City of Smithville, Missouri Pump Station Standards (Revised 2020)

1. Pump Station Plans and Design Information

- A. Submit to the City for review and approval prior to construction.
- B. All variations from the standard shall be noted and approved by the City of Smithville.

2. General Requirements

- A. Additional detailed requirements are contained in the following documents:
 - 1. Above Ground Pump Station with Duplex Self-Primed or Vacuum-Primed Pumps Drawing.
 - 2. Submersible Pump Station with Above Ground Valve Package Drawing.
 - 3. Typical Details.

3. <u>Submittals</u>

- A. Product Data and Shop Drawings
 - 1. Prior to fabrication, pump station manufacturer shall submit 3 copies of submittal data for review and approval.
 - 2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.
- B. Operations and Maintenance Manuals
 - 1. Operation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.
 - 2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station

manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

- 3. Functional description of each major component, complete with operating instructions.
- 4. Instructions for operating pumps and pump controls in all modes of operation.
- 5. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
- 6. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
- 7. Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA 70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.
- 8. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.
- 4. Quality Assurance
 - A. The pumps and pump station manufacturer must be certified to ISO 9001 by an accredited certification agency.
 - B. Factory System Test
 - 1. All internal components including the pumps, motors, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall simulate actual performance anticipated for the complete station.

- C. Manufacturer's Start-up Services
 - 1. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in provided manuals.

5. Manufacturer's Warranty

- A. All components of the pump station shall be manufactured, assembled and tested as a unit by a single supplier. The pumping station must be a standard catalog item with the manufacturer. The supplier must assume system responsibility. The complete pump station assembly must be warranted by the manufacturer. Individual component warranties are desirable. However, individual warranties honored solely by the manufacturer of each pump station component will not be acceptable.
- B. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.
 - 1. Fiberglass components of the station enclosure shall be warranted for twenty (20) years to resist UV damage, corrosion from moisture or corrosive soils, or physical failures occurring in normal service, without the need for special protective coatings, when installed according to the manufacturer's recommendations.
 - 2. All other equipment, apparatus, and parts furnished shall be warranted for five (5) years excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, 0 rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.
 - 3. Components failing to perform as specified herein, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.
- C. It is not intended that the station manufacturer assume liability for consequential damages or contingent liabilities arising from failure of any vendor supplied product or part which fails to properly operate, however caused. Consequential damages resulting from defects in design, or delays in delivery are also beyond the manufacturer's scope of liability.
- D. The warranty shall become effective from the time of startup.
- 6. <u>Pump Station Design</u>

- A. Lift station designs shall be based upon the criteria set forth in the Missouri Department of Regulations 10 CSR 20-8 (January 2018).
- B. All lift station top elevations shall be below the lowest basement elevation being served. Request for variance from this requirement must be approved by the City.
- C. All new pump stations with flows below 75 gpm shall be a grinder type lift station as specified and manufactured by ABS Piranha, ITT Flygt, or an approved equal.
- D. All new lift stations with a flow greater than 75 gpm and suction lift of 20 FT. or less shall be a wet well mounted, factory-built, above ground pump station with duplex self-primed or vacuum primed pumps as manufactured by Gorman-Rupp, or an approved equal. The installed lift station must conform to the standards set forth herein.
- E. If the aforementioned criteria cannot be met, the new lift station shall be a factory-built submersible pump station complete with duplex submersible pumps as manufactured by ITT Flygt, Ebara, Fairbanks Morse, ABS, Gorman-Rupp or an approved equal, and an above ground valve package. The installed lift station must conform to the standards set forth herein.
- F. Pumps shall be designed to handle raw, unscreened, domestic sanitary sewage. Pumps, other than grinder pumps, shall be capable of passing solid spheres of at least 3 IN. diameter. Pump suction and discharge openings should be a minimum of 4 IN. diameter.
- G. Wet well access shall have a minimum entry clearance of 24 IN.
- H. No valves shall be located in the wet well.
- I. Place isolation and check valves on the discharge of each pump. Check valves shall be located in the horizontal portion of the discharge pipe and shall be suitable for the material being handled.
- J. All pump stations shall include a pressure gauge on discharge side of each pump upstream of the isolation valve.
- K. All lift station manholes/wet wells shall provide suitable and safe access in the form of a ladder or steps.
- L. Provide calculations that evaluate the design fill time and minimum pump cycle time in sizing the wet well. Utilize the manufacturer's duty cycle recommendations when selecting the minimum cycle time. Evaluate detention times for initial and ultimate flow conditions.

- M. Each of the pumps shall be designed to pump the design peak hourly flow with any unit out of service. Provide calculations used to determine the average and peak hourly design flows for current and ultimate conditions.
- N. For self-prime and vacuum-prime pumps provide calculations of static suction lift as measured from the "lead pump off" elevation to the centerline of the pump suction, friction and other hydraulic losses of the suction piping, and net positive suction head available.
- O. The installation of the new lift station shall not affect the existing sewerage system. Lift station designs shall take into account the head conditions of the entire system. City's Engineer shall supply conditions when connecting to an existing force main.
- P. Pump station high water level shall be at least 10 IN. below the invert of the incoming sewer.
- Q. Within the valve vault provide a portable pump connection on the discharge line with rapid connection capabilities.
- R. Provide supports of 304 stainless steel for the suction and discharge lines located within the wet well. Provide stainless steel hardware in all wet wells. Submersible pumps shall be provided with stainless steel lifting chains and guide rails.
- S. Suction and discharge pipe shall be of Schedule 80 PVC or ductile iron. Ductile iron shall be lined with Protecto 401 or Permox CTF and have field applied epoxy protective coating.
- T. O & M manuals including electrical schematics and pump curves shall be submitted and approved prior to project acceptance by the City.

7. Valves and Piping

- A. Check Valve: Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.
- B. Plug Valve: A 3 way plug valve must allow either or both pumps to be isolated from the force main.
- C. Air Release Valves
 - 1. Self-prime and vacuum prime stations shall be equipped with an automatic air release valve, designed to vent air to atmosphere during initial priming, or unattended repriming cycles. Upon completion of the priming or

repriming cycle, the valve shall automatically close to prevent recirculation. A visible indication of valve closure shall be evident, and shall operate solely on discharge pressure. Valves which connect to the suction line, or rely on vacuum pumps are not acceptable.

- D. Piping
 - 1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.
 - 2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.
 - 3. Supports and Thrust Blocks: 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 anchored with thrust blocks where shown on the contract drawings.

8. Enclosures

- A. Provide a minimum 8 FT. X 8 FT. X 7.5 FT. enclosure consisting of molded orthophthalic polyester resins with a minimum of 30% fiberglass, and a maximum of 70% resin. Resin fillers or extenders shall not be used.
 - 1. The enclosure shall contain and protect all pumps, interior piping, valves and associated controls.
 - 2. Enclosure shall include a 36 IN. X 78 IN. entry door.
 - 3. Enclosure shall include a 1,000 LB capacity bridge crane with chain hoist for removal of pumps and valves.
 - 4. Provide enclosure with space heater, blower, and intake louver for climate control.
 - 5. For submersible pump stations the pump control panel shall be located within the valve vault enclosure.
 - 6. Lockable wet well access hatch shall be exterior to the enclosure.

9. <u>Electrical Control Components</u>

- A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.
- B. Panel Enclosure

- 1. Electrical control equipment shall be mounted within a common NEMA 4X stainless steel, dead front type control enclosures. Doors shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on removable steel back panels secured to enclosure with collar studs.
- 2. All control devices and instruments shall be mounted using threaded fasteners, and shall be clearly labeled to indicate function.
- C. Grounding
 - 1. Station manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection.
 - 2. The contractor shall provide an earth driven ground connection to the pump station at the main grounding lug in accordance with the National Electric Code (NEC).
- D. Liquid Level Control
 - 1. Provide floats and relay logic controls. PLC control is not acceptable.
 - 2. Manual/Auto Control
 - a Pump manual and automatic control capability shall be provided. Manual control to be performed through hardwire switches and indicating lights. Automatic control shall be performed through floats and relay controls. The manual control shall be fully operable and not impacted during the loss of the automatic controls.
 - 3. Pump Start Delay
 - a The control circuit for pump #2 shall be equipped with a time delay to prevent simultaneous motor starts.

10. Lighting System and Facility Receptacles

- A. Provide 120Vac lighting to illuminate the pump enclosure or valve vault. Light fixtures shall be corrosive resistant.
- B. Provide a minimum of one duplex receptacle. Receptacles shall be weatherproof.
- C. A dusk to dawn activated yard light shall be provided at the pump station site. Install a wall-mounted switch located at the enclosure entry location.

11. <u>120/240Vac Facility Power</u>

- A. One, minimum 12 pole 120/240V, 1-phase facility panelboard shall be provided. The panelboard shall contain a copper bus and rated 10,000A RMS for power facility accessories and instrumentation.
- B. Provide arc flash labels on electrical equipment.

12. Electrical Service

- A. Provide 480V, 3-phase, 60Hz electrical power to be installed by the local Utility to power the pumps. Variance from this must be approved by the City of Smithville.
- B. Reduced Voltage Starters (Soft Starter, RVSS) or Variable Frequency Drives (VFD)
 - 1. An RVSS or VFD shall be provided for each pump 30 Hp and greater. The RVSS or VFD shall also be sized per the manufacturer's requirements, installed in a NEMA 4X enclosure, and provided with cooling equipment as required.

13. SCADA System

A. A Mission Controls telemetry monitoring system shall be provided for each pump station. All setup activities shall be arranged through the City and coordinated with Mission Controls. No other monitoring system shall be allowed.

14. Wash-Down Systems

A. Unless otherwise approved by the City, provide wash down yard hydrant with backflow prevention, as shown on drawings.

15. <u>Emergency Operation</u>

- A. Shall be in accordance with Missouri Department of Regulations 10 CSR 20-8.
- B. Lift station design shall include the following overflow prevention methods, to be approved by City Engineer, for lift stations with an average daily flow greater than 10,000 GPD. These methods are:
 - 1. Storage capacity for a minimum volume of two hours peak hourly flow. The storage capacity will be in the form of underground pipes, which must drain back to the wet well as flow recedes. The storage shall be at such elevation as to not cause the influent sewer to backup when filled. Adequate access for maintenance must be provided.
 - 2. By-Pass Pumping Connection

- a A by-pass pumping connection shall be provided on the discharge piping to allow connection of a portable pump.
- b The by-pass pumping connection shall incorporate a 2 way plug valve to permit emergency access to the pump station force main after isolation of the pumps. The plug valve shall be non lubricated, tapered type. Valve body shall be semi steel with flanged end connections drilled to 125 pound standard.
- 3. Provide a Standby Generator with Automatic Transfer Switch
 - a Standby Generator shall be diesel fueled 480Vac, 3-phase, emergency generator provided with automatic remote start and stop capability to provide emergency electrical power to the pump station in the event of the Utility source failure. The generator shall be provided with a fuel tank capacity of at least 24 hours run time at full load.
 - b Provide an Automatic Transfer Switch (ATS) for automatic source switching to the emergency generator upon loss of Utility primary power. The ATS shall be capable of monitoring the primary source, start the generator, and automatically transfer the pump station load to the emergency generator. The ATS shall be capable of shutting down the generator and switching back to the primary source once it has been reestablished.
 - c Generator shall be provided with sound attenuated enclosure.
- 4. An alternate to a standby generator is connection of the pump station to two independent utility substations with automatic transfer switch.

16. Fencing

- A. Lift station sites shall be fenced to provide protection of the facility. A hinged access gate will be provided with width sized to permit vehicular access (10 FT minimum).
- B. Fence shall be 6' high with 3 strands of barbed wire.
- C. Fence fabric shall be vinyl coated, black in color.

17. <u>Site Access</u>

- A. All weather access for maintenance vehicles shall be provided to the lift station site.
- B. Access drive apron within public right-of-way shall be concrete. Drive beyond right-of-way shall be asphalt or concrete unless otherwise approved by City.
- C. If the access drive connects to a main road, there must be adequate sight distance for traffic safety.

18. Field Quality Control

A. Operational Test

- 1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.
- 2. After construction debris and foreign material has been removed from the wet well, contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.
- B. Manufacturer's Start-up Services
 - 1. Coordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation. He will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.