opened only when circuit breakers are in the "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.
- H. Motor Starters
 - 1. An open frame, across the line, NEMA rated magnetic motor starter shall be furnished for each pump motor. Starters of NEMA size 1 and above shall be designed for addition of at least two auxiliary contacts. Starters rated "O", "OO", or fractional size shall not be acceptable. Power contacts shall be double break and made of cadmium oxide silver. Coils shall be epoxy molded for protection from moisture and corrosive atmospheres. The starter assembly shall be equipped with a metal mounting plate for durability. All motor starters shall be equipped to provide under voltage release and overload protection on all three phases. Motor starter contacts and coils shall be easily replaceable without removing the motor starter from its mounted position.

2. Overload relays shall be solid state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one (1) normally open and one (1) normally closed isolated alarm/control contact to reset, thus re establishing a control circuit. Trip setting shall be governed by solid state circuitry and adjustable current setting. Trip classes shall be 10, 15 and 20. Additional features to include phase loss protection, selectable jam/stall protection and selectable ground fault protection.
 3. A reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the door.
- I. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating
- J. Other Control Components
1. The pump control panel shall be equipped to terminate pump operation due to high motor winding temperature or moisture in the motor housing or seal cavity, utilizing contacts in the pump motor housing and seal cavity. If a moisture or thermal event should occur, the motor starter will drop out and a visible indicator on the door shall indicate the pump motor has been shut down. If shutdown is due to high motor temperature, motor power will automatically be restored when the temperature returns to normal range. If the shutdown occurs due to moisture, a manual reset will be required before motor power is restored. Dry contacts, wired to terminal blocks, shall be furnished for each pump for thermal/moisture shutdown.
 2. The control circuit shall be protected by a normal duty thermal magnetic air circuit breaker which shall be connected in such a manner as to allow control power to be disconnected from all control circuits.
 3. Pump mode selector switches shall be connected to permit manual start and manual stop for each pump individually, and to select automatic operation of each pump under control of the liquid level control system. Manual operation shall override the liquid level control system. Selector switches shall be heavy duty, oil tight design, with contacts rated NEMA A300 minimum.
 4. Pump alternation shall be integral to the liquid level controller. Provisions for automatic alternation or manual selection shall also be integral to the liquid level controller.

5. Control panel shall be equipped with one oil tight pilot light for each pump motor. Light shall be wired in parallel with the related pump motor starter to indicate that the motor is on or should be running.
 6. Six digit elapsed time meter shall be shall be displayed on the Integrinex™ Standard operator interface to indicate total running time of each pump in "hours" and "tenths of hours". Pump runtime shall be adjustable and password protected.
 7. A switch shall be provided to permit the station operator to select automatic alternation of the pumps, to select pump number one to be the lead pump for each pumping cycle or to select pump number two to be the lead pump for each pumping cycle. Selector switch shall be oil tight design, with contacts rated NEMA A300 minimum.
 8. A duplex ground fault indicating utility receptacle providing 115 VAC, 60 Hertz, single phase current, shall be mounted on the door panel of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal magnetic circuit breaker.
 9. Auxiliary Power Transformer
 - a. The lift station shall be equipped with a 5 KVA stepdown transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment as specified, shown or required for a complete functioning pump station. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.
 - b. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, voltage unbalance, high voltage, and low voltage. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.
- K. The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.

L. Wiring:

1. The control panel, as furnished by the manufacturer, shall be completely wired. The contractor shall field connect the power feeder lines to the main terminal block, final connections to the remote alarm devices, and the connections between the pump and the pump motor control. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications set forth by the National Electric Code (NEC).
2. All user serviceable wiring shall be type MTW or THW, 600 volts, and shall be color coded as follows:
Line and load circuits, AC or DC power Black
AC control circuit less than line voltage Red
DC control circuit Blue
Interlock control circuit, from external source Yellow
Equipment grounding conductor Green
Current carrying ground White
Hot with circuit breaker open Orange
3. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be of 16 gauge minimum, type MTW or THW, 600 volts. Power wiring shall be 14 gauge minimum.
4. Motor branch and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires shall be clearly numbered at each end in accordance with the electrical diagrams. All wires on the sub plate shall be bundled and tied.
5. Wires connected to components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be provided to allow the door to swing to its full open position without undue stress or abrasion on the wire or insulation. Bundles shall be held in place on each side of the hinge by mechanical fastening devices.

M. Conduit requirements are as follows

1. All conduit and fittings shall be UL listed.
2. Liquid tight flexible metal conduit shall be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight, polyvinyl chloride cover.
3. Conduit shall be supported in accordance with articles 346, 347, and 350 of the National Electric Code.
4. Conduit shall be sized according to the National Electric Code.

N. Grounding

1. The pump control manufacturer shall provide a common ground bar mounted on the enclosure back plate. The mounting surface of the ground bar shall have any paint removed before making final connections.
2. The contractor shall make the field connections to the main ground lug and each pump motor in accordance with the National Electric Code.

O. Identification

1. A permanent corrosion resistant name plate(s) shall be attached to the control and include the following information:
 - a. Equipment serial number
 - b. Control panel short circuit rating
 - c. Supply voltage, phase and frequency
 - d. Current rating of the minimum main conductor
 - e. Electrical wiring diagram number
 - f. Motor horsepower and full load current
 - g. Motor overload heater element
 - h. Motor circuit breaker trip current rating
 - i. Name and location of equipment manufacturer
2. Control components shall be permanently marked using the same identification shown on the electrical diagram. Identification label shall be mounted adjacent to the device.
3. Switches, indicators, and instruments shall be plainly marked to indicate function, position, etc. Marking shall be mounted adjacent to and above the device.

- P. Provide Aquavx™ Scout alarm notification and remote monitoring system designed for the water and wastewater applications. Provide monitoring and control for up to 74 inputs and outputs: Standard physical inputs include 10 digital, 4 analog and 2 output relays. 58 standard Modbus I/O.

2.06 PUMP STATION CONTROL OPERATION

- A. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.
- B. The level control system shall be capable of operating submersible transducer type system type system.

- C. The level control system shall utilize alternation to select first one pump, then the second pump to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle, or in the event of excessive run time.
- D. The level control system shall utilize an electronic pressure switch which shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second and/or third pump (if required) when the liquid reaches the "lag pump start level", or "standby pump start level" so that all pumps are operating. These levels shall be adjustable as described below.
- E. The electronic pressure switch shall include integral components to perform all pressure sensing, signal conditioning, EMI and RFI suppression, DC power supply and 120 volt outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below.
1. The electronic pressure switch shall be capable of operating on a supply voltage of 12-24Vdc in an ambient temperature range of 10 degrees C (14 degrees F) through 55 degrees C (131 degrees F). Ingress Protection of IP56 for indoor use with closed cell neoprene blend gasket material. Evaluated by Underwriters Laboratories for Pollution Degree 2 device for U.L. and U.L. Control range shall be 0 to 33.3 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be non volatile. A Battery backed real time clock shall be standard.
 2. Eleven optically isolated, user defined digital inputs for pump and alarm status. Rated at 10mA at 24Vdc. Eight digital output relays (mechanical contacts), configurable for pump start/stop or alarms. Three relays rated at 12 Amp @ 28Vdc and 120Vac, five relays rated at 3 Amp @ 30Vdc and 120Vac. The electronic pressure switch shall consist of the following integral components: pressure, display, electronic comparators, digital inputs and digital output relays.
 - a. The internal pressure sensor shall be a strain gauge transducer and shall receive an input pressure from the air bubbler system. The transducer shall convert the input to a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. The transducer range shall be 0 14.5 PSI, temperature compensated from 40 degrees C (40 degrees F) through 85 degrees C (185 degrees F), with a repeat accuracy of (plus/minus) 2.5% full scale about a fixed temperature. Transducer overpressure rating shall be 3 times full scale.

- b. The electronic pressure switch shall incorporate a digital back lighted LCD panel display which, upon operator selection, shall indicate liquid level in the wet well, and pump status indication for up to 3 pumps. The display shall include a 128 x 64 bit resolution LCD to read out directly in feet of water, accurate to within one tenth foot (0.1 foot), with a full scale indication of not less than 12 feet. The display shall be easily convertible to indicate English or metric units.
 - c. Level adjustments shall be electronic comparator set points to control the levels at which the lead, lag and standby pumps start and stop. Each of the level settings shall be easily adjustable with the use of membrane type switches, and accessible to the operator without opening any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.
 - d. Each digital input can be programmed as pump run, pump HOA, pump high temp, pump moisture/thermal, starter failure (FVNR, RVSS, VFD), and phase failure. Inputs are used for status and alarm indication.
 - e. Each output relay in the electronic pressure switch shall be hard contact mechanical style. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. Each output relay shall have an inductive load rating equivalent to one NEMA size 3 contactor. A pilot relay shall be incorporated for loads greater than a size 3 contactor.
3. The electronic pressure switch shall be equipped with alarm banners with time and date history for displaying alarm input notification. Alarm history will retain a 16 of the most recent alarm events.
 4. The electronic pressure switch shall be equipped with pump start/stop and alarm input delay(s) that have an adjustable delay set points.
 5. An Antiseptic function with a built in timer shall be incorporated in the electronic pressure switch to prevent the well from becoming septic.
 6. The electronic pressure switch shall be capable of jumping to next available pump if current pump is out of service due to pump failure or manual selection. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.
 7. The electronic pressure switch shall be equipped with a simulator system capable of performing system cycle testing functions.
 8. The electronic pressure switch shall be capable of calculating and displaying pump elapse run time. The elapse run time is resettable and adjustable.

9. The electronic pressure switch shall have internal capability of providing automatic simplex, duplex, and triplex alternation, manual selection of pump sequence operation, and alternation in the event of 1-24 hours of excessive run time.
 10. The electronic pressure switch shall be equipped with a security access code to prevent accidental set up changes and provide liquid level set point lock out. The supervisor access code is adjustable.
 11. The electronic pressure switch shall be equipped with one (1) 0 33 ft. W.C. input, one (1) scalable analog input of either 0 5Vdc, or 4 20mA, and one (1) scalable analog output of either 0-5Vdc, 0-10Vdc or 4-20mA. Output is powered by 10-24Vdc supply. Load resistance for 4 20mA output shall be 100 1000 ohms.
 12. The electronic pressure switch shall include a DC power supply to convert 120Vac control power to 12 or 24Vdc power. The power supply shall be 500 mA (6W) minimum and be UL listed Class II power limited power supply.
 13. The electronic pressure switch shall be equipped with an electronic comparator and mechanical output relay to alert maintenance personnel to a high liquid level in the wet well. An alarm banner, visible on the front of the controller, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.
 14. The electronic pressure switch shall be equipped with an electronic comparator and mechanical output relay to alert maintenance personnel to a low liquid level in the wet well. An alarm banner, visible on the front of the controller, shall indicate that a low wet well level exists. The alarm signal shall be maintained until the cause for the low wet well level has been corrected and the circuit has been manually reset. A low liquid level condition shall disable all pump motors. When the wet well rises above the low level point, all pump motors shall be automatically enabled. Low water alarm shall be furnished with a dry contact wired to terminal blocks.
- F. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be a membrane style button integral to the Integrinex Standard level controller.

2.07 LIQUID LEVEL CONTROL

- A. Submersible Transducer System
1. The level control system shall utilize a submersible transducer. It shall be a strain gauge transducer with a pressure sensor housed in a 316 SST or Titanium

case designed to extend into the wet well. The pressure transducer shall provide a proportional signal for distribution to the display and electronic comparators of the electronic pressure switch, and remainder of the level control system. Sensor range shall be 0-12 ft. W.C. minimum with an over-pressure rating 3 times full scale. The transducer shall have output capability of 0-5Vdc or 4-20mA. The transducer's polyurethane jacketed shielded cable shall be of suitable length for proper installation into the wet well without splicing.

2. An intrinsically safe repeater shall be supplied in the control enclosure. Repeater must be recognized and listed as intrinsically safe by a nationally recognized testing laboratory. Station manufacturer shall make all connections from repeater to feeder lines and motor controls. Installing contractor shall make connections from repeater to transducer.
3. Submersible transducer will be furnished with transient voltage surge suppression to protect related equipment from an induced voltage spike from lightning.

2.08 PUMP STATION ENCLOSURE

- A. The station enclosure shall contain and enclose all valves, and associated controls and shall be constructed to enhance serviceability by incorporating the following design characteristics:
- B. Two access panels per side of station shall be provided. Panels shall be sized and placed to permit routine maintenance operations through the panel openings of the enclosure. For these purposes, routine maintenance shall include frequently performed adjustments and inspections of the electrical components, controls and valves.
- C. The access panels shall be provided with a hinge and latch. Hinge shall be the continuous type. Latch shall engage the enclosure at not less than three places, and shall be protected by a keyed lock.
- D. One enclosure side shall contain a screened vent to maximize air flow for enclosure ventilation.
- E. Station enclosure, less base, must be removable or able to be disassembled following the removal of reusable hardware.
- F. Removal or disassembly of the enclosure shall be accomplished by not more than two maintenance personnel without the use of lifting equipment.
- G. The station enclosure shall be manufactured of molded reinforced orthophthalic polyester resins with a minimum of 30% fiberglass, and a maximum of 70% resin. Resin fillers or extenders shall not be used.
- H. Glass fibers shall have a minimum average thickness of 1 1/4 inches. Major design considerations shall be given to structural stability, corrosion resistance, and watertight properties. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to insure long life. They must be impervious to micro organisms,

mildew, mold, fungus, corrosive liquids, and gases which can reasonably be expected to be present in the environment surrounding the wet well.

- I. All interior surfaces of the housing shall be coated with a polyester resin rich finish. It shall provide:
 1. Maintenance free service
 2. Abrasion resistance
 3. Protection from (sewage) (industrial waste), greases, oils, gasoline, and other common chemicals
 4. The outside of the enclosure shall be coated with a suitable pigmented resin, compounded to insure long maintenance free life.
- J. An exhaust blower shall be mounted on the side of the enclosure. Blower capacity shall be sufficient to change station air a minimum of once every two minutes. Blower motor shall be operated automatically and shall be turned on at approximately 70 degrees F and shall be turn off at 55 degrees F. Blower motor and control circuit shall be protected by a thermal magnetic air circuit breaker to provide overcurrent and overload protection. Blower exhaust outlet shall be designed to prevent the entrance of rain, snow, rocks, and foreign material.
- K. Station base shall be constructed of pre cast, reinforced concrete bonded inside a fiberglass form covering top and sides, and shall be designed to ensure adequate strength to resist deformation of the structure during shipping, lifting, or handling. The enclosure base shall function at the wet well top and incorporate a duplex access lid with safety grating, sized for the installation and removal of the specified pumps, and shall be of sufficient size to permit access to the wet well.
- L. A static wet well vent shall be mounted in the station base, and be housed in the station enclosure. The station enclosure shall provide a transition area between the wet well and the vent outlet. The vent shall terminate through the station wall with a screened opening which shall be designed to prevent the entrance of rain, snow, rocks and foreign material.
- M. The station base shall be furnished with elastomeric compression sealing devices for all piping penetrations to provide for a vapor tight transition between the wet well and lift station enclosure.
- N. Pump station shall be provided with a 1300/1500 watt, 115 volt electric heater with cord, thermostat and grounding plug. Ungrounded heaters shall not be acceptable
- O. The pump station shall be furnished with 1" thick spray foam insulation, which shall be applied to the roof, doors, and corner panels.
- P. The station enclosure shall include limit switches with defeater switch alarm circuit and time delay, mounted and wired in the station enclosure to indicate that there has been a door left open or unauthorized entry to the station. There shall be an adjustable time period for the operator to disable alarm with an unmarked pushbutton located inside

the station. The notification shall be activated when a station door is opened. Includes dry contacts pre-wired to a terminal strip for remote monitoring

- Q. The pump station shall be provided with a portable hoist with winch assembly. Hoist shall be designed to lift pumps weighing.

2.09 VALVES PIPING SUPPORTS AND GAUGES

- A. Valves and piping shall be manufactured by established companies and rated for wastewater applications.
- B. A 2-way eccentric plug valve and lever & weight swing check valve shall be installed on each pump discharge pipe to allow for each pump to be isolated. Rated for drip-tight shutoff and throttling service. Seats shall be applicable for wastewater service.
- C. Wet well piping and fittings shall be ductile iron piping and comply to ANSI/AWWA A21.51/C115 standards for sanitary sewage service as follows:
- D. A bypass port complete with plug valve and cam-loc quick disconnect fitting shall be mounted on the outside of the pump station enclosure for use by a Vac-Truck.
- E. Piping and valving shall constitute a complete system for accepting discharge from either, or both submersible pumps mounted in the wet well, and discharging to the force main described in this specification and as shown on the related drawings, or to the Vac-Truck connection described above.
- F. Piping system shall extend 3 feet from the outside perimeter of the wet well, where the contractor shall connect it to the existing force main shown on the drawings.
- G. Support and Braces: Piping system shall be connected to the wet well and enclosure in sturdy fashion designed to prevent pipe static and dynamic loads from being transmitted to pumps or any other pump station piping. Pump station discharge force main piping shall be anchored with thrust blocks where appropriate.
- H. Discharge pressure from each pump discharge pipe must be displayed in the enclosure for operations staff to examine. Glycerin-filled pressure gauges are to be at least 4 inches in diameter and graduated in PSI and feet of water column (0 to 70 feet water column minimum). Gauges to be installed complete with all hoses and stainless-steel fittings, including shutoff valves for each gauge line at each end of its associated pressure monitoring line at the display and the point of connection to the discharge pipe.
- I. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping.
- J. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service.
 - 1. There shall be no need for personnel to enter the pump well.

2. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a single linear downward motion of the pump.
- K. Discharge fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in controlled compression of nitrile rubber O-rings without the requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

2.10 PRECAST CONCRETE WET WELL

- A. Wet well shall be a precast reinforced concrete structure with inlets/drop connections, precast concrete top slab and cast-in-place reinforced concrete bottom, as specified in section 02551 and as shown on the drawings.
- B. Metering structures shall be a precast concrete structure, as specified in section 02551 and as shown on the Drawings.
- C. Precast and cast in place admixture:
1. Contractor to provide crystalline waterproofing additive to cast-in-place concrete and precast concrete for the wet well structure (Xypex Admix C-500 or C-1000).
 2. The manufacture of the crystalline water proofing shall provide the type of material and the dosage rate for the application. Admix must be added to concrete mix at time of batching. The actual dosage in the mix design shall be certified at the time of application.
 3. Manufacturer shall coordinate with the concrete batch facility and other admixture suppliers to ensure compatibility with the concrete mix design, other admixtures and concrete properties. The addition of the crystalline water proofing shall not reduce the concrete strength or compromise the ASTM specifications or other quality standards governing the concrete mix.
 4. Concrete containing Xypex Admix shall be moist cured in accordance with ACI Reference 308, "Standard Practice for Curing Concrete".

2.11 FABRICATION

- A. All metal surfaces, coming into contact with wastewater, other than stainless steel or brass, shall be protected by an approved wastewater resistant coating. All coatings and finishes shall be factory applied.
1. Cast iron impeller shall be coated with Epoxy.

PART 3 EXECUTION

3.01 COORDINATION

- A. Pump stations in an existing system, being modified, replaced, or abandoned shall be coordinated with the operation of the Owner's existing sewer system so as to cause the least disruption to sewer service.
- B. Contractor shall coordinate with Owner as may be required for sequencing and timing or re-timing of existing pump stations in the Owner's system as may be affected by the Work.
- C. Contractor shall be responsible for providing and operating by-pass pumping. No sanitary overflows will be allowed.

3.02 ERECTION

- A. The equipment shall be erected in accordance with the manufacturer's recommendations. Required grout and leveling shims shall be provided by the Contractor.
- B. The Contractor shall strip the immediate area of organic material and stockpile the topsoil as directed by the Engineer.
- C. Excavation and backfill for each pump unit and force main shall conform to the requirements of Section 02200. All backfill shall be considered to be under pavement.
- D. All soil surface areas disturbed by the construction of the pump system shall be restored according to Section 02800.
- E. Pavement removed shall be replaced as scheduled or shown on the Drawings.
- F. The Contractor shall construct and maintain stilling basins with overflows to receive pumpage or surface drainage from excavation as required to prevent siltation to nearby streams and lakes.

3.03 INSPECTION, START-UP, AND TESTING

- A. The Contractor shall furnish a representative of the manufacturer to perform inspection, start-up, and training services. The manufacturer's representative shall be experienced in the operation and maintenance of the equipment.
- B. Initial lubrication required for start-up and field test operation shall be furnished and applied in accordance with the manufacturer's recommendations.
- C. The representative shall check the installation and supervise initial start-up of the equipment. The representative shall certify that the installation is correct and that the equipment has operated satisfactorily. This service shall be provided for a minimum period of one trip and one day.

- D. After the installation and operation of the equipment has been certified, the manufacturer's representative shall train the Owner's personnel for one eight-hour day in the proper operation and maintenance of the equipment. The Owner may videotape the training.

3.04 PUMP STATION PERFORMANCE TESTING

- A. Contractor shall perform all tests with clean water (no sewage will be allowed). Contractor shall be responsible for providing water for all testing at no additional cost to the Owner.
1. Pump(s) shall discharge through the force main system as planned.
 2. All downstream systems shall be able to appropriately handle the discharge.
- B. Run pumps continuously for a minimum of an hour before starting test. (Providing inflow as required):
1. Turn all pump selector switches to the OFF position.
 2. Fill wet well to just below inlet pipe. (Well may be filled higher if inlet pipe is plugged at well.)
 3. Measure water elevation.
 4. Start one pump and pump for a measured time period. (At least 3 minutes.)
 5. Measure water elevation.
 6. Calculate volume pumped, flow rate, and pressure gauge recording. Check against pump curve.
 7. Repeat steps 2 through 6 three times for each pump.
- C. Pump Station and Telemetry Test:
1. Supply a steady flow to the station wet well at a rate less than the pump capacity. Confirm telemetry system is communicating.
 2. Turn all pump selector switches to the AUTO position. Confirm telemetry indicates pumps are in AUTO Mode.
 3. Turn the Lead Pump selector switch to the Pump One position. Let well fill to Lead Pump ON position and measure water elevation. Confirm Pump One is running and that telemetry indicates Pump One is running. Let well empty to Pump OFF position and measure water elevation. Confirm Pump One shuts off.
 4. Turn Pump One selector switch to the OFF position. Confirm telemetry indicates Pump One is not in AUTO Mode. Let well fill to Lag Pump On position and measure water elevation. Confirm Pump Two is running and that telemetry indicates Pump Two is running. Turn Pump One selector switch to the AUTO position. Confirm Pump One is running and that telemetry

indicates Pump One is running and in AUTO Mode. Let well empty to Pump OFF position.

5. Confirm both pumps shut off.
6. Turn all pump selector switches to the OFF position. Let well fill to High Water Alarm and measure water elevation and confirm that telemetering indicates High level.
7. Make sure generator and automatic transfer switch are in the AUTO position.
8. Confirm that telemetering indicates service disconnect in closed position.
9. Open disconnect and confirm that telemetering indicates disconnect in open position and power fail. Leave power off until automatic transfer switch starts generator and transfers power. Confirm that telemetering indicates Generator is running.
10. Let station run on generator and repeat steps 2 through 9. Generator should run for at least 15 minutes.
11. Turn selector switch of generator to the OFF position. Allow generator fail alarm to activate and confirm that telemetering indicates Generator Fail.
12. Turn selector switch of generator to the AUTO position. Allow Generator to restart and run for 5 minutes.
13. Close disconnect and let automatic transfer switch transfer power and stop generator. Confirm all telemetering signals.
14. Simulate phase loss, intrusion, and authorized entry and confirm all telemetering signals.
15. Simulate station out of service. Confirm upstream stations, as applicable to system, will not operate.
16. Simulate downstream pump station out of service and check Enable Function prevents pumps from operating, where applicable.

PART 4 SPECIAL PROVISIONS

4.01 PUMP STATION CONDITIONS

Description	Manufacturer 1	Manufacturer 2	Manufacturer 3
Quantity	2 pumps		
Type	Grinder		
Model No.	KG3X-230		
Solids Content	1% to 4%		
Temperature	140 F (Max)		
Suction Condition	Submersible		
Stator or Impeller Type	Recessed Vortex -		

	Grinder		
Rotating "Radial" Cutter	440 SST Hardened 58-60 Rockwell C		
Stationary "Radial" Cutter	440 SST Hardened 58-60 Rockwell C		
Casing & Impeller Coating	Manf. Standard Paint		
Impeller Trim	4.25 inches		
Seal Type	IN/Out board Silicon Carbide / Silicon Carbide, Viton® Elastomers		
Lubrication	Oil Filled		
Coupler Type	N/A		
Coupler (Manufacturer/Model)	N/A		
Bearings	Conrad Style Single Row Deep Groove Ball Bearing 100,000 Hours, L-10		
Motor HP	3		
Motor RPM	3450		
Pump RPM	N/A		
Inverter Duty (VFD)	Yes		
Voltage	240v		
Phase	3		
Minimum Pump Efficiency (at design point)			
Design Point (gpm/ft TDH)	92 gpm at 44 ft		
Approximate Points (gpm/ft TDH) (on pump curve)	40 gpm at 52 ft 120 gpm at 36 ft		
Certified Test Curve (Yes/No)	Yes		
Volute Inlet (inches)	N/A		
Volute Discharge (inches)	3 inch		

4.02 PUMP SELECTION

- A. The following pump selections were made based on the force main as shown on the Drawings. If force main is installed other than shown, the Contractor shall adjust pump heads to account for the differences in friction losses.

4.03 TEMPORARY PUMPING

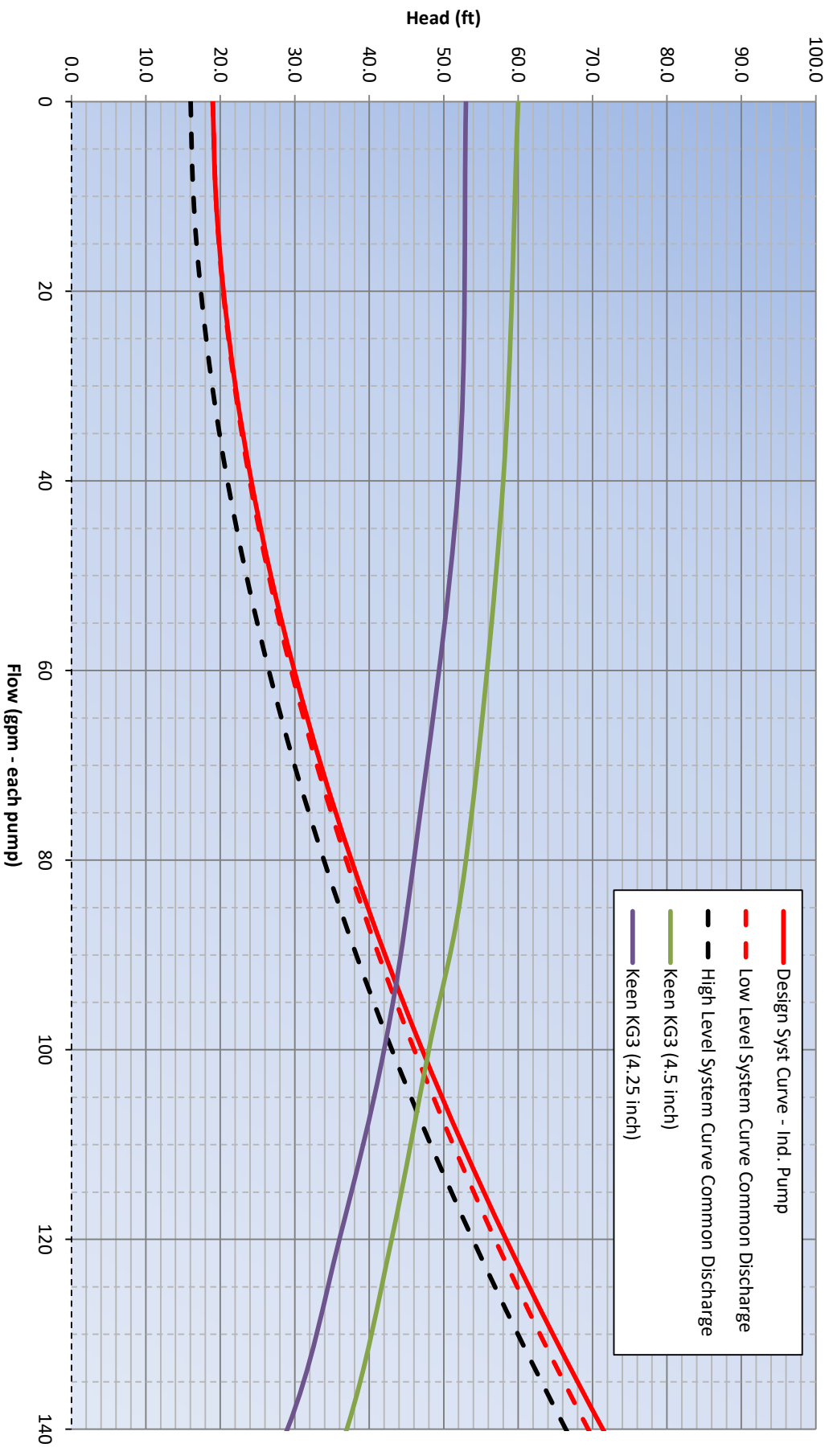
- A. The Contractor is responsible for temporary by-pass pumping during the installation of the pump station and shall be coordinated with the Owner.

END OF SECTION

Efficiency not provided. Motor HP=3 hp. Pump needs to be at least 41% efficient.

Kunkle, Ohio - WWT Force main

Keen KG3 (3450 RPM)



Fluid thinking™

9/24/2020

**SECTION 01300
SUBMITTALS**

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes requirements for submittals.
- B. Contractor shall adhere to the submittal schedule as submitted under the provisions of the General Conditions. Contractor shall modify the schedule as required to allow sufficient time for submittal review based on current construction schedule.
- C. Owner, Contractor and Engineer shall utilize the electronic project management system EPMS as specified in Section 01320 for the central repository of project related documents including but not limited to submittals, information for the record and Operation and maintenance manuals.

1.02 COORDINATION OF SUBMITTALS

- A. The Contractor shall be responsible for the coordination of submittals and field verifications as required for the various parts of the Work.
- B. All submittals to the Engineer, unless otherwise specified, shall be made only by the Contractor. Direct submittals from subcontractors or suppliers will not be accepted.
- C. All submittals shall reference the Specification item that it covers, the Contractor's name, the Contract title and location, and the date of submission. Submittal shall also indicate whether the information is for the Engineer's review and approval, for record purposes, or for the fulfillment of the operation and maintenance requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. Two categories of information are normally required:
 - 1. Shop Drawings for review.
 - 2. Information for Record:
 - a. Operation and maintenance manuals.

Applicable to Addendum 2 - Division A

2.02 SHOP DRAWINGS FOR REVIEW

- A. Shop Drawings:
1. The Contractor shall submit Shop Drawings in accordance with the General Conditions, as required by individual Sections, shown on the Drawings or as directed.
 2. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with the General Conditions.
 3. The Contractor shall clearly indicate quantities and the exact intended use of the equipment or material contained in the submittal.
 4. All Submittals shall be tailored to the project by high-lighting appropriate information and deleting or crossing out nonapplicable information or where applicable the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual material or equipment furnished. All options furnished shall be indicated.
 5. Color charts or samples shall be included for all submittals where a color selection by the Owner is required. Original Color Charts (not Color Copies) and samples shall be delivered to the Site, Engineer's RPR or Owner as required. The Engineer shall be copied on the transmittal letter for record purposes.
- B. Samples shall be provided as required in the individual Sections. Samples shall be of the precise material proposed to be furnished. The number of samples and sample size shall be the industry standard unless otherwise stated in the individual Sections.

2.03 INFORMATION FOR RECORD

- A. Material certificates shall be submitted for materials as indicated in the individual Sections. The certificate shall state that the products have been sampled and tested in accordance with the proper industrial and governmental standards and meet the requirements of the Specifications. Certificates shall be signed by an authorized agent of the manufacturer.
- B. Licenses and Permits - The Contractor shall submit copies of all licenses and permits required by Local, State, and Federal laws.
- C. Installation and calibration certificates shall be submitted for equipment as indicated in the individual Sections. These certificates shall indicate manufacturer's satisfaction with the installation, the accuracy of calibration and alignment, and the operation of the equipment. Such certificates must be signed by an authorized agent of the manufacturer.
- D. Progress Schedules shall be submitted in accordance with the General Conditions and Section 01310.
- E. Schedule of Shop Drawings and Sample Submittals shall be submitted in accordance with the General Conditions.

- F. Schedule of Values shall be submitted in accordance with the General Conditions.
- G. Copy of programming for all PLC's and computers on the project.

2.04 OPERATION AND MAINTENANCE INFORMATION

- A. Operation and maintenance manuals shall be submitted as information for the record.
- B. Operation and maintenance manuals shall be submitted as electronic documents prior to the printing of the record copy.
 - 1. Contractor shall provide one electronic copy of the manuals for preliminary review.
 - 2. The final accepted manuals shall be provided as one electronic copy of the manual and one printed copy as specified below.
- C. Electronic manuals shall be in Portable Document Format (PDF) as generated by Adobe Professional Version 7.0 or newer. The PDF file shall be fully indexed using the table of contents, searchable with thumbnails generated. PDF documents shall have bookmark created in the navigation frame for each major entry (Section, Chapter, Tab) in the table of contents. PDF images shall be at a readable resolution typically 300 dpi or higher. Optical Character Recognition (OCR) capture shall be performed on these images text can be searched, selected and copied from the PDF file.
 - 1. The opening view of each PDF document shall be the bookmarks to the left and cover page or table of contents.
 - 2. The PDF file name shall include the Name of Owner, Project title, Contract Number, and Specification Section. Commonly used abbreviations acceptable to the Owner may be used to minimize length of file name.
 - 3. The Contractors Name shall be the electronic "Author" of the PDF document.
- D. This information will be reviewed only if properly identified with Specification Section numbers and only after revised, where necessary, to conform to the Engineer's notes on previous submittals that have been marked "Make Corrections Noted." Manuals shall be tailored to suit the specific equipment provided.
- E. Submittals shall include but not limited to the following:
 - 1. Descriptive literature, bulletins, or other data covering equipment or system.
 - 2. Complete list of equipment and appurtenances included with system, complete with manufacturer serial number and model number.
 - 3. Utility requirements.
 - 4. General arrangement drawing.
 - 5. Sectional assembly.
 - 6. Dimension print.

Applicable to Addendum 2 - Division A

7. Materials of construction.
 8. Certified performance curve.
 9. Parts list with assembly drawings.
 10. Recommended spare parts list with part and catalog number.
 11. Lubrication recommendations and instructions.
 12. Schematic wiring diagrams.
 13. Schematic piping diagrams.
 14. Description of associated instrumentation.
 15. Drive dimensions and data.
 16. Operating instructions.
 17. Maintenance instructions including trouble-shooting guidelines, lubrication, and preventive maintenance instructions with task schedule.
 18. Special tools and equipment required for operation and maintenance.
 19. Description of equipment controls.
 20. Pump seal data.
 21. Assembly, installation, alignment, adjustment, and checking instructions.
 22. Confirmation of all corrections noted on Shop Drawings marked "Make Corrections Noted."
 23. Manufacturer's name, address, and telephone number along with manufacturers job number and Purchase Order number.
 24. Manufacturer's local sales representative, address, telephone number.
 25. All installation instructions that were provided to Contractor for use to install equipment.
- F. All manuals shall be tailored to the project by high-lighting appropriate information and deleting or crossing out nonapplicable information or the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual equipment furnished. All options furnished shall be indicated.
- G. Manuals shall be printed on 8-1/2 by 11-inch size with standard three-hole punching. Large manuals shall be submitted in three-ring binders. Small manuals shall be submitted in folders with metal fasteners. Index tabs shall be furnished for all manuals containing data for three or more items of equipment. All manuals shall have a title label on the cover stating the specification item number and item name. A table of contents shall be included in all manuals.

- H. Drawings shall be reduced to 8-1/2 by 11 inch or 11 by 17 inch. Where reduction is not possible, larger drawings shall be folded separately and placed in envelopes which are bound into the manual.
- I. Equipment installations shall not be considered substantially complete until all associated operation and maintenance manual submittals are accepted by the Engineer.
- J. Field modifications to equipment during installation shall be included in the manual so that the manual reflects as-built conditions. Revisions to the manual may be submitted for incorporation into the manual where appropriate. However, the Engineer reserves the right to return all six manuals for revision to reflect as-built conditions.

PART 3 EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

- A. All submittals shall have a Submittal Identification & Approval cover sheet attached. A sample of the submittal cover sheet is attached for reference. The form will be provided by Engineer and coordinated with Contractor.
- B. All submittals shall be given a consecutive number when they are entered into the Electronic Project Management System (EPMS), See Section 01320.
- C. Resubmittals shall be entered into EPMS as resubmittals.
- D. Submittals to satisfy the operation and maintenance information requirements shall be entered into the EPMS as a submittal. The description shall have the prefix "OM".

3.02 PRINTING AND DISTRIBUTION

- A. Contractor shall provide printed copies of approved submittals and deliver them to the Owner and Engineers RPR at the Site.
- B. Contractor shall provide one printed copy of the approved operation and maintenance manual and the electronic copy on portable electronic media device to the Owner.
- C. Contractor shall provide printed copies of submittals, project information or documents required to satisfy the building permit and inspections as may be required by the governing agency.
 - 1. The Engineer will provide the stamped/sealed Contract Drawings for the initial filing of the building permit applications.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

**SECTION 01350
COMMON PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes general requirements for all materials, equipment and systems furnished or installed under this project.
- B. Additional specific requirements included under a particular Section shall take precedence.
- C. This Section includes, but is not limited to, the following procedural and administrative requirements:
 - 1. Product Delivery Storage and Handling.
 - 2. Warranties.
 - 3. Quality Assurance and Control.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and related specification sections.
- B. The specification sections and Drawings contain the specific submittal requirements.

1.03 QUALITY ASSURANCE

- A. Where Contractor is required to provide design services or certification of the design, the specified product, equipment or system shall comply with the specified criteria.
 - 1. Contractor shall submit a written request for clarification when specified criteria is incomplete or insufficient.
- B. Manufacturer's name, make, model number and other designations provided in the contract documents are to establish the significant characteristics, including but not limited to, type, function, dimensions and physical properties, performance, and appearance for the purpose of evaluating comparable products. Contractor shall verify product, equipment or system proposed meets or exceeds the requirements as specified or shown on the Drawings.

1.04 PROJECT HANDLING

- A. Schedule delivery to minimize the time goods are kept in storage.
- B. Deliver goods to Site in manufacturer's original packaging.
- C. Inspect the goods to determine if there is visible damage to the packaging.

1. The packaging shall be removed in a manner that will allow resealing for storage.
 2. If packaging cannot be removed and reused, the goods shall be repackaged per the manufacturer's recommendations.
- D. Goods that are susceptible to damage by the environmental or project conditions, including but not limited to, switchgear, motor control centers, panelboards, instrument control panels, fixtures shall be stored in a controlled environment per the manufacturer's recommendations. If no such area is available at the time such equipment is received, such space shall be provided by the Contractor at no expense to the Owner.
- E. Where construction is in roads or streets, that portion of the right-of-way not required for public travel may be used for temporary storage purposes unless otherwise prohibited. Materials shall not be stored in areas where such storage creates a hazard. Any other additional space required for construction or storage of materials and equipment shall be obtained by the Contractor at his expense.
- F. The Contractor shall confine his equipment, the storage of materials and equipment, and the operations of his workers to areas permitted by law, ordinances, permits, and the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.

1.05 GUARANTEE

- A. Manufacturer's warranty, extending beyond one-year after substantial completion for the specified product, equipment or system shall be provided to the Owner and endorsed by the manufacturer.
- B. Requirements for warranties extending beyond one-year after substantial completion are described in individual Sections of these specifications.
- C. Manufacturer's limitations and disclaimers shall not relieve the Contractor from warranty obligations under the Contract Documents.

PART 2 PRODUCTS

2.01 SHOP PAINTING

- A. Non-galvanized ferrous surface shall be painted.
- B. Shop painting of ferrous surfaces shall be as follows:
 1. Surfaces shall be thoroughly cleaned of dirt, grease, oil, rust, scale, or other foreign substances. All metal surfaces shall, as a minimum, be abrasive blasted in accordance with SSPC-SP6, Commercial Blast Cleaning. More stringent surface preparation shall be provided where required by Section 09900.
 2. Surfaces shall receive a shop coat of a primer compatible with the finish coating to be used by the Contractor and specified in Section 09900.

2.02 GALVANIZING

- A. Where galvanized metal is indicated, unless otherwise specified, galvanizing shall conform to ASTM A123 (Hot Dip Galvanized). Threaded parts and hardware shall be galvanized in conformance with ASTM A153.

2.03 REGULATORY REQUIREMENTS

- A. Materials, equipment, coatings, and chemicals in contact with potable water or water being treated for potable water use shall comply with the applicable NSF Standards.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Products shall be installed in accordance with the manufacturer's instructions and Contract Documents.
- B. Required appurtenances including but not limited to, anchors, grout, and leveling shims, shall be provided.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

**SECTION 02200
EXCAVATION AND BACKFILL**

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes all excavations and related Work for the construction of the designated structures, pipelines, and other incidental Work.
- B. Excavation includes the Work of making all necessary excavations for the construction of all Contract Work; of furnishing, placing, and use of sheeting, shoring, and sheet piling necessary in excavating for and protecting the Work and workers; of doing all pumping and fluming necessary to keep the excavation free from water; of providing for uninterrupted flow of existing streams, treatment plant processes, drains and sewers; of damming and cofferdamming where necessary; of supporting and protecting existing structures, pipes, conduits, sewers, culverts of all types of materials of construction, of supporting and protecting railroad tracks, posts, poles, wires, fences, buildings, and other public and private property adjacent to the Work; of removing and replacing existing sewers, culverts, pipelines, and bulkheads where necessary; of removing after completion of the Work all sheeting and shoring not necessary to support the sides of excavations; of removing and disposing of all surplus excavated material or material under structures that does not meet the soil design bearing capacities; of doing all backfilling, of compacting backfill to limits specified or ordered by the Engineer; and restoring all property damaged as a result of the Work involved in this Contract.
- C. The Work includes obtaining and transporting suitable fill material from off-site when on-site material is not available.
- D. The Work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, or disposal of all surplus on other sites selected by the Owner.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
 - 1. Shop Drawings for Review:
 - a. Sieve Analysis (ASTM C136) - One test for each material source.
 - b. Submit a moisture density curve (ASTM D698) for each type of material used for backfill. Test shall be referenced to appropriate sieve analysis test. The maximum dry weight and optimum moisture content shall be indicated.
 - c. Controlled Density Fill Material - Design Mix and Certified Test Results.

- d. Test results for conformance with specified “Compaction Requirements”:
 - 1) Retests shall be referenced to the corresponding failing test.
 - e. Stripped soil and topsoil test per ODOT 659.
2. Information for the Record:
- a. When excess excavated material is disposed at locations off the Site, the Contractor shall obtain and submit written permission from the Owner of the property upon which the material is to be placed.

PART 2 PRODUCTS

2.01 TOPSOIL

- A. Soil stripped from the Site shall consist of loose, friable, loamy topsoil without admixture of subsoil or refuse. It shall be reasonably free from peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The stockpiled soil shall be subject to the approval of the Engineer.
- B. Topsoil provided shall be in accordance with ODOT 653 and be loose, friable, loamy soil without admixture of subsoil or refuse. In order for the topsoil to be considered loamy the fraction of topsoil, passing a No. 10 sieve, shall contain not more than 40% clay. Topsoil shall contain not less than 4% nor more than 20% organic matter as determined by loss on ignition of oven-dried samples to constant weight at 212 degrees F.
- C. Excess material shall be removed from Site, unless directed otherwise by Owner or Engineer.

2.02 SELECTED BACKFILL

- A. Selected backfill shall be clean excavated soil. It shall be free of rock and foreign debris of any kind and shall be tested in accordance with ASTM C136 sieve screen analysis and ASTM D2487 soil classification. The material’s use as selected backfill shall be approved by the Engineer.
- B. Engineer may waive material testing of selected backfill. Such waiver shall apply only to the designated location and the source of the selected backfill. Such waiver shall not apply to excavated soil from locations not so designated.

2.03 SPECIAL BACKFILL MATERIAL

- A. Special backfill material shall conform to ODOT 304.

2.04 AGGREGATE BEDDING MATERIAL

- A. Aggregate bedding material shall be well-graded durable crushed gravel, crushed stone or meeting the graduation requirements of ODOT Table 703.01-1.

- B. Aggregate bedding material shall be as follows:
1. For PVC, HDPE or plastic pipe diameters 10 inches and less, bedding material shall be No. 8 (nominal size 3/8-inch to sieve No. 8).
 2. For PVC, HDPE or plastic pipe diameters over 10 inches, bedding material shall be No. 67 (nominal size 3/4-inch to sieve No. 4) or No. 8 (nominal size 3/8-inch to sieve No. 8).
 3. All other aggregate bedding shall be No. 8, No. 67 or No. 57 stone. No. 57 (nominal size 1-inch to sieve No. 4) shall not be used for bedding PVC, HDPE or plastic pipes.

2.05 CONTROLLED DENSITY FILL (CDF) MATERIAL

- A. Controlled density fill material shall be a cement base fill material that can be deposited in a fluid state. It shall be composed of portland cement and approved filler material, sand and water. The mixture shall have a compressive strength of 100 psi minimum and 500 psi maximum:
- B. Filler material shall consist of mineral aggregates, slag, or fly ash. Metals, soil, or organic material will not be permitted.

2.06 SLOPE AND CHANNEL PROTECTION

- A. Riprap shall be in accordance with ODOT 601.04
- B. Crushed aggregate slope protection shall be in accordance with ODOT 601.06.
- C. Dumped rock fill shall be in accordance with ODOT 601.08.
- D. Rock Channel protection shall be in accordance with ODOT 601.09.

PART 3 EXECUTION

3.01 COORDINATION

- A. Construction Through Highways:
1. Permits - The Owner will obtain permits required for open cut construction through highways. Contractor shall be responsible for compliance with and furnishing any item required by permit such as Bond Security.
 2. Notification - The Contractor shall give written notice to appropriate officials of the affected Department of Transportation, City, or County at least five days, not including weekends and holidays, before starting construction under highways and as required under other roadways.
 3. Contractor shall comply with standard permit conditions of controlling authority and special provisions noted in Part 4 of this Section.

- B. Test Pits:
1. The Contractor shall perform exploratory test pits as may be necessary or ordered by Engineer in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines, and conduits which are likely to be encountered and shall make acceptable provision for their protection, support, and maintenance in operation. Vacuum excavation (pot hole) may be used if adequate information can be obtained by such method. No additional payment shall be made for test pits.
 2. Conflicts with existing utilities not located, as specified, far enough in advance of construction, shall not be considered as a basis for delay claims or additional payment.

3.02 REMOVING AND REPLACING TOPSOIL

- A. Removal
1. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed: The Contractor may elect to strip soil and stockpile unless the Contract Documents direct stripping and stockpiling prior to excavation.
 2. General excavation, other than trench excavation: The Contractor shall remove, and stockpile the top 12 inches of the existing soils from all areas of construction including, but not limited to, excavation and embankment areas, stockpile sites, construction yard, storage areas, etc.
- B. Replacing stockpiled soil and topsoil
1. Trench excavation areas disturbed as a result of trenching operations and which are to be restored with grass or other plantings shall be free of peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The surface shall be mechanically conditioned after removal of debris. After surface is prepared, it shall be covered with topsoil or stockpiled soil material to a minimum depth of 4 inches. Topsoils and stockpiled soil material shall meet the requirements specified herein and be tested.
 2. General excavation areas which are to be restored with grass or other plantings shall be free of peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris, wood products and construction debris including loose stone. The surface shall be mechanically conditioned after removal of debris. After surface is prepared it shall be covered with stockpiled soil and then have a minimum of 4 inches of topsoil placed.
- C. The Work shall be in accordance with applicable portions of ODOT items 652 and 653.

3.03 GENERAL EXCAVATION

- A. All necessary excavation shall be performed to accommodate the completion of all Contract Work.
- B. The Drawings show the horizontal and the lower limits of structures, pipelines, sewers and other utilities. The methods and equipment used by the Contractor when approaching the bottom limits of excavation and when trimming the bottom of the excavation to a smooth surface shall be selected to prevent disturbing the soil below the bottom limits of excavation.
- C. Excavation which is carried below the bottom limits shall be classified as Unauthorized Excavation, unless said excavation has been authorized by the Engineer prior to each occurrence.
- D. Unauthorized excavation shall be filled with CDF material to the bottom limits. Under circumstances where structural integrity is not a factor, the Engineer may allow the filling of unauthorized excavation with pipe bedding material or special backfill material compacted to 100% density, as specified under compaction requirements.
- E. Sheeting, Shoring, and Bracing:
 - 1. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all existing adjacent and neighboring structures and utilities from damage by settlement.
 - 2. Sheeting, shoring and bracing shall be arranged so as not to place a strain on portions of completed Work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built Work and adjacent and neighboring structures and utilities.
 - 3. Sheeting, shoring and bracing shall be removed or cut-off at the time of backfilling to avoid problems with finish grade or future excavation.
- F. Construction Sheeting Left in Place:
 - 1. The Contractor shall furnish, install, and leave in place, construction sheeting and bracing when specified or when indicated or shown on the Drawings.
 - 2. Construction sheeting and bracing, placed by the Contractor to protect adjacent and neighboring structures and utilities, may be left in place if desired by the Contractor. All such sheeting and bracing left in place, shall be included in the cost for excavation.
 - 3. Any construction sheeting and bracing which the Contractor has placed to facilitate his work may be ordered, in writing by the Engineer, to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of

the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of his responsibility under the Contract.

G. Removal of Water:

1. The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work and shall keep said excavations dry until the structures to be built or pipelines to be placed therein are completed. No water shall be allowed to rise over or come in contact with concrete or masonry until the concrete and mortar has attained a satisfactory set, except in cases where the concrete has been tremied into place with the approval of the Engineer. Water shall not be allowed to rise above the bottom of the bedding stone prior to placing pipe. In waterbearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation free of water and in compliance with government regulations.
2. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures and in compliance with all regulations.

3.04 TRENCH EXCAVATION

- A. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed shall provide adequate space for workers to place and joint the pipe properly. The trench shall be kept to a minimum width. The width of trench at the top of the pipe shall comply with the limits specified or shown on the Drawings.
- B. Excavation shall be to the depth necessary for placing aggregate bedding material under the pipeline, sewer, conduits and other utilities as shown on the Drawings. If over excavation occurs, the trench bottom shall be filled to grade with compacted aggregate bedding material.
- C. The amount of trench open at any one time in advance of completed Work shall be limited to the minimum necessary for conducting laying operations.
- D. In general, backfilling shall begin as soon as the pipeline, sewer, conduits and other utilities are in a condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe condition.

3.05 EXCAVATION OF UNSUITABLE MATERIAL

- A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as required by the Engineer. The Engineer may rely upon the independent laboratory retained on this Project when determining unsuitable soil conditions, removal and backfill. Such excavation shall be conducted at a time when the Engineer

and independent laboratory are present and shall not exceed the vertical and lateral limits prescribed by both.

- B. The voids left by removal of unsuitable material shall be filled with special backfill, pipe bedding material, or CDF material as listed in Part 4 or as prescribed by the independent laboratory and as approved and ordered by the Engineer. Special backfill or pipe bedding shall be installed as described in this Section and in general shall be compacted to 100% density as specified under compaction requirements.

3.06 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and materials excavated that are in excess of that required for backfilling and for constructing fills and embankments as shown on the Drawings, shall be disposed of by the Contractor at his expense and at sites provided by him as may be required, except that the Owner reserves the right to require the Contractor to deposit such surplus at locations designated by the Owner within a five-mile radius of the Work.
- B. No surplus excavated material of any class shall be deposited in any stream or watercourse or be dumped on public property without the consent of the Owner. All spoil areas shall be left smooth, level, with drainage to a water course and proper erosion and runoff control shall be used.

3.07 BACKFILL AND COMPACTION

- A. Pipe and Conduit Bedding - Unless otherwise directed, pipe, conduits and other utilities shall be installed in specified aggregate bedding material as shown on the Drawings and as specified.
- B. Backfilling Under Existing Pipeline, Sewer, Conduits and Other Utilities - Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with aggregate bedding material tamped in place in 6-inch layers to the required density. The aggregate bedding shall extend outward from the spring line of the conduit a distance of 2-feet on all sides and thence downward at its natural slope.
- C. Backfilling with Selected Backfill - Unless otherwise specified or directed, material excavated in connection with the Work may be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification for selected backfill. No material shall be used for backfilling that contains stones, rock, or pieces of masonry greater than 12 inches, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl. No large pieces of rock or masonry shall be deposited closer than 24 inches from the completed outside surface of any structure or pipe.
- D. Backfill Immediately - All trenches and excavations shall be backfilled immediately after completion of construction therein, unless otherwise directed by the Engineer. Under

no circumstances shall water be permitted to rise in unbackfilled excavation during construction or after pipe has been placed.

- E. Backfilling around and over structures, pipelines, conduits and other utilities comprising the Work shall be carefully done by hand and tamped with suitable tools of approved weight when within 2 feet of structures, pipeline, conduit and other utilities. Selected backfill or, where specified, shown on Drawings, or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6 inches in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.
- F. Backfilling may be done by machinery after the backfill has been placed and compacted beyond 2 feet horizontally of structures, pipelines, conduits and other utilities and to a minimum depth of 1 foot above the tops of any buried structures, pipelines, conduits, and other utilities. The backfill material shall be deposited in horizontal layers, not thicker than one foot, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case, will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.
- G. Backfilling Under Pavement and Walks - Where existing or new pavement, driveway, parking lot, curb and gutter, or walk is over an excavation, special backfill material shall be used to backfill the entire excavation from the bedding to surface. The material shall be placed and compacted to the required density in accordance with one of the following methods:
 - 1. The backfill material shall be deposited in 6-inch horizontal layers and each layer shall be thoroughly compacted to the proper density by approved compaction method before a succeeding layer is placed.
 - 2. No method of compaction which alters the gradation of the special backfill material or prevents compaction testing by standard testing methods shall be used.
- H. Backfilling with Controlled Density Fill Material (CDF) - Where called for on the Drawings, specified, or ordered, CDF material shall be used in lieu of special backfill or bedding material specified herein. Before placing CDF material, the Contractor shall take required measures to protect the Work against flotation.
- I. Backfilling Under Structures - Where structural slabs, mats or footings are to be placed on a backfilled area, special backfill material shall be used unless otherwise noted on the Drawings. The backfill material shall be placed in 6-inch horizontal layers and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. Where backfill is to be placed on undisturbed side slopes steeper than one vertical to six horizontal, steps shall be formed into the slope before

each layer of the backfill is placed. These steps shall be cut vertically at no more than 2-foot intervals and shall have a horizontal dimension of not less than 3-feet.

- J. Prior to backfilling under structures the natural subgrade shall be evaluated at regular intervals in each direction by the independent testing laboratory to determine that the subgrade can obtain the design bearing capacity given by the “Structural Design Data” table on the Drawings. If the subgrade cannot obtain the design bearing capacity then the testing laboratory shall submit a remedy to the Engineer for approval and for the Contractor to perform.

3.08 COMPACTION REQUIREMENTS

- A. In areas to be filled, after the top 12-inches of soil is stripped, then the undisturbed subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D698 (Standard Proctor) prior to placing of fill.
- B. Backfill placed under areas receiving concrete slabs, mats, footings, or within the interior of buildings shall be compacted to not less than 100% of maximum dry density per ASTM D698.
- C. Backfill placed around structures where other structures, pipelines, or slabs are to be constructed shall be compacted to not less than 100% of maximum dry density per ASTM D698.
- D. The material used to construct embankments and fills in locations other than under pavements, walks, structures, or slabs and around and over pipelines, shall be compacted to not less than 95% of maximum dry density per ASTM D698.
- E. All other backfill, including backfill around and over pipelines, and backfill around structures not covered in Paragraphs B. and C. above, shall be compacted to not less than 95% of maximum dry density per ASTM D698.
- F. The bottom of excavations upon which concrete slabs or structures are to be placed shall be compacted to obtain 100% maximum dry density per ASTM D698 in the top 12 inches.
- G. All soil subgrade which will provide bearing support for pavements or curbs, shall be compacted to a width of 6 inches beyond the back of curb and to a depth of 12 inches below the bottom of excavation to a density of not less than 100% of maximum dry density per ASTM D698. All fill below the subgrade shall be compacted to not less than 98% of maximum dry density, unless specified otherwise.
- H. Subgrade under the driveways and walks shall be compacted to a depth of 6 inches below the subgrade surface to density of not less than 100% of the maximum dry density determined by ASTM D698.
- I. Subgrade under structures shall be compacted to a depth of 12 inches below bottom of excavation surface to a density of not less than 100% of the maximum dry density determined by ASTM D698.

3.09 COMPACTION TESTS

- A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.
- B. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.
- C. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

3.10 RESERVED

3.11 STREAM BANK PROTECTION

- A. Following the installation of the pipeline or other structures, all Work areas along or crossing streams shall be restored immediately in accordance with procedures outlined below and in accordance with applicable permits.
- B. Excavated areas shall be backfilled and compacted as specified herein and in no case, shall the density be less than the surrounding area.
- C. Permanent riprap shall be placed 12 inches thick over disturbed areas of the stream's bank as shown on the Drawings or required. Excavated areas to be riprapped shall be backfilled and consolidated as specified for pavement and sidewalks. Installation of and materials for riprap shall conform to ODOT Item 601.08 "Dumped Rock Fill," (703.19-Type B).
- D. All soil exposed above the permanent riprap protection line shall be either sodded or seeded, fertilized, and mulched. Temporary jute matting or synthetic matting shall be used to protect slopes until climatic conditions permit seeding or sodding. Exposed banks shall not remain unprotected over five days unless permitted by the Engineer in writing.
- E. Seeding and sodding shall be as specified in Section 02800.

3.12 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 FIELD TESTING (MINIMUM REQUIREMENTS)

- A. The laboratory shall perform the following field tests:
 - 1. Trench Backfill - One test for every 200 cubic yards of backfill material.
 - 2. Subgrade Compaction - One test for every 300 square yards of subgrade.

3. If directed by the Engineer, additional tests shall be performed for any of the above.

4.02 PERMITS

- A. ODNR
- B. The U.S. Army Corps of Engineers Permit No. _____, Nationwide Permit No. ____ is attached and made a part of the specified requirements. Contractor shall be responsible for compliance with permit requirements and cross reference requirements.
- C. The Owner has submitted the Notice of Intent (NOI) for the Work. Contractor shall apply for coverage as a Co-permittee, to the OEPA.

4.03 DEWATERING

- A. Contractor shall provide dewatering as necessary to construction the work.
- B. Any well, well point, pit or other device installed for the purpose of lowering the ground water level to facilitate construction of this project shall be properly abandoned in accordance with the provisions of Section 3745-9-10 of the Ohio Administrative Code or in accordance with the provisions of this plan or as directed by the Director or his representative. For more information please contact: Division of Drinking and Ground Water - Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, Ohio 43215 (614) 644-2752.
- C. Any person installing any well, well point, pit or other device used for the purpose of removing ground water from an aquifer shall complete and file a Well Log and Drilling Report from with the Ohio Department of Natural Resources, Division of Water, with 30 days of the well completion in accordance with the Ohio Revised code Section 15211.01 and 1521.05. In addition, any such facility that has a capacity to withdraw waters of the state in an amount greater than 100,000 gallons per day from all sources shall be registered by the Owner with the Chief of the Division of Water, Ohio Department of Natural Resources, within three months after the facility is completed in accordance with Section 1521.16 of the Ohio Revised Code. For copies of the necessary well log, drilling report, or registration forms, please contact:

Ohio Department of Natural Resources
2045 Morse Road Bldg. E.
Columbus, OH 43229-6693

END OF SECTION

SECTION 02800
SODDING, SEEDING AND MULCHING

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes fine grading, placing sod, and seeding and mulching areas designated on the Drawings, specified, or ordered.
- B. The Work consists of fine grading; furnishing and placing topsoil; sod seed, mulching material; and fertilizer; and watering seeded or sodded areas until growth is established.
- C. The Contractor shall restore all grass areas damaged by his operations in construction of facilities included in the Contract.
- D. Unless otherwise specified herein or directed, Work shall be in conformance with ODOT Item 659 Seeding and Mulching, and Item 660 Sodding.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
 - 1. Shop Drawings for Review:
 - a. Manufacturer's project information for materials.
 - 2. Information for the Record:
 - a. Submit to Resident Project Representative:
 - 1) Invoices showing the weight, brand, and composite analysis of all fertilizer used on the Project.
 - 2) Bag tickets showing weight and composition of all seed used on the Project.

PART 2 PRODUCTS

2.01 RESERVED

2.02 SEED

- A. Seed mixtures shall be in conformance with the requirements of ODOT Item 659.07 and ODOT Item 659.09 Class 1, unless otherwise specified in Part 4. See mixtures shall be free of Crown Vetch.

Applicable to Addendum 2 - Division A

2.03 FERTILIZER

- A. Commercial fertilizers shall be from a dealer or manufacturer whose brands and grades are registered or licensed by the State of Ohio, Department of Agriculture. The content of nutrients shall be 12-12-12, unless otherwise approved by the Engineer.

2.04 MULCHING MATERIAL

- A. Mulching material shall be straw, wood fiber, or compost reasonably free of weed seed, and other foreign materials. Mulch shall meet the requirements of ODOT Item 659.13, and either Item 659.14, 659.15, or 659.16.

2.05 MATTING MATERIAL

- A. Matting material shall be in conformance with the requirements of ODOT Item 712.11 Type A or B.

2.06 TOPSOIL

- A. Topsoil furnished by the Contractor shall be as specified in Section 02200.

PART 3 EXECUTION

3.01 FURNISHING AND PLACING TOPSOIL

- A. Areas from which the top layer of soil has been removed or disturbed shall be recovered with a minimum of 4 inches of topsoil placed in conformance with Section 02200 or ODOT Item 659.11.

3.02 PREPARATION

- A. The operation of finish grading and sowing shall not be performed when the ground is frozen or muddy.
- B. Areas to be Sodded:
 - 1. Preparation of areas to be sodded shall be in conformance with ODOT Item 660.04.
- C. Areas to be Seeded:
 - 1. Unless otherwise shown on the Drawings or specified in Part 4, all areas of disturbed soils on the Site shall be seeded.
 - 2. The area to be seeded shall be prepared in accordance with Section 02200 and 02120.
 - 3. Fertilizer shall be applied at a standard dry application rate of 10 pounds per 1000 square feet. Either dry or liquid fertilizer may be used and shall be

distributed in an even pattern over the specified area, then thoroughly disked, harrowed, or raked into the soil to a depth of not less than 1 inch.

3.03 INSTALLATION

- A. Sodding:
 - 1. Sod shall be placed in conformance with ODOT Items 660.05 and 660.06.
 - 2. No sod shall be placed when the temperature is below 32 degrees F. No frozen sod shall be placed nor shall any sod be placed upon frozen soil. When sod is placed between the dates of June 1 and October 15, it shall be covered immediately with a straw mulch 1-inch thick, loose measurement.
- B. Seeding:
 - 1. The seed shall be mixed thoroughly and sown evenly at a rate specified in ODOT Item 659.09. The seed mixture may be sown dry or hydraulically unless directed otherwise in Part 4 of this Section.
 - 2. The seed mixture shall be applied when the soil is in a workable condition and shall be raked into a depth of approximately 1/4 inch.
 - 3. Seed shall be sown only between May 1 and October 15, unless otherwise permitted by the Engineer.
- C. Mulching:
 - 1. Within 24 hours after an area has been seeded, it shall be mulched in conformance with one of the following specified methods as designated in Part 4.
 - 2. Mulch:
 - a. Mulching with straw shall be in conformance with ODOT Item 659.14, except that in front of residences, the mulching material shall be kept in place by an approved non-tracking adhesive or other approved method in lieu of the specified asphalt emulsion. Mulching with wood fiber shall be in accordance with ODOT Item 659.15 and mulching with compost shall be in accordance with ODOT Item 659.16.
 - b. Matting shall be used as mulch on slopes greater than 3:1 and shall be placed in conformance with the applicable portions of ODOT Item 671.
- D. Seeded and sodded areas shall be watered and maintained as specified below until they are established.
 - 1. The seed bed shall be thoroughly watered, as soon as the seed is mulched.
 - 2. Water shall be applied by a hydro-seeder or water tank under pressure with a nozzle producing a spray that will not dislodge the mulching material.

3. Water applications shall be made at rates and at frequencies necessary to establish the growth of grass to its full density and to a minimum height of 2 inches.
4. The rate application shall be 120 gallons per 1,000 square feet.
5. The Contractor shall keep all sodded areas, including the subgrade, thoroughly moist for two weeks after sodding. After the two-week period, the Contractor shall water the sod as necessary to maintain its healthy condition until accepted by the Owner.
6. Matting areas shall be maintained until all Work on the Contract has been completed and accepted.
7. Seeded and sodded areas shall be maintained by the Contractor until acceptance by the Owner. The Contractor shall repair and restore any damaged areas. Repair of the damaged area shall be performed using the same materials and procedures as used for the original installation of the area.
8. The Contractor shall clean all surfaces coated with hydro-seeding overspray. Contractor shall be responsible for surface staining or damage caused by hydro-seeding and restoration damage or staining.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

**SECTION 15210
PIPING**

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes the furnishing and installing of all pipelines 4-inch diameter and larger shown on the Drawings or as required to complete the Work.
- B. Piping less than 4-inch diameter, will be included under other Sections unless otherwise specified.
- C. Material to be furnished and installed, but not limited to:
 - 1. All pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joint restraints, joints and jointing materials.
 - 2. Pipe supports other than those specified in Section 15010.
 - 3. Granular material for bedding and encasement of pipelines.
 - 4. Class B concrete as specified in Section 03300 for blocking and encasement of pipelines.
 - 5. Make connections to all existing and/or new facilities and provide temporary services.
 - 6. Install temporary plugs and/or stoppers and harnessing.
 - 7. Test and clean pipelines.
 - 8. Sterilize water mains.
- D. The Contractor shall make adequate field measurements before new piping is fabricated.
- E. All wall, floor, and roof penetrations and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.
- F. Instruments which are to be located in pipelines 4-inch in diameter and larger shall be furnished under Division 16 and installed under this Section.

1.02 QUALITY CONTROL

- A. Laboratory Services - Laboratory testing services shall be provided as specified under Section 01410 of the Specifications.
- B. Field Inspection:
 - 1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective

- piece discovered installed shall be removed and replaced with a sound one in a manner satisfactory to the Resident Project Representative at the Contractor's expense.
2. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.
- C. Field Testing:
1. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.
 2. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications.
- D. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300 showing: layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, and any special provisions required for assembly.
- B. Shop drawings shall be drawn to not less than 1/4-inch scale and show the laying length and piece mark for each section of pipe and fitting.
- C. Drawings shall show the position and elevation of valves, pumps, and/or other equipment served by the various pipe systems.
- D. The concrete pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification. The certificate shall be signed by an authorized agent of the manufacturer.
- E. If directed by the Engineer, each certificate shall be accompanied by a report showing test results compared to specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.
- F. Before fabrication of any concrete pressure pipe, fittings, or specials, the Contractor shall furnish to the Engineer at least six copies of the design calculations for the pipe showing the calculations to arrive at the gross wrapping stress in wire; initial and

resultant stresses in concrete, cylinder, and wire; internal pressure when compression in concrete is zero; compression strength of concrete at time of wrapping; and calculations to show stress, conditions, and the core and steel when the pipe is simultaneously subjected to the design pressure and external loads. The Contractor shall also furnish the full details of all pipe, specials, and fittings, and a laying schedule showing dimensions, details, and specifications of all pieces.

- G. Submit a schedule of all proposed pipe escutcheons.
- H. Other submittals may appear in Part 4 of this Section.
- I. Any proposed grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series number.

PART 2 PRODUCTS

2.01 SEWER PIPE AND JOINT MATERIALS

- A. Sewer pipe shall be of the type specified as shown on the Drawings or as indicated in the Piping Schedule and of quality conforming to the following requirements.
- B. Polyvinyl Chloride Pipe (PVC):
 - 1. Polyvinyl chloride pipe shall be manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454-B. PVC pipe and fittings shall meet the requirements of ASTM D2241, pressure rating 200 psi, and have a standard thermoplastic pipe dimension ratio (SDR) of 21.0.
 - 2. Polyvinyl chloride pipe joints shall be integral bell push-on type meeting the requirements of ASTM D3139. Gaskets shall be rubber ring type meeting the requirements of ASTM F477.
 - 3. Mechanical joint cast iron fittings with iron pipe transition gaskets, meeting all requirements of ANSI A21.11 (AWWA C111) may be used in lieu of PVC pipe fittings.
- C. Non-shrinking Mortar Material for Joints - Material for non-shrinking mortar used in pointing joints shall be Sauereisen F-100 Grout as manufactured by Sauereisen Cements Co., Pittsburgh, Pennsylvania; Five-Star Grout as manufactured by US Grout Corp., Old Greenwich, Connecticut; or equal.
- D. Flexible Pipe Repair Couplings - Flexible repair coupling used to repair existing pipes shall be an 18-8 Type 304 stainless steel repair coupling. The coupling shall have a full length and diameter rubber gasket, type 304 stainless steel nuts and bolts and be manufactured by Rockwell, Romac, Ford or equal.
- E. Flexible Connection Coupling - Flexible connection couplings shall be made of an elastomeric polyvinyl chloride boot with Series 300 stainless steel connecting clamps. Couplings shall be used as manufactured by Fernco Joint Sealer Co., Mission Day Products Corp. or equal.

Applicable to Addendum 2 - Division A

- F. Flexible Watertight Connector - Flexible watertight connector used to connect smaller sewers to larger sewers shall be an elastomeric polyvinyl “boot” type sealed to the larger pipe with a stainless steel internal expanding band and around the connecting pipe with a stainless steel external adjusting band. Connector shall be as manufactured by Fernco Joint Sealer Co., Mission Clay Products Corp or equal. Other types of applicable flexible connectors may be submitted for approval.
- G. High-Density Polyethylene (PE) Profile Wall Sewer Pipe:
1. Pipe shall have a smooth interior with a profile wall. Pipe, fittings, and jointing systems shall conform to ASTM F894. Pipe and fittings shall be made of high density, high molecular weight polyethylene material meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D1248.
 2. Joint systems shall be elastomeric seal (gasket) type. Seals shall conform to ASTM F477 requirements. Joint materials and testing shall conform to ASTM D3212 requirements. Joints shall be able to pass an ASTM D3212 test at 10.8 psi for 10 minutes with no leakage.
 3. Fittings shall include couplings, tees, wyes, elbows, plugs, and adapters. Tees and wyes shall be die cast or factory-fabricated.
 4. Manhole adapters shall have a smooth exterior surface to ensure a watertight joint with “Flexible Joints” as specified in Section 02552.
 5. Profile Wall Basis of Design:
 - a. In addition to the above certifications, and if required by the Engineer, for pipe 18 inch and larger, the manufacturers of plastic profile wall pipes shall provide a certification that shows the basis of design for each pipe class furnished and that they are satisfactory for use as shown on the Drawings. Basis of design limits provided shall include but are not limited to; crushing resistance of pipe wall, pipe deflection, and constrained buckling resistance.
 - b. The following constraints shall be used as minimum conditions for the basis of design:
Safety Factor = 2
Bedding Class = ASTM D2321 Class 1A
Loads = Soil weight (120 lb/cft) + H₂O
Depth of burial as shown of Drawings
Depth of submergence as indicated on soil borings or 4-feet minimum.
 - c. If more than one pipe class is proposed for any diameter of pipe a depth range shall be provided for each class in addition to the above. A sample for the pipe markings shall be provided for each class of pipe.

2.02 RESERVED

2.03 PROCESS AND PRESSURE PIPE

- A. Ductile Iron Pressure Pipe (DIP):
1. Ductile Iron Pressure Pipe (DIP) shall conform to ANSI A21.51 or AWWA C151 and shall be pressure class 350 psi for sizes 12-inch and below, and pressure class 300 psi for larger sizes unless otherwise specified herein. Mechanical joint fittings shall be ductile iron and conform to ANSI A21.10 or AWWA C110 and ANSI A21.53 or AWWA C153. Flanged fittings shall be ductile iron and conform to ANSI A21.15 or AWWA C115. All fittings shall have a pressure rating of 250 psi for all pipe sizes unless otherwise specified.
 2. Ductile iron pipe buried underground, unless otherwise specified or shown, shall have rubber gasket (slip-on) type joints in straight runs and mechanical joints with retainer glands each way from bends as shown on the Drawings. The gasket shall be a single molded rubber ring fitted into a specially shaped recess in the bell forming a pressure tight seal. The spigot end of each pipe shall be marked to indicate when the pipe is "home." Fittings shall have mechanical joints with retainer glands unless otherwise specified or shown. Retainer glands shall be ductile iron. The restraining mechanism shall impart multiple wedging action against the pipe. Restraining devices shall be of heat treated ductile iron. Twist-off nuts shall be used to ensure proper actuation of the restraining device. The mechanical joint retainer gland shall be Ebaa Iron, Inc., Series 1100 Megalug, or equal.
 3. Ductile Iron pipe inside buildings or structures shall be joined with flanged, or mechanical joints as shown on the Drawings, or as indicated in the pipe schedule. All mechanical joints shall have retainer glands. Flanges shall comply with ANSI 21.15 or AWWA C115 and shall be ANSI 125-pound drilling, unless otherwise specified. Flanged joints shall have full face 1/8-inch rubber gaskets or of thickness and type approved by the Engineer. The pipe shall not be threaded or flanged in the field. Flanges shall be firmly bolted with machine, stud, or tap bolts of the proper size and number. Within buildings the bolts and nuts shall be of the best quality mild steel, with true threads, meeting the requirements of ANSI B16.1.
 4. Flange adapters for plain end pipe (not fittings), where specified, shown on Drawings, or approved by Engineer shall be a restrained flange adapter. The restraining mechanism shall be multiple gripping wedges set against the pipe wall. Twist off nuts shall be used to ensure proper actuation of the restraining device. The restrained flange adapter shall be Series 2100 Megaflange by Ebaa Iron, Inc., or equal.
 5. Wherever specified or shown, mechanical joints shall conform to ANSI A21.11 (AWWA C111), except as specified under Subsection Process and Pressure Pipe Nuts and Bolts.

6. Couplings, if required or permitted, shall be Dresser Style 38, Rockwell, or equal. Restrained coupling shall be Dresser Style 167 Lock Coupling, Rockwell, or equal.

2.04 PROCESS AND PRESSURE PIPE NUTS AND BOLTS

- A. Nuts and bolts used on buried pressure pipe and fittings in contact with earth shall be Cor-Blue coated low alloy steel and have a minimum yield strength of 45,000 psi complying with ANSI A21.11 and AWWA C111.
- B. Nuts and bolts encased in grout on concrete pressure pipe shall conform to recommendations of the pipe manufacturer.
- C. All other nuts and bolts shall be low carbon steel in conformance with the chemical and mechanical requirements of ASTM A307, Grade B. Higher strength bolts will be acceptable.

2.05 RESERVED

2.06 COATINGS AND LININGS OF PROCESS AND PRESSURE PIPE

- A. Coatings and linings where required shall conform to the following requirements unless otherwise indicated in Part 4 of this Section or on the Drawings.
- B. Ductile Iron Pipe:
 1. Ductile iron pipe, and fittings unless otherwise specified, shall be lined on the interior with a standard thickness cement lining meeting ANSI A21.4 and AWWA C104. A seal coat of bituminous material shall be applied in conformance with the above Specifications. Piping used for compressed air shall not receive a cement lining.
 2. All pipe buried underground shall be coated on the outside with a standard coating of coal tar or asphalt, 1 mil thick unless otherwise specified. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe. The coating materials, after drying 48 hours, shall impart no objectionable color, odor, or taste to water standing in contact with the coating for a minimum of 48 hours.
 3. Where approved, the bituminous material used for an interior seal coat may be used for exterior coating of pipe buried underground.
 4. All pipe used within buildings and structures and which are to receive field coats of paint shall not be coated with any black bituminous paint. Such pipe, after proper cleaning, shall be painted with one coat of primer paint that is compatible with the field coats. Painting specifications shall be followed for cleaning and painting.

2.07 BEDDING MATERIAL

- A. Unless otherwise shown on the Drawings or specified herein, all pipe bedding material shall be in conformance with Section 02200.
- B. Concrete bedding and encasement in lieu of standard bedding material shall be installed as shown on the Drawings or specified.
- C. All underdrain pipe shall be bedded in AASHTO No. 67 aggregate in lieu of the standard bedding material to a depth shown on the Drawings.

2.08 PIPE ESCUTCHEONS

- A. Split-type escutcheons shall be used for piping passing through finished wall, floors, or ceiling. Escutcheons shall be brass plated or chromium plated Model 3A by Ritter, Model 284 by Fee & Mason, or equal.

2.09 WALL PIPE AND SLEEVES

- A. Type A Wall Pipe:
 - 1. Cast iron wall pipe shall be used where noted on the Drawings.
 - 2. Wall pipe shall be cast in place with joints as indicated on the Drawings.
 - 3. Where wall pipe is flush with wall, bolt holes shall be tapped for studs.
- B. Type B Sleeve:
 - 1. Type B sleeves are for use in exterior walls.
 - 2. Type B sleeves consist of casting in place a cast iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.
 - 3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.
- C. Type C Sleeve:
 - 1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.
 - 2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links.
 - 3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of minus 40 degrees F to 250 degrees F. The pressure plates shall be of delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.
- D. Type D Floor Sleeve:
 - 1. Type D sleeves are used for pipes passing through floors.

2. Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.
- E. Type E Sleeve:
1. Type E wall sleeves shall be used where noted on the Drawings.
 2. Type E sleeves consist of casting in place a mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.
 3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting the requirements of AWWA C111 on both ends.
- F. Type F Sleeve:
1. Type F sleeves shall be used for passing through existing masonry walls.
 2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.
- G. Type G Sleeve:
1. Type G sleeves used for passing through gastight floors shall be similar to Type C sleeves with the addition of non-shrink grout as shown on the Drawings.
- H. Type H Sleeve:
1. Type H sleeves shall be similar to Type G sleeves and used for passing through gastight walls.
 2. Type H sleeves shall be as detailed on the Drawings.
- I. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

2.10 RESERVED

PART 3 EXECUTION

3.01 PRODUCT HANDLING

- A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.
- B. Store all pipe on a flat surface so as to support the barrel evenly. It is not recommended that pipe be stacked higher than 4-feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from the sun's rays.

3.02 PREPARATION OF TRENCH

- A. Trench excavation shall conform to requirements of Section 02200.
- B. Unless otherwise specified or called for on the Drawings, the width of trench at the top of pipe 24-inch in diameter or less shall not exceed the outside diameter of the pipe or encasement, plus 9-inch on each side of the pipe measured to the face of the trench or to the back of the sheeting when used. For pipe having a diameter greater than 24-inch, the width of trenches at the top of the pipe shall not exceed the outside diameter of the pipe or encasement, plus 15-inch on each side of the pipe measured as specified above.
- C. Unless otherwise directed or called for on the Drawings, all pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the Drawings.

3.03 PIPE INSTALLATION

- A. General:
 - 1. All loose dirt shall be removed from the bottom and the trench backfilled with specified bedding material to pipe laying grade as detailed on the Drawings. Bell holes shall be dug in the bedding where necessary and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Additional bedding material shall be placed and compacted in 6-inch layers to the height shown on the Drawings or as directed. A mechanical tamper shall be used when installing bedding material for pipe 24-inch diameter and larger. The remainder of the trench shall be backfilled as specified and called for on the Drawings.
 - 2. All pipe shall be laid to lines and grades in conformance with Section 01800.
 - 3. Wherever piping passes through walls or floors, a wall casting pipe or sleeve of the type indicated on the Drawings shall be installed. Escutcheons shall be provided for pipe passing through finished walls, floors, or ceilings.
 - 4. Pipe Anchoring:
 - a. Disjointing hydrostatic pressure at bends, valves, plugs, tees, and wyes shall be counteracted by restrained joints or reinforced concrete anchorage as directed on the Drawings or specified.
 - b. Thrust blocks shall be installed only where directed or specifically called for on the Drawings, unless otherwise specified. Installation shall be in conformance with Drawings.
 - c. Approved joint restraints shall be installed for the distance from each side of each bend, valve, plug, tee, or wye in locations shown or scheduled on the Drawings.

- d. Reinforced concrete joint anchorage shall be installed in conformance with the Drawings.
 5. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 5-feet. Pressure piping which carries gases shall be installed with a minimum cover of 4-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation or horizontal alignment, the Contractor shall install the new piping at a deeper elevation, or new alignment to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation or alignment shall be made either by installing fittings or by deflecting joints in accordance with the pipe manufacturer's recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade and alignment shall be approved by the Engineer.
- B. Sewer Pipe:
 1. Flexible pipe shall be installed in accordance with ASTM D2321. Bedding, backfill, and compaction shall meet the requirements of this Section and Section 02200.
 2. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings. Laser beams shall be used to maintain line and grade unless other methods are approved by the Engineer.
 3. Where holes are cast in concrete pipe for handling, they shall be completely filled with non-shrinking mortar after the pipe is placed. A metal disc of proper size may be inserted near the bottom of the hole to retain the mortar until hardened. Wood plugs or rocks intended to plug the hole for retention of the mortar will not be permitted.
 4. Joints:
 - a. O-Ring and Chemically Welded Joints - Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.

- b. Non-shrinking Mortar Joints - Where specified or shown on the Drawings, joints of concrete pipe sewers shall be thoroughly pointed full inside circumference with a non-shrinking mortar in conformance with the material manufacturer's instructions. The mortar shall be tightly packed and the interior face of the joint shall be left smooth and continuous with the interior face of the pipe. Pointing shall not be done until the backfill over the pipe is placed and compacted.
- C. Process and Pressure Pipe:
- 1. Pipe and appurtenances shall be installed true to line, grade, and location; with joints centered, spigots home; pipe properly supported and restrained against movement; and all valve stems plumb.
 - 2. All elbows, tees, plugs, etc., shall be properly anchored, blocked, or otherwise restrained to prevent movement of the pipe in the joints due to internal or external pressure.
 - 3. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug to the approval of the Resident Project Representative before leaving the Work for the night, and at other times of interruption of the Work. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.
 - 4. Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The finished cut must be approved by the Resident Project Representative.
 - 5. Joints:
 - a. Gaskets - Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. The pipe is then forced "home" firmly and fully. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.
 - b. Concrete Pressure Pipe Diapers - A band at least 5-1/2-inch wide shall be placed around the outside of concrete pressure pipe, over each joint as recommended by and available from the pipe manufacturer. This band shall serve as a form for placing a 1:2 cement mortar grout in the external recess formed by the face of the bell and the shoulder of the spigot. If the air temperature is below 40 degrees the spigot, bell, and

mortar shall be heated. If a reinforced paper joint band is used, it shall be drawn up tight around the pipe and backfill tamped against it up to the springline before pouring the grout. If a cloth band is used, it shall be wired around the outside of the pipe and the grout poured before backfilling.

- c. Concrete Pressure Pipe Interior Joints - The interior joint recess of pipe 24-inch and larger shall be pointed using a non-shrinking mortar specified in Subsection 2.01. The inside surface shall be struck off smooth with the pipe interior. On pipe 20-inch and smaller a rope type mastic or trowellable mastic shall be affixed to the concrete face of the bell socket just prior to pushing the spigot into the bell, such that the mastic material squeezes to fill the internal joint recess. Mastics that are detrimental to rubber gaskets shall not be used. Similarly, primers to be used in conjunction with rope type mastics must be kept off gaskets and sealing surfaces of joint rings.
- d. Bell and Spigot Lead Joints - If used, the spigot of each pipe shall be fully seated in the bell of the adjoining pipe, adjusted to form a uniform annular space which shall be caulked with sterilized pre-molded rubber, forming a solid packing against which molten lead shall be poured and caulked. Lead, after caulking, shall have a depth of at least 2-inch for pipes 14-inch or less in diameter, and 2-1/2-inch for larger pipe. The melting pot shall be kept near the joint which shall be made by one pouring. Dross shall not be allowed to accumulate in the pot. All Work shall be performed by skilled workmen.
- e. Electrical Continuity - Where specified, electrical continuity shall be provided in concrete and steel pressure pipes by welding an insulated #4RR copper cable across joints. The cable shall be welded to the steel of bell and spigot of concrete pressure pipe and across joints including each piece of coupling on jointed steel pipes.
- f. Where new piping is to be connected into an existing joint, said joint shall be cleaned sufficiently to result in a liquid- or gastight seal. If applicable, a new gasket shall be supplied and installed.

3.04 SLEEVES AND WALL PIPE

- A. Type A wall pipes shall be provided for all pipes passing through the exterior walls unless other sleeve types or wall pipes are designated on the Drawings. Type C sleeves shall be provided in interior walls unless designated otherwise on the Drawings.
- B. At all points where piping passes through floors, Type D sleeves shall be provided, unless otherwise designated on the Drawings.
- C. Other sleeve types and wall pipe shall be provided as indicated on the Drawings.

- D. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

3.05 TESTS FOR INFILTRATION AND EXFILTRATION IN SEWER PIPE

A. Preparation:

1. Before sections of sewers may be tested for infiltration or exfiltration, all house leads from it must be constructed to limits called for and plugged or capped and all trenches backfilled and compacted.
2. Sewers to be tested shall be clean and free from construction debris. Sand, dirt, concrete, or other materials shall be completely removed in a manner that will not damage the sewer pipe.
3. Pipe joints shall be watertight. The Contractor shall repair manholes and pipe joints as required to stop all visible leaks. Seepage permitted through walls or patched joints shall be at the discretion of the Resident Project Representative but in no instance will the specified allowable infiltration be exceeded.
4. Where sewers are above the groundwater table, the Contractor may flood the trench or air test the sewer to find and repair leaks prior to exfiltration tests.
5. The materials and methods for repairing leaks shall be submitted to the Resident Project Representative for approval before beginning Work.

B. Observation:

1. After a sewer has been cleaned and all repairs made as specified, the sewer shall be observed and approved by the Resident Project Representative before conducting infiltration or exfiltration tests.
2. Sewers 36-inch diameter and larger shall be observed from the inside. Observation of sewers smaller than 36-inch diameter from the inside shall be at the discretion of the Resident Project Representative.
3. Unless otherwise specified, smaller sewers shall be observed by lamping between manholes.
4. The Resident Project Representative may require the Contractor to run close circuit television through smaller sewers that appear defective or do not pass infiltration tests.
5. The Contractor shall furnish all lights, carts, television, and other equipment and labor required to assist the Resident Project Representative in the observation.

C. Test Sections:

1. The maximum length of a sewer test section shall be 900 lineal feet. Every manhole shall be included in at least one test section.

Applicable to Addendum 2 - Division A

2. The Contractor shall furnish and install bulkheads, sewer plugs, weirs, water level tubes, lighting, and other equipment required to conduct the tests in locations and as directed by the Resident Project Representative.
3. Infiltration:
 - a. Where the groundwater level is above the top of the pipe, the sewer shall be tested for infiltration.
 - b. The Contractor shall plug or bulkhead the sewer to isolate the test section and install a weir in the pipe at the outlet manhole. The weir shall be direct reading of an approved design calibrated to read gallons per day.
4. Exfiltration:
 - a. Where the groundwater level is below the top of the pipe and cannot be maintained above it, the sewer shall be tested for exfiltration.
 - b. The Contractor shall bulkhead or plug each end of the designated test section and fill the water to the elevation directed by the Resident Project Representative. Exfiltration will be computed from the loss of water as measured in the manholes.
5. Allowable Leakage:
 - a. The test in each section shall be continued for at least 24 hours and, if its measured leakage during that period exceeds 100 gallons per inch of diameter per mile of pipe, the Contractor shall locate the points of leakage and make necessary repairs, continuing the Work until leakage is reduced to the permissible maximum as specified.
 - b. The amount of infiltration allowed for storm sewers shall be limited to reasonable seepage, except that, if specified, the total in any section shall not exceed the amounts allowed for sanitary sewers as herein specified.

3.06 LOW PRESSURE AIR ACCEPTANCE TESTS

- A. Where approved by the Engineer, the Contractor may perform low pressure air acceptance tests in lieu of infiltration or exfiltration tests for pipes 24 inches in diameter or smaller. Test shall be made in accordance with ASTM F1417-Plastic Gravity Sewer Lines; ASTM C924-Concrete (Circular) Sewer Pipe with Gasket.
 1. If the air pressure required for the test is greater than 5.0 psig, the low-pressure air acceptance test shall not be used.
- B. The Contractor shall furnish all equipment, materials, and labor, and conduct the tests under observation of the Resident Project Representative.

- C. Safety:
1. The air test may be dangerous if the line is improperly prepared. All plugs shall be installed and braced in such a manner to prevent blowouts. No one shall be allowed in manholes during testing.
 2. Pressurizing equipment shall include a regulator set at the maximum pressure.
- D. Line Preparation:
1. Sewers to be air tested shall be prepared and inspected as specified herein for infiltration and exfiltration tests.
 2. Where porous pipe materials are used, the pipe walls may be wetted to temporarily reduce the porosity of the material.
 3. All pipe outlets shall be plugged, braced, and the joints restrained adequately to prevent blowouts.
- E. Test Procedure:
1. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater above the invert of the pipe.
 2. When a constant pressure of 4.0 psig greater than the average back pressure of any groundwater above the pipe is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes to permit temperature equalization.
 3. When temperatures have been equalized and the pressure stabilized at 4.0 psig greater than the average back pressure of any groundwater above the pipe, the air supply shall be shut off or disconnected.
 4. Decrease the pressure in the sealed line until the continuous monitoring pressure gauge reads 3.5 psig greater than the average back pressure of any groundwater above the pipe. When this pressure is reached, timing shall commence with a stop watch.
 5. Determine the time, as shown on the stop watch, required for the pressure in the sealed line to drop 1.0 psig.
- F. Test Method ASTM F1417-Plastic Gravity Sewer Line:
1. Low pressure air test method shall be the Time-Pressure Drop Method.
 2. The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.
 3. The time required for the pressure in the test section to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM F1417, the section fails. The table below has been reprinted from ASTM F1417 for Contractor's information.

Applicable to Addendum 2 - Division A

Pipe Diameter, Inches	Minimum Time, Min.: Sec.	Length for Minimum Time, Feet	Time for Longer Length, Sec. (L=Ft)
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470L
24	22:40	99	13.674L

Note: Minimum time applied to all lengths less than or equal to the length shown. For more information, see ASTM F1417, Table 1.

G. Test Method ASTM C924-Concrete (Circular) Sewer Pipe with Gasket:

- The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.
- The time required for the pressure in the test to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM C924, the section fails. The table below has been reprinted from ASTM C924 for Contactor’s information.

D Nominal Pipe Size, Inches	Minimum Time (minutes)/100 feet
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6

H. Air Pressure Adjustment for Groundwater:

- In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately, 10-inch long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the groundwater level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube.
- The air pressure correction, for the average back pressure of the groundwater above the pipe, shall be calculated by subtracting the average invert elevation

from the measured groundwater elevation and dividing the difference by 2.31 psi/feet. This correction must be added to the test pressures stated in the test procedure.

3.07 SPECIAL TESTING - DEFLECTION OF PVC SEWER PIPE

- A. In addition to infiltration and exfiltration testing all PVC sewer pipe shall receive the following testing.
 - 1. Vertical Ring Deflection - Before final acceptance of sewer lines constructed of these materials, all sections of sewer pipe 8-inch and larger specified diameter shall be measured for vertical ring deflection by the Contractor and witnessed by the Resident Project Representative. Maximum deflection under full load shall not exceed 5% of the average inside diameter as determined by the laboratory for the specified piping.
 - 2. Failures - Should any pipe exceed the allowable deflection; the Contractor shall replace those pipes and retest the section as directed by the Resident Project Representative.
 - 3. Equipment used in testing shall be go-no go pull through gauges of a type approved by the Engineer. Each gauge must be checked and approved by the laboratory before using. A metal or plastic gauging ring of diameter equal to 95% of the specified average pipe diameter shall be furnished with each gauge required.
 - 4. Testing Equipment and Personnel to perform the required tests shall be provided by the Contractor. Tests must be witnessed by the Resident Project Representative.
 - 5. Use of mechanical pulling devices will not be permitted.

3.08 PRESSURE AND LEAKAGE TESTS FOR PROCESS AND PRESSURE PIPE

- A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all lines including the joint between existing and new pipes unless otherwise directed by the Engineer.
- B. Tests shall be conducted on all pipelines or valved sections thereof as directed by the Resident Project Representative. Testing of pipelines laid in excavation or bedded in concrete shall be done prior to backfilling or placing concrete cover, except restrained sections of pipe which shall be backfilling prior to testing, unless otherwise permitted by the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.
- C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The test pressure shall be maintained two hours minimum and additional time as required

Applicable to Addendum 2 - Division A

for thorough inspection to find any leaks or defects in the force main and appurtenances. Unless indicated otherwise in Part 4, the test pressure shall be 100 pounds per square inch or 50% above the normal operating pressure, whichever is greater. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.

- D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water added to the pipe under test to maintain the required test pressure for a specified time. The leakage test pressure shall be not less than the maximum operating pressure of the section under test. The duration of the leakage test shall be not less than two hours. Allowable leakage for buried piping shall not exceed 9 gallons per inch of pipe diameter per mile of pipe in 24 hours. For piping not buried, any leakage during the test is unacceptable.
- E. Lines that conduct fuel oil, gasoline, or chemicals that would have a deleterious effect upon the pipeline or process when mixed with water shall be purged after the pressure and leakage tests. Purging shall be performed with air or an inert gas such as nitrogen or carbon dioxide. Purging shall be continued for a minimum of two hours after all visible water has disappeared.
- F. Testing of lines governed by other authorities, i.e. natural gas, shall be witnessed and approved by the authority.

3.09 RESERVED

3.10 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 PIPING SCHEDULE

- A. The following letter designations are used in the Piping Schedule:

Material Designation:

- DIP - Ductile Iron Pipe
- RCP - Reinforced Concrete Pipe
- PVC - Polyvinyl Chloride
- HDPE - High Density Polyethylene

- B. Schedule:

Service	Size	Material	Remarks
Force Main	DIP	2.03	
Lagoon Crossover pipes	DIP	2.03	
Effluent pipes	DIP	2.03	Flange x PE required for valve mounting
Effluent pipe (thru Dike)	DIP	2.03	To MH
Effluent pipe	PVC SDR 35	2.01 B	From MH

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Service	Size	Material	Remarks
Storm Sewers	HDPE	2.01 G	
Drainage tile	Match existing		

- C. Schedules are not guaranteed to be complete. All piping shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.

END OF SECTION

Kunkle Wastewater System Improvements
Division A: Collection System and Pump Station
Addendum 2 - Exhibit A

END OF EXHIBIT A