

DIVISION 33 – UTILITIES
SECTION 33 32 00 – WASTEWATER UTILITY PUMPING STATIONS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Pumping stations which are proposed by the Developer are to remain privately owned and operated and shall also meet these design criteria, unless specifically requested by the Developer and waived by the Authority.
- B. The purpose of these guidelines is to establish technical and design specifications for Developers and their engineers for the design and acceptance of wastewater pump stations within the service area of the Authority. The criteria are intended to assure uniformity and quality of construction for the facilities constructed hereunder. Any deviation from the criteria contained herein shall be at the approval of the Authority and their Engineer. Drawings and specifications shall be prepared and certified by a Professional Engineer registered and in good standing in the Commonwealth of Pennsylvania.
- B. Certain equipment manufacturers have been noted herein for the purposes of establishing standards for: the level of quality for materials, workmanship, and reliability; ease of maintenance; and minimization of inventory. Alternate equipment manufacturers will be considered on an approved equal basis by the Engineer.

1.02 QUALITY ASSURANCE

- A. All work contained in this section shall be in accordance with the requirements outlined in the Pennsylvania Department of Environmental Protection's Domestic Wastewater Facilities Manual, latest edition.

1.03 SUBMITTALS

- A. The following shall be submitted to the Authority prior to approval of Land Development Plans:
 - 1. A design memorandum signed and sealed by a registered Professional Engineer in the Commonwealth of Pennsylvania to include the following:
 - a. Wet well volume calculations.
 - b. Wet well and force main detention time calculations.
 - c. Flow quantification.
 - d. Pump duty cycle at average and peak daily flow.
 - e. Force main velocity.

- f. Static and dynamic head calculations.
 - g. Pump curves.
 - h. System curves.
 - i. Emergency stand-by power requirements.
 - j. Any other design calculations or assumptions.
 - 2. Pump station building drawings.
 - 3. Site plan including pump station, pump station building, development, and sanitary sewer collection and conveyance system.
 - B. Submit under provisions of Section 01 33 00.
 - C. Shop Drawings: At a minimum, shop drawings shall include:
 - 1. Dimensional prints of all major items of equipment.
 - 2. Complete installation drawings including a layout drawing showing location, arrangement, and sizing of all equipment supports, anchor bolts, and foundation blocks.
 - 3. Complete material and mechanical details of the equipment.
 - 4. Any piping, structural, or electrical changes required for the equipment proposed by Contractor. Contractor shall be responsible for making these revisions at no cost to the Authority.
 - 5. Manufacturer's recommended installation procedures which, following review by Engineer, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.
 - D. Submit three (3) copies of complete operation and maintenance manuals for all major mechanical and electrical equipment.
- 1.04 SPARE PARTS
- A. Provide all spare parts recommended by the manufacturer.
- 1.05 WARRANTY
- A. All equipment furnished under this specification shall be guaranteed free from defects in workmanship, material and design. The equipment manufacturer shall provide a guarantee to promptly replace any defective part or parts of the equipment without cost for a period of one year after equipment has been placed in regular operation.

PART 2 – PRODUCTS

2.01 SITE

- A. The pump station site shall be generally level graded to remove runoff from site in a non-erosive manner. Drainage swales and/or stormwater inlets shall be provided to direct drainage away from the site as necessary.
- B. The pump station site shall be protected by a chain link fence 8-feet in height. One 3-foot personnel gate and one 12-foot cantilevered sliding or double swing gate for vehicle access shall be provided (location to be approved by Authority). Provide keyed alike padlocks for each gate.
- C. Provide space for future expansion, especially if population growth or development in the drainage area may increase substantially.
- D. The pump station, including, all structures, mechanical, and electrical equipment, etc. shall be designed to remain fully operational and accessible during the one hundred (100) year flood event. The predicted 100-year flood elevation shall be shown on all site plans.
- E. Provide sufficient area, in the best judgment of the Authority, between wastewater pumping stations, structures, electrical equipment, etc. and perimeter fencing for adequate access.
- F. The entire area contained by the protective fence and an area extending one (1) foot outside of the fence shall be provided with one of the following surfaces, as selected by the Authority:
 - 1. A minimum of 6-inches of PennDOT 2A aggregate and a minimum of 5-inches of PennDOT Superpave base course and 1.5-inches of PennDOT Superpave wearing course over the entire area.
 - 2. A minimum of 6-inches of PennDOT 2A aggregate and a minimum of 5-inches of PennDOT Superpave base course and 1.5-inches of PennDOT Superpave wearing course over the entire area for the access road and parking areas. The remainder of the area shall be provided with geotextile material and 6-inches of AASHTO #57 aggregate.
 - 3. A minimum of 6-inches of PennDOT 2A aggregate and a minimum of 5-inches of PennDOT Superpave base course and 1.5-inches of PennDOT Superpave wearing course over the entire area for the access road and parking areas. The remainder of the area shall be graded, top soiled, seeded for grass, and landscaped.
- G. All grounds outside the fenced area shall be graded, top soiled, seeded for grass, and landscaped. Slopes requiring mowing shall not exceed 15 percent.

2.02 ACCESS FOR MAINTENANCE VEHICLES

- A. Adequate access to the site is required for maintenance personnel, equipment and vehicles.
- B. Adequate parking spaces for maintenance equipment and visitors shall be provided.
- C. Access to the pump station site shall be via a dedicated asphalt or concrete paved road. The road shall have a minimum 12 ft. single lane width. Curbs and gutters may be required at the discretion of the Authority. In no case shall the grade exceed 12 percent for acceptance of streets. The road and parking configuration shall be adequate for vehicle turnaround.

2.03 FIBERGLASS REINFORCED PLASTIC BUILDING

- A. A fully insulated, waterproof, corrosion-resistant fiberglass reinforced plastic (FRP) shelter with integral floor shall be furnished for housing of electrical equipment and pump controls.
- B. The outside dimensions of the shelter shall provide adequate space around the equipment to allow for service and repair of the equipment.
 - 1. A minimum of four (4) feet clearance for opening panel doors shall be provided.
 - 2. Shelter shall have a minimum sidewall height of seven (7) feet.
 - 3. Adequate dimensions of the shelter shall be determined by the Developer's Engineer and approved by the Authority.
- C. Floor shall be molded integral with the walls and of same construction but having 6-pound per cubic foot, closed-cell rigid polyurethane foam core may be specified.
- D. An insulated FRP door of similar construction to the shelter walls shall be provided and have a resilient, closed-cell foam neoprene seal having skin on all surfaces per ASTM D 1056 to provide weathertight closure. Stainless steel 3-point door catch and padlocking handle, heavy duty corrosion-resistant stainless steel hinges.
- E. Sufficient electrical or gas heat shall be provided as to prevent freezing inside the shelter at -10°F ambient temperature.
- F. Outside entry light(s) (dusk to dawn) with appropriate glare shield shall be provided above each entrance door(s) and operated by a light switch located near each door. Outside site lights shall be mounted on each wall face and operated by a light switch located near the pump room door. Lighting circuits shall be protected by a thermal magnetic circuit breaker.
- G. Provide adequate interior lighting for all areas in the building, a minimum of 2 watts illumination per square foot shall be provided. This lighting shall be supplied by the required number of fluorescent type lighting fixtures, each having two 32-watt fluorescent

T8 tubes and an electronic ballast. A light switch shall be located adjacent to each door opening. Lighting circuits shall be protected by a thermal magnetic circuit breaker.

- H. A minimum of two (2), 220 volt interior wall receptacles and four (4), 110 volt interior wall receptacles (one on each wall) shall be provided with ground fault protection and waterproof covers. Provide appropriately sized distribution branch circuit breakers.
- I. No manholes or wet well entrances shall be located inside the fiberglass reinforced plastic building.

2.04 WET WELL

- A. Wet well diameter shall be of sufficient diameter to provide adequate pump cycle times and drawdown levels for anticipated flows but shall not lead to excessive detention times. Provide adequate water depth at pump off level in wet well to prevent any vortex action or motor over-heating from occurring to the submerged pump(s). Influent to wet-well should be located to minimize splashing and turbulence.
- B. Wet well structures shall be cast in place reinforced concrete or precast concrete construction. If precast units are utilized, they shall conform to the requirements of ASTM C478, with watertight joints per ASTM C443. Refer to Section 33 05 13 for requirements.
- C. When required by the Authority, the wet well structures shall be provided with a corrosion protection interior coating. Provide the interior coating on all interior wet well surfaces. Refer to Section 09 97 23 for requirements.
- D. The bottom of the wet well shall be sloped so as to minimize solids settling.
- E. The wet well shall have a minimum six (6) inch SCH. 80 PVC vent pipe with a 180° turn-down and insect screen outside of the building.
- F. A stainless steel ladder or FRP ladder shall be provided to provide access to the bottom of the wet well.
- G. The wet well shall contain a stainless steel or trash basket located over the influent pipe. The trash basket should be easily removed from above grade with a stainless steel lifting chain for maintenance purposes.
- H. All support brackets and hardware in the wet well shall be stainless steel.
- I. An aluminum access hatch shall be provided for access to the wet well and sized to allow removal of the pumps and equipment as well as use of the ladder. The aluminum door shall provide a minimum 36" x 36" clear opening. The door shall be designed to withstand a live load of 300 pound per square foot. Hatch shall be provided with an automatic hold open arm and a locking mechanism to prevent unauthorized entry.
- J. Wet wells should be designed to provide sufficient volume to prevent excessive pump cycling and sufficient depth for pump control, while minimizing solids deposition. The wet well shall be designed for the ultimate build-out of the sewershed draining to the pump

station. The minimum volume between pump on and off levels should be calculated using the following general formula:

$V = tQ/4n$, where

V = minimum volume (gallons)

t = minimum time between pump starts

Q = pump capacity (gallons/minute)

n = number of pumps

The minimum time between pump starts shall be a minimum of 10 minutes for motor sizes less than 15 HP and 15 minutes for motor sizes 15 HP and greater.

2.05 WET WELL AERATION SYSTEM

- A. When required by the Authority and in order to prevent grease and grit buildup, and to avoid excessive detention time in the wet well and to reduce odors, provide a wet well aeration system including blower, control panel installed inside the building or “shelter”, and piping installed in the wet well.
- B. The blower operating point shall be designed based on wet well configuration. At a minimum the blower shall be capable of producing a minimum of 30 CFM at 36” of water column. The blower shall operate at 3,450 rpm with a minimum of 1.0 HP, TEFC motor. Include pressure/vacuum gauge, inlet filter with replaceable filter elements, discharge check valve, elastomer vibration isolators, pressure relief valve and discharge muffler pre-assembled with galvanized piping on an aluminum base plate. Blower shall turn off when a sewage pump is operating. The wet well aeration control system and blower shall be installed inside the building or “shelter”.
- C. Include a control panel with NEMA 1 wall mounted panel, circuit breaker, repeat cycle interval timer, panel mounted H-O-A selector switch, and interlock auxiliary contacts. In the “Auto” mode, the blower shall operate when a sewage pump is not operating and is called to run by the timer.

2.06 PUMPS AND MOTORS

- A. The pumps shall be located in the wet well. Submersible pumps with impeller, motor and guide rail systems shall be manufactured by Barnes to provide uniformity with existing Authority pump stations.
- B. All pumps shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Impeller shall be keyed to the shaft, retained with an Allen head bolt and shall be capable of passing a minimum 3 inch diameter solid.
- C. Pump and motor shaft shall be same unit. The pump shaft is an extension of the motor shaft; couplings shall not be acceptable. Pump shaft shall be stainless steel.
- D. Pump shaft shall be sealed against leakage by two (2) mechanical seals arranged in tandem.

- E. Motor shall be a squirrel cage, induction type in an air filled watertight enclosure. Motor shall conform to NEMA design Class B and incorporate Class H insulation rated for 356°F. Motor shall have a minimum service factor of 1.15 and a voltage tolerance of +/- 10%.
- F. Motor shall be capable of operating while only partially submerged for extended periods of time without damage and be non-overloading throughout the entire pump performance curve. Motor shall be designed for continuous duty and capable of up to 15 evenly spaced starts per hour.
- G. Motor and pump shall be designed and assembled by the same manufacturer.
- H. Guiderail Assembly: A lift-out guide rail assembly shall be provided with each pump to permit easy removal and installation of pump without the necessity of personnel entering the wet well. Lift-out assembly shall generally include a baseplate, guide shoe, two (2) guide rails, and davit crane/hoist for removal.

2.07 PUMP CONTROL PANEL

- A. All Control panels utilized shall be built to design specifications approved by the Authority.
- B. The pump control panel shall be manufactured by a UL panel builder and the assembly shall bear a serialized UL label for "Enclosed Industrial Control Panels". All wiring, workmanship, and schematic wiring diagrams shall be in compliance with the National Electric Code (NEC).
- C. Enclosure shall be constructed in conformance with National Electrical Manufacturers' Association (NEMA) standards for Type 12 electrical enclosures. Enclosures shall be fabricated of stainless steel and capable of wall mounting.
- D. A properly sized heavy-duty air circuit breaker shall be furnished for each pump motor.
- E. An open frame, across-the-line, NEMA rated magnetic motor starter shall be furnished for each pump motor. All motor starters shall be equipped to provide undervoltage release overload protection on all three phases.
- F. Circuit breakers shall have through the door operating mechanisms to prevent the door from opening when the breakers are in the "on" position. Motor starters, relays, and selector switches shall be NEMA rated.
- G. The control panel shall be equipped with circuitry to override the level control system and shut down the pump motor(s) when required to protect the pump from damage caused by excessive temperature. A thermostat shall be mounted on each pump to detect its temperature. If the pump temperature should rise to a level which could cause pump damage, the thermostat shall cause the pump motor to shut down. A pilot light shall indicate that the pump motor has been stopped because of a high temperature condition.

The pump shall remain locked out until the pump has cooled and the circuit has been manually reset. Automatic reset of the circuit shall not be acceptable.

- H. The pump controller shall be a 120 V, single phase AC powered level control system with a Programmable Logic Controller (PLC) and a display operator interface utilizing a submersible pressure transducer as well a high and low level float back-up. The PLC logic shall be configured with high wet-well level and low wet-well level alarm capability. A float regulator control system shall be provided as a complete backup.
- I. The pump control panel shall also include hour meters for each pump and each combination of pumps operating (e.g. Pump 1, Pump 2, Pumps 1 & 2), indicating lights, switches, lag pump start time delay, three phase voltage monitor, secondary surge arrestor ground network, low building temperature sensor, GFI utility receptacle, alarm contacts, and a panel light.
- J. The pump control panel shall be provided with an exterior flashing alarm light (red) that actuates on an alarm condition.

2.08 HEADER PIPING

- A. All piping shall be ductile iron pipe, minimum four (4) inch diameter, unless otherwise approved by the Authority's Engineer. Refer to Section 33 31 00 for pipe material requirements.
- B. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be provided with thrust restraints.
- D. The pump station header piping shall include the necessary valves (check and plug valves) and fittings to permit emergency access to the pump station force main after isolation of the pumps. Refer to Section 33 31 00 for check and plug valve requirements.

2.09 FLOW METER

- A. Provide one (1) magnetic type flowmeter and circular pen chart recorded as required by the Authority for each force main for the measurement of flow through the pump station. Provide sample meter specs to Authority for approval. Meter shall incorporate empty pipe detection circuitry to avoid false readings if pipe were to empty. Meter shall have a non-resettable totalizer.
- B. Circular pen chart recorder which records flow over a seven (7) day, 24-hour a day basis should be provided. Provide 100 charts.

2.10 ELECTRICAL

- A. All work shall, at a minimum, be in accordance with the National Electric Code (NEC), National Electrical Safety Code (ANSI), and all federal, state, and local codes. Particular attention shall be given to classifying the various enclosed spaces to ensure adequate

ventilation, and using explosion proof and intrinsically-safe electrical equipment where necessary.

- B. Code Compliance: The installation shall be in accordance with the National Electric Code, latest edition. The developer shall obtain and pay for duplicate certificates stating that the installation is in accordance with the requirements of the National Electric Code and deliver one certificate to the Authority.
- C. Electrical service shall be 460, 230, or 208 volt 3-phase. Phase conversion equipment to convert single-phase to 3-phase power shall not be acceptable.
- D. Design shall include all arrangements with utility company to provide 3-phase power to facility. Design shall be in accordance with all utility company requirements.
- E. The main electrical panel shall be service entrance rated with a main circuit breaker and circuit breakers to feed building loads.
- F. A surge protection device shall be provided on the main service disconnecting device.
- G. Two (2) separate intrinsically-safe float switches shall be installed in the wet well to serve as an independent high water alarm and an independent low water alarm.

2.11 PORTABLE GENERATOR

- A. Portable generator size shall be adequate to provide power for pump motor starting during failure of utility power and during scheduled exercise periods. The generator set rating shall be based on sizing calculations for Emergency service.
- B. Manual transfer switch equipment shall be provided in the pump station to electrically connect to a portable generator. Sufficient storage capacity in the pump station shall be provided to allow time for detection of pump station failure and connection of generating equipment.

2.12 TELEPHONE DIALER

- A. The pump station shall include an automatic telephone dialer.
- B. The dialer shall be equipped with a cellular modem. Provide two years of cellular service for the device.
- C. Include an antenna mounted on the enclosure or as recommended by the manufacturer.
- D. The dialer shall be configured, programmed, setup, and monitored using the internet.
- E. The dialer shall be capable of monitoring up to 11 alarm contacts. The device shall be capable of calling, paging, or emailing to alarm condition to a pre-programmed contact list.

- F. The dialer shall monitor the following conditions:
 - 1. Power/Phase Failure.
 - 2. Pump Failure to Start.
 - 3. High Water Alarm (Transducer or Float).
 - 4. Low Water Alarm (Transducer or Float).
 - 5. High Pump Temperature, Pump 1.
 - 6. High Pump Temperature, Pump 2.
- G. The dialer shall be equipped to accept a 4-20mA input from the flow meter.
- H. The dialer shall be equipped with a key switch to disable false alarms during maintenance operations and report to the website that the unit is out of service.
- I. The dialer shall contain its own tapered type battery charging power supply and battery backup with a 36-hour minimum operation time.
- J. The dialer shall be protected by a circuit breaker and a single-phase lightning arrestor.

2.13 FORCE MAIN

- 1. Force main material shall be polyvinyl chloride (PVC) pipe, minimum four (4) inch diameter unless otherwise approved by the Engineer. Refer to Section 33 31 00 for force main material requirements.
- 2. Minimum depth of cover shall be 4' - 0".
- 3. A shut-off plug valve shall be installed on the force main near the discharge from the pump station.
- 4. The force main shall be designed to maintain a minimum velocity of 2.0 feet per second.

PART 3 – EXECUTION

3.01 START-UP

- A. Start-up and equipment check operations shall be performed by an authorized service technician from the original equipment manufacturer.
- B. The Engineer shall be notified seventy-two hours prior to start-up and an Authority representative shall be present during the period of start-up.
- C. A copy of the technicians report showing all field data control, set points, gauge readings and equipment condition shall be furnished to the Authority.

- D. Sufficient water for start-up and equipment check shall be the responsibility of the Contractor.
- E. The manufacturer shall furnish the services of a qualified, factory-trained operations and maintenance service man to instruct and train the Authority's personnel in proper care, operating, and maintenance of the equipment.

3.02 PUMP MANUFACTURER'S EQUIPMENT RE-CERTIFICATION

- A. The manufacturer's factory-trained service technician shall return to the site six (6) month's after initial start-up of the equipment to perform a final re-certification of the equipment.

3.03 PROTECTION OF EQUIPMENT

- A. The pumping station should be placed into service soon after delivery of the equipment. If operation is delayed, the equipment including control shall be stored indoors free from excessive dust in a low humidity, heated environment.

3.04 CLEAN UP

- A. The contractor shall clean up as the work progresses and shall maintain his construction areas in a clean condition up until acceptance by the Authority, without regard to who caused the need for clean up.
- C. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed materials or damage. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap, and debris.

3.05 HYDROSTATIC TESTING FOR PRESSURE LINES

- A. Refer to Section 33 31 00 for force main leakage test requirements.

END OF SECTION