



GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building • 688 Route 15, Mangilao, Guam 96913 • Tel. (671) 300-6036

Invitation To Bid: IFB-07-ENG-2018
Talofofo Sewer Improvement
GWA Project No. S16-004EPA

Addendum No.: 02

Date: July 18, 2018

All Qualified Bidders:

This addendum is issued to modify the previously issued bid documents and/or given for informational purposes and is hereby made a part of the bid documents. Failure to acknowledge receipt of this addendum shall be grounds for the bidder's disqualification and rejection of the bidder's proposal.

1. Plans – Clarification to Drawing

Sheet M-1.0

Refer to PUMP SCHEDULE tabulation under column heading CAPACITY (GPM); figures listed in the table indicates the actual sewage flow (GPM) for each area served. For pump capacity sizing requirements, refer to Mechanical Basis of Design (BOD).

2. Specification

- a. Specification Table of Contents has been revised and is attached to this addendum.
- b. Specification Section 33 32 16 Package Sewage Pumping Station is attached to this addendum.
- c. Revised Section 33 32 13 Fiberglass Wet Wells is attached to this addendum.
- d. Revised Section 40 00 10 Instrumentation and Control System is attached to this addendum.

3. Basis of Design

The Mechanical/Plumbing Basis of Design attached to this addendum is provided to guide qualified bidders in determining proper pump selection requirements.

Bidders are also notified to visit GWA website: www.guamwaterworks.org to ensure that addenda to the bid, answers to questions, and reminders are communicated to all bidders throughout the solicitation process.


MIGUEL C. BORDALLO, P.E.
General Manager 

Attachment:

- *Sheet M-1.0*
- *Section 33 32 13*
- *Section 33 32 16*
- *Section 40 00 10*
- *Mechanical Basis of Design*

MCB;gb

GENERAL PLUMBING NOTES

- ALL PLUMBING WORKS SHALL CONFORM TO THE 2009 EDITION OF THE INTERNATIONAL BUILDING CODE, 2009 EDITION OF THE INTERNATIONAL PLUMBING CODE, THE CONTRACT DOCUMENTS AND RULES AND REGULATIONS OF GOVERNMENT OF GUAM AUTHORITIES HAVING JURISDICTION.
- VERIFY LOCATION AND DEPTH OF UTILITIES AT POINT OF CONNECTION BEFORE START OF PIPING INSTALLATION.
- DRAWINGS ARE DIAGRAMMATIC ONLY AND REPRESENT THE GENERAL SCOPE OF THE WORK. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND PLANS FOR ADDITIONAL REQUIREMENTS THAT MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECTS OR OWNER'S REPRESENTATIVE OF ANY CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
- THOUGH SOME OFFSETS AND TRANSITIONS ARE SHOWN IN PIPING TO HELP INDICATE THE PHYSICAL RELATIONSHIP BETWEEN THEM, IT IS NOT THE INTENT OF THE DRAWINGS TO SHOW ALL PIPING OFFSETS AND TRANSITIONS REQUIRED. THE CONTRACTOR SHALL COORDINATE THE MECHANICAL WORK WITHIN ITSELF AND THE WORK OF ALL TRADES TO PROVIDE COMPLETE AND OPERABLE SYSTEM WITHOUT INTERFERENCES.
- NO PIPING SYSTEM SHALL BE BURIED OR CONCEALED UNTIL INSPECTED, TESTED AND ACCEPTED BY THE ARCHITECT OR OWNER'S REPRESENTATIVE. ALL PIPING SHALL BE TESTED FOR LEAKAGE.
- ALL SANITARY/SEWER PIPES EMBEDDED ON GROUND AND BELOW CONCRETE SLAB SHALL BE PROVIDED WITH SAND BEDDING MATERIALS.
- PROVIDE ACCESS PANELS FOR VALVES, HAMMER ARRESTOR, ETC. REQUIRING SERVICING, INSPECTION, MAINTENANCE AND ADJUSTMENT CONCEALED IN WALLS OR ABOVE GYPSUM BOARD CEILING.
- PROVIDE PIPE SLEEVES FOR PIPES PASSING THRU WALLS AND FOUNDATION.

PLUMBING SPECIFICATIONS

SCOPE OF WORK: SHALL INCLUDE THE FURNISHING OF SYSTEMS, EQUIPMENT AND MATERIALS SPECIFIED, AND AS CALLED FOR IN THE PLUMBING DRAWINGS. ALL FACILITIES, SUPERVISION, COORDINATION, TRANSPORTATION, HANDLING, LABOR AND METHODS FOR THE FABRICATION, INSTALLATION, INTERCONNECTIONS, PAINTING AND OTHER FINISHES, STARTUP, TESTS, ADJUSTMENTS, CLEANUP AND OTHER NECESSARY WORK FOR THE COMPLETE AND SATISFACTORY SYSTEMS AND EQUIPMENT, READY FOR OPERATION AND USE, SHALL BE INCLUDED. THE PLUMBING CONTRACTOR SHALL EXAMINE ALL CONTRACT DOCUMENTS INCLUDING ALL DRAWINGS, SPECIFICATIONS, PLUMBING DESIGN REQUIREMENTS, PLUMBING DESIGN DETAILS, AND SHALL BE RESPONSIBLE FOR ASCERTAINING TO WHAT EXTENT ALL THOSE DOCUMENTS, DRAWINGS, SPECIFICATIONS, DESIGN REQUIREMENTS, AND SYSTEM DESIGN DETAILS AFFECT WORK HEREIN SPECIFIED. ALL ERRORS, OMISSION, CONFLICTS OR CODE VIOLATIONS SHALL BE REPORTED TO ARCHITECT AND OWNER PRIOR TO COMMENCEMENT OF WORK.

MATERIALS:

PIPING

- SUMP PUMP DISCHARGE PIPING: SHALL BE GALVANIZED CARBON STEEL SCH 40 PIPE (ASTM A53 GRADE B) WITH THREADED END JOINTS. FITTINGS SHALL BE GALVANIZED CAST IRON THREADED DRAINAGE FITTINGS CONFORMING TO ANSI B 16.12.
- SUMP PUMP DISCHARGE PIPING SHALL BE DUCTILE IRON (ASTM D3034 SDR 35) WITH MECHANICAL OR PUSH-ON JOINT FITTINGS.

VALVES:

- GATE VALVE (2" AND SMALLER): BRONZE BODY, SCREWED BONNET, NON-RISING STEM, SOLID WEDGE DISC (ASTM B62), SOLDER ENDS.
- GATE VALVE (2-1/2" AND LARGER): CAST CARBON STEEL, CLASS 150, O,S&Y, RISING STEM WEDGE DISC, FLANGED END.
- CHECK VALVE (2" AND SMALLER): BRONZE BODY, SCREWED CAP, SWING TYPE DISK, INTEGRAL SEAT SCREWED END TO NPT.
- CHECK VALVE (2-1/2" AND LARGER): CAST CARBON STEEL, BOLTED CAP, FLANGED END.
- BALL VALVE (2" AND SMALLER): BRONZE BODY, CLASS 150, SERVICEABLE IN-LINE, QUARTER TURN LEVER, SOLDERED CONNECTIONS.
- BUTTERFLY VALVE (2-1/2" AND LARGER): 200 PSI WORKING PRESSURE, DUCTILE IRON BODY, ALUMINUM/BRONZE DISC, STAINLESS STEEL SHAFT, RESILIENT SEAT O-RING SEALS, LUG-TYPE FOR DEAD-END SERVICE, LEVER OPERATOR.

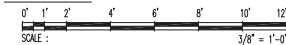
LEGEND AND ABBREVIATIONS

SYMBOL	ABBR	DESCRIPTION
	P	PUMP
		EXIST PIPE (CW, HW, S, W, V) TO BE REMOVED
		EXIST PIPE (CW, HW, S, W, V) TO REMAIN
	S OR W	SOIL OR WASTE LINE, ABOVE FLOOR
	S OR W	SOIL OR WASTE LINE, BELOW FLOOR
	V	VENT LINE
	CW	COLD WATER LINE
	HW	HOT WATER LINE
	GV	GATE VALVE
	CV	CHECK VALVE
	ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
	ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
	DWG	DRAWING
	GEPA	GUAM ENVIRONMENTAL PROTECTION AGENCY
	GPM	GALLON PER MINUTE
	HP	HORSEPOWER
	NTS	NOT TO SCALE
	RPM	REVOLUTIONS PER MINUTE
	TDH	TOTAL DYNAMIC HEAD

PUMP SCHEDULE										
MARK NO.	AREA SERVED	TYPE	CAPACITY (GPM)	TDH (FT)	ELECTRICAL CHARACTERISTICS					REMARKS
					HP	RPM	VOLTS	PHASE	HERTZ	
P 1	CHALAN KANTON LADERA 1	SUBMERSIBLE PUMP	65	65	3	1750	208	3	60	-
P 2	CHALAN KANTON LADERA 2	SUBMERSIBLE PUMP	85	35	3	1750	208	3	60	-
P 3	CHALAN AYUYU	SUBMERSIBLE PUMP	30	75	3	1750	208	3	60	-
P 4	LEONARDO TENORIO STREET	SUBMERSIBLE PUMP	130	45	3	1750	208	3	60	-
P 5	E. JOHNNY S. TAITAGUE STREET	SUBMERSIBLE PUMP	200	65	7.5	1750	208	3	60	-

Capacity (GPM) shown on Pump schedule table is basically "ACTUAL SEWAGE FLOW (GPM). For pump capacity sizing requirements, refer to Mechanical Basis of design (BOD) as provided in Part E of this Addendum.

GRAPHIC SCALE:



	REV	DATE	BY	DESCRIPTION	APPROVED BY
PROJECT: TALOFOFO SEWER IMPROVEMENT GWA Project No. S16-004-EPA					DRAWING NO. M-1.0
DES. BY: JBE DRN. BY: JBE CHK. BY: JBE	CHIEF ENGR. ENGR. SUR. PROJ. ENGR.	COMMENTS: NOTES, SPECIFICATIONS, SCHEDULES, LEGENDS AND ABBREVIATIONS			SHEET 17 OF 22

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- Section 33 30 00 Sanitary Sewers
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SECTION 33 32 13
FIBERGLASS WET WELLS

PART 1 GENERAL

1.1 DESCRIPTION

- A. SCOPE OF WORK: Contractor shall furnish all labor, materials, equipment and performance of all work necessary or incidental to furnish and install a Fiberglass Reinforced Polyester Wet Well. FRP Wet Wells shall be one piece units manufactured to meet or exceed all specifications of ASTM D3753. Fiberglass reinforced polyester wet wells shall be manufactured from commercial grade polyester resin with commercial grade continuous strand fiberglass reinforcement material.

1.2 QUALITY ASSURANCE

- A. QUALIFICATION OF MANUFACTURER: The manufacturer shall demonstrate the ability to fabricate the various lift station components, as shown in the plans.

B. REFERENCE STANDARD

- ASTM D883 Standard Terminology Related to Plastics
ASTM D3299 Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM D3753 Standard Specifications for Glass-Fiber-Reinforced Polyester Manholes and Wet Wells
ANSI/AWWA D120-09 AWWA Standard for Thermosetting Fiberglass Reinforced Plastic Tanks

1.3 SUBMITTALS

- A. The manufacturer shall supply a complete set of scale drawings detailing dimensions of heights, diameter, elevations to invert, pipe sizes and any other necessary details.
- B. Anti-Floatation (Buoyancy) Calculations and design report– A set of signed calculation and sealed by a US Registered Professional Engineer. Anti-floatation calculations shall be provided which meet the following criteria:
- Wet well weight and soil pressure on concrete base collar may be used to calculation down forces, but pump and piping weights shall not be used.
 - Assume groundwater is at grade.
 - A factory of safety of 1.2, minimum, must be used.
 - The design calculations shall meet design conditions as shown on the drawings.
- C. Engineering Design Report – Manufacturer shall provide a complete engineering design analysis for the wet well. The calculations shall include:
- Design Inputs

- b. Design of Cylindrical shell
- c. Flat Top head design
- d. Bottom head design
- e. Pump anchorage on flat bottom
- f. Component weight
- g. Buoyancy Calculations
- h. Lateral earth pressures
- i. Hydrostatic pressures
- j. Lifting Trunnion Design
- k. Access Cover opening reinforcement
- l. Design Summaries and Sketches
- m. P.E. Stamp for the Design Calculations, Reports and Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Xylem, inc. Flygt Brands; 14125 South Bridge Circle Charlotte, NC 28273; Tel No. 704.409.9700; Web: www.ittwww.com
- B. Barski Industries (1985) Ltd.; 2378 Westlake Road, West Kelowna, B.C. Canada; Tel No. 250.769.6848; Web: www.fiberglasspumpstations.com
- C. OR GWA approved equal

2.2 MATERIALS

- A. Resin – The resins used shall be commercial grade isophthalic resins. Interior corrosion liner shall be an isophthalic resin.
- B. Reinforcing Materials – The reinforcing materials shall be a commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric, or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcements and the resin.
- C. Surfacing Materials – If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass that includes compatible liner that will provide a suitable bond with the resin and leaves a resin rich surface. The cylinder is a filament wound laminate constructed by saturating continuous strand glass roving in a controlled pattern over a corrosion liner that is to be 110 mils minimum thickness. The roving's shall be applied uniformly throughout the entire length of the cylinder as required to provide adequate thickness for the mechanical loads of each application. The winding pattern shall be a combination of helical and hoop wraps and shall produce a dense laminate without non-reinforced resin pockets or air bridging between the rovings. The glass content of the structural laminate shall be 60% to 70% by weight. The station bottom is a 30% to 50% glass content, chop spray laminate, constructed by built-up alternating layers of chop spray and woven roving applied along with a catalyzed isophthalic resin. Each layer shall be properly

wetted out and rolled out so that it is free of air voids until the required wall thickness has been obtained.

- D. Interior Materials - A minimum of a 3/8 inch laminate layer of the tank construction shall include the reinforcing materials, compatible liner, and a commercial isophthalic resin for added chemical resistance. All inside surfaces shall be smooth and free of cracks and crazing. All surfaces other than those made in contact with the mold surface shall be coated with air-inhibited resin or gel coat; this includes any cut of edges of laminate.
- E. Fillers and Additives – Fillers, when used, shall be inert to the environment and wet well construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification. No sand fillers will be allowed.

2.3 PHYSICAL PROPERTIES – The FRP Wet well must be designed to withstand wall collapse or buckling based on the following assumptions:

- A. Hydrostatic pressure of 62.4 lbs per square foot
- B. Saturated soil weight of 120 lbs per cubic foot
- C. Soil modulus of 700 lbs per square foot.
- D. Pipe stiffness value as specified in ASTM D3753

The FRP wet well laminate must be constructed to withstand or exceed two times the assumed loading on any depth of the wet well.

2.4 FABRICATION

- A. Exterior Surface – The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show.
- B. Interior Surface – The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted if they are less than 3/4 inch in diameter and less than 1/16 inch deep.
- C. Defects Not Permitted –
 - 1. Exposed fibers – Glass fibers not wet out with resin.
 - 2. Resin runs: runs of resin and sand on the surface.
 - 3. Dry areas: areas with glass not wet out with resin.
 - 4. Delamination: separation in the laminate.
 - 5. Blisters – None. Crazing: cracks caused by sharp objects.
 - 6. Pits or Voids – Air pockets.
 - 7. Wrinkles – Smooth irregularities in the surface.
 - 8. Sharp Projection – Fiber or resin projections necessitating gloves for handling.

- D. Installation of Brackets – Manufacturer or Manufacturer-certified field personnel shall glass in all stainless steel fasteners and brackets, discharge piping brackets, etc.; Manufacturer of wet well shall be responsible for integrity of all field glassing.
- E. Markings – Each wet well shall have wet well data integrated into fiberglass affixed outside the station with all the information below. Product data shall not be written in ink or paint. Production/serial numbers shall be kept on file by Manufacturer for a minimum of 20 years and shall be accompanied by project data for future reference and recall. Data required includes the following:
 - 1. Manufacturer’s Name
 - 2. ASTM Designation
 - 3. Production or Serial Number
 - 4. Production date
 - 5. Wet Well Depth
 - 6. Wet Well Diameter
 - 7. Warranty Length
- F. Wet Well Top Flange - The wet well flange shall have an outside diameter of at least 3.0 inches greater than the diameter of the wet well.

2.5 FIBERGLASS CONSTRUCTION METHODS

- A. Wet Well Penetrations – Cutouts/stub-outs must be installed by the manufacturer. Installations in the field are not recommended and may void the manufacturer’s warranty. Penetrations of FRP pipe will be performed using resin and reinforced hand lay-up procedures. All resin and fiberglass shall be the same type and grade as used in the manufacturer of the basin.
- B. Pipe Installation – Discharge wall penetrations are to have sleeves large enough to accept O.D. of pipe discharge flange. Influent pipe connections shall be made with a Press Seal Boot with stainless steel band or approved equal.

2.6 DESIGN FEATURES

- A. Station Design – The fiberglass pump station shall have an integral, hopper-shaped pump station bottom, which is self-cleaning by virtue of its design. The flat surface shall be minimized to an area that is directly influenced by pump suction and shall be free of obstacles. The bottom surface area shall have a ratio of 1:4 as it relates to the cross-sectional area of the pump station. The sloping walls of the pump station bottom shall further optimize the self-cleaning features of this station by directing all solids, trash and sludge, normally found in sewage and wastewater, to the suction of the submersible pumps to facilitate removal and effectively clean the bottom.
- B. Top Slab Support – Pour reinforced concrete slab support a minimum of two feet outside of fiberglass wet well wall and minimum of six inches thick.

- C. Design – Fiberglass wet well system to be designed, signed and sealed by a US Registered Professional Engineer. Resistance to floatation and traffic or pedestrian loading requirements shall be addressed in the design and as stated under paragraph 1.3 Submittals.
- D. Wet Well Top – The station cover shall be of ¼-inch thick Type-5086 aluminum diamond plate with an integral Safe-Hatch access cover. All bars, angles and shapes shall be type 6061-T6 aluminum. The access cover frame shall be a minimum of 4-inches deep and shall be adequately sized to allow for easy passage of the submersible pumps. The Safe-Hatch access cover shall be designed to support the weight of the pump unit plus pedestrian traffic. The access door(s) shall be equipped with a hold-open arm, held open in the 90-degree position. Cover door hinges shall be heavy-duty design and be cast 1/4-inch thick Type 316 stainless steel with 3/8-inch diameter stainless steel hinge pins. All fasteners shall be type-316 stainless steel. Each hatch shall be supplied with a type-316 stainless steel slam lock, having a key-way protected by a threaded plug. The plug shall be flush with the diamond plate cover. The hatch shall be equipped with an aluminum lift handle that shall be flush to the top of the diamond plate cover.

The station lid shall have an integral four-inch diameter stub-pipe connection for the purpose of venting the pump station. The inverted J-shaped vent pipe shall be schedule 40 PVC pipe and shall end at a point at least 3-foot above the elevation of the station cover. There shall also be an option for a second vent to accommodate positive ventilation of the wet well.

- E. Safety net and Debris Basket– The access cover unit shall be equipped with a Safe-Hatch hinged safety grate to provide protection against fall-through and to control access into the confined space. Grate openings shall be sized to allow for routine maintenance inspection without having to open the safety grate. The closed safety grate shall be designed to support the weight of one pump to facilitate site pump wash-down and inspection. The hatch opening will have a 4" elevated toe board to prevent tools from being kicked into the wet well (per OSHA 1926.502 (j)). The fall through protection system shall consist of the following:
1. Provide safety hatch manufactured from high strength polyester netting that has been tested and certified to meet the current OSHA standard 1926.502 (c) (4) (i) drop test.
 2. Provide all stainless steel 316 hardware, hooks and anchors.
 3. Provide Debris Baskets
 4. A permanently attached metal tag with the following information: net manufacturer's name, identification of net material, date of manufacture, date of prototype test, name of testing agency, and serial number.

2.7 WARRANTY

The fiberglass Manufacturer shall warrant the fiberglass wet well against defects for 25 years on all FRP components and 5 years on all other items except for the mechanical items which is 1 year warranty as per manufacturer. Defects are defined as cracking, delaminating, or leaking. The warranty shall require the Manufacturer to supply all necessary labor, materials, and equipment to repair defects to the satisfaction of the Owner. The Contractor and/or Manufacturer shall not make any exemption or exception to the above stated conditions or warranty. Manufacturer's recommended installation procedures to assure warranty provided to the Owner to be included in submittal package.

PART 3 INSTALLATION

3.1 GENERAL

- A. The FRP wet well shall be installed in the location shown on the plans in accordance with the Manufacturer's recommendations.
- B. Contractor shall pile excavated material in a manner that will not endanger the work and will avoid obstructing sidewalks, driveways, power poles, etc.
- C. The Contractor shall be responsible for the execution and construction of all works for the wet well installation works including any temporary works and temporary pit/shaft supporting structures.
- D. Based on the project site locations shown in the contract drawings, the Contractor shall design and size the limit of excavation to accommodate all temporary and permanent works.
- E. The Contractor is responsible for submitting the work plan for approval prior to commencing work which includes:
 - 1. The design of all temporary works associated with the trenchless construction, including but not limited to the pit/shaft support (including access ladders and pipe fixings), crane pads and access roads or laydown areas;
 - 2. The design of the means and methods of excavation to be used and the associated equipment and tools;
 - 3. Verify the suitability of the excavation methodology proposed with respect to wet-well install and site limitations;
 - 4. All construction methods shall ensure the safe operation and use of plant, equipment and materials handling under all expected loadings such as ground pressure, superimposed loads and thrust forces.
 - 5. The Contractor shall thoroughly familiarize himself with the site and make its own deductions and conclusions as to the proposed methodology of maintaining required excavations and of doing other work affected by the local geology and boundaries of the site.

3.2 HANDLING

The wet well shall not be dropped or impacted. Wet wells shall be chocked if stored horizontally. Wet wells shall not be moved by rolling, FRP wet wells shall be lifted as specified by the Manufacturer. Use of chains or cables in contact with the wet well surface is prohibited.

3.3 WET WELL INSTALLATION

Bottom of excavation should be compacted to a minimum 95 percent Modified Proctor Density. Pour reinforced concrete base a minimum of one foot deep and at least two feet in diameter larger than the fiberglass wet well outside diameter.

END OF SECTION

SECTION 33 32 16

PACKAGED UTILITY WASTEWATER PUMPING STATIONS

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C509	(2015) Resilient-Seated Gate Valves for Water Supply Service
AWWA C515	(2015) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C517	(2009) Resilient-Seated Cast-Iron Eccentric Plug Valves
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	(2013) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA M23	(2002; 2nd Ed) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(2013) Pipe Threads, General Purpose (Inch)
ASME B16.1	(2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASTM INTERNATIONAL (ASTM)

ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C443	(2011) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C443M	(2012) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
ASTM C478	(2015a) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C478M	(2015a) Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D1785	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3753	(2012; E 2013) Glass-Fiber-Reinforced Polyester Manholes and Wetwells
ASTM D883	(2012; E 2016) Standard Terminology Relating to Plastics
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2016) Motors and Generators
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UNDERWRITERS LABORATORIES (UL)

UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 67	(2009; Reprint Dec 2016) UL Standard for Safety Panelboards

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

A. Product Data

Submersible Sewage Grinder nonclog Pumps

Pump Performance Curve

Pump Motor

Pump Control System

Wet Well and Valve Vault

Flexible Flanged Coupling

Station Piping and fittings

Valves

List of Spare Parts

B. Samples

Warranty

C. Design Data

Buoyancy Calculations

D. Operation and Maintenance Data

Submersible Sewage Grinder Nonclog Pumps Data Package 3

Submit in accordance with Section 01 78 10, Operation and Maintenance Data.

Include pumps, alarms, and motors. Include information on equipment, alarm panel and controls, pumps and pump performance curves, station layout, piping, valves and other accessories in data for submersible sewage grinder nonclog pump station.

1.3 MAINTENANCE MATERIAL SUBMITTALS

1.3.1 SPARE PARTS

Provide list of spare parts as recommended by the manufacturer of the packaged pump station.

1.4 QUALITY CONTROL

1.4.1 INSTALLER QUALIFICATIONS

Provide manufacturer's authorized pump representative who is trained and approved for installation of pumps and packaged pump station required for this project.

1.5 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.5.1 DELIVERY AND STORAGE

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials in enclosures or under protective covering. Rubber gaskets which are not to be installed immediately must be stored under cover, out of direct sunlight. Do not store materials directly on the ground. Keep interior of pipes and fittings free of dirt and debris.

1.5.2 HANDLING

Handle pipe, fittings, valves, and other accessories in such manner as to ensure delivery to the trench in sound, undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Carry pipe to the trench; do not drag it. Do not use any device or fitting inserted into (such as loader forks) or attached to (such as chain hooks) the bell or spigot ends of the pipe to transport pipe. Handle ductile iron pipe, fittings, and accessories in accordance with AWWA C600 and PVC pipe, fittings, and accessories in accordance with AWWA C605.

1.6 WARRANTY

Provide standard manufacturer's warranty for a minimum of one year for package pump station including pumps, controls, wet well basin and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Xylem, Inc. Flygt brands; 14125 South Bridge Circle Charlotte, NC 28273; Tel No. 704.409.9700; Web: www.ittwww.com
- B. ITT Water and Wastewater Flygt brand; www.ittwww.com
- C. DEZURIK/APCO/HILTON; 250 Riverside Avenue North Sartell, MN 56377; Tel No. 320-259-2000; web: www.dezurik.com
- D. Or GWA approved equal

2.2 SYSTEM DESCRIPTION

Provide a complete packaged sewage pump station with submersible grinder nonclog pumps complete including equipment and materials, installed and ready for operation. The pump supplier furnishes the controls, pumps and rail system to ensure unit integrity. The pre-engineered pump station package, including submersible pumps, pump control, fiberglass pump station, internal piping, accessories and auxiliary equipment shall be supplied by the pump supplier.

2.3 SUBMERSIBLE SEWAGE GRINDER NONCLOG PUMPS

Provide submersible sewage nonclog pumps with grinder units as indicated. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two (stainless steel, galvanized steel) guide pipes extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor. Provide UL listed pumps for explosion proof Class 1, Division 1, Groups C and D hazardous locations. Provide submersible, centrifugal sewage pumps and grinder units capable of grinding the materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, animal hair and wooden articles into a finely ground slurry with particle dimensions no greater than 6 mm or 1/4 inch of the non-clogging type with passageways designed to pass 75 mm (3 inch) diameter spheres without clogging. Provide pump capacity, number of pumps and motor characteristics as indicated on the drawings. Select pumps to continuously operate in a submerged or partially submerged condition.

2.3.1 CASING

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

Provide hard, close-grained cast iron casing which is free from blow holes, porosity, hard spots, shrinkage defects, cracks, and other injurious defects. Provide casings permitting replacement of wearing parts. Ensure passageways permit smooth flow of sewage and are free of sharp turns and projections. Use free standing pump support legs of cast-iron providing enough clearance for the solids to get into the grinder.

2.3.2 IMPELLER

The impeller shall be of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on a replaceable insert ring.

The impeller shall have vanes hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. The impeller shall be capable of momentarily moving axially upwards a distance of 5mm/0.6-in. to allow larger debris to pass through and immediately return to normal operating position.

2.3.2.1 Pump Impeller / Volute for N – type Pumps

The impeller(s) shall be of (gray cast iron, Class 35B / high chrome iron), dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction which shall keep them clear of debris, maintaining an unobstructed leading edge. The impeller(s) vanes shall have screw-shaped leading edges. The leading edges of the cast iron impellers shall be hardened to Rc 45. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. Impellers shall be locked to the shaft, held by an impeller bolt and treated with a corrosion inhibitor.

The pump volute shall be of A48 Class 35B gray cast iron and shall have a (cast iron / high chrome iron) replaceable ring having spiral shaped cast groove(s) at the suction of the volute. The internal insert ring shall provide effective sealing between the pump volute and the multi-vane, semi-open impeller. The sharp spiral groove(s) shall provide the shearing edge(s) across which each impeller vane leading edge shall cross during its rotation in order to remain unobstructed. The clearance between the internal volute bottom and the impeller leading edges shall be adjustable.

2.3.3 SHAFT AND SHAFT SEALS

Provide shaft of stainless steel and the mechanical seal of double carbon and ceramic construction. Hold rotating ceramics in mating position with stationary carbons by a stainless steel spring. Oil lubricate bearings.

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T.

The use of stainless steel sleeves will not be considered equal to stainless steel shafts as shaft sleeves only protect the shaft around the lower mechanical seal.

2.3.4 BEARINGS

Provide heavy duty ball thrust bearing or roller type bearing sized to withstand imposed loads. Oil lubricate bearings.

2.4 PUMP MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque,

current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

Provide hermetically sealed electric motors with moisture and temperature-sensing probes in the wet well NEMA MG 1 of the RPM, voltage, phase indicated in the plans and 60 Hz cycle for submersible pumps. Motor horsepower must not be less than pump horsepower at any point on the pump performance curve. Fit motors with lifting "eyes" capable of supporting entire weight of pump and motor. Seal the power cable inside the motor end bell. Provide a waterproof power cable for its full length. Motors shall be UL listed for explosion proof Class 1, Division 1, Groups C and D. Air filled motors are not acceptable. Oil used must be able to be disposed as non-hazardous waste.

2.4.1 MOTOR PROTECTION

All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.

A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.

The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS monitoring unit shall be designed to be mounted in any control panel.

2.4.2 CABLE ENTRY

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist 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 the cable. The assembly shall provide ease of changing the cable when necessary using the

same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.4.3. MOTOR COOLING SYSTEM

Pumps with motors up to 10-hp shall be sufficiently convection-cooled by the surrounding environment or pumped media.

Pumps with motors of 12-hp and greater shall be equipped with an integral motor cooling jacket of either an open type or closed-loop type.

2.4.4. BEARINGS

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

2.4.5. SUMP MIXING VALVE

One pump unit in each TOP pump station shall be equipped with an automatically operating Mix-flush Valve mounted directly to a machined boss located on the exterior of the pump volute casting that will provide mixing action within the sump at the start of the pumping cycle. The valve shall redirect a portion of the pumped media into the sump to re-suspend solids and grease by the turbulent action of its discharge.

The valve shall be equipped with an adjustable, wear-resistant discharge nozzle that can be used to direct flow within the sump. The valve shall operate by differential pressure across the valve and shall to require any electric or pneumatic power source to operate. The valve shall be suitable for use in Class I, Division 1 hazardous locations.

The valve shall open at the beginning of each pumping cycle and shall automatically close during the pump operation after a pre-set time. A method of adjusting the valve operating time shall be provided.

2.4.6. PUMP MECHANICAL SEAL

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant, tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant, tungsten-carbide seal ring. Each seal interface shall be held in contact by its

own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For unique applications, other seal face materials shall be available.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to affect sealing shall be used.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate non-submerged without damage while pumping under load.

Seal lubricant shall be non-toxic and FDA Approved.

2.5 PUMP CONTROL SYSTEM

Refer to Division 40 – Process Integration, for general component identification and support requirements to provide pump control and monitoring requirements.

2.5.1 CONTROLS

Automatically alternate operation from one pump to the other and start second pump in the event first pump cannot handle incoming flow. Provide manual "on-off" switch for each pump.

Provide independent adjustable high and low water level switches.

Provide level control system, supports, and alarm. Metal parts, if used, must be of bronze or equivalent corrosion resistant material.

2.5.2 LEVEL CONTROL SYSTEM

Provide a sealed, mercury-free float switch control system to sense variations of sewage level in the wet well.

Use a direct acting float switch consisting of a normally-open mercury switch enclosed in a float. Use float molded of rigid high-density polyurethane foam, color-coded and coated with a durable, water and corrosion-resistant jacket of clear urethane.

Provide stainless steel float brackets in accordance with manufacturer's recommendations.

Mount floats at fixed elevations as shown on the drawings.

Use floats designed to tilt and operate their switches causing sequential turn-on turn-off of the pump, when the liquid level being sensed rises or falls past the float.

Float switches must be intrinsically safe relays. Provide an intrinsically safe barrier relay between the wet well and the control panel.

Provide the pump station with a submersible pressure type level sensor and an electronic pump controller. Sense levels by a 24 VDC, 1 percent submersible pressure transmitter provided by controller manufacturer. Construct the system as follows:

- a. The pressure type level sensor is a submersible type, suspended on its cable.
- b. Install the sensor per manufacturer's instructions for wet well installations, including any recommended mounting accessories, NEMA 4X connection pull box, Zener barrier, etc.
- c. The level sensor is as follows:
 - (1) Select the sensor range based on the wet well depth.
 - (2) The sensor output is 4-20mA proportional to water level, 2-wire type.
 - (3) Construct all exposed parts of 316 Stainless Steel.
 - (4) Fill the sensor with Silicon Oil.
 - (5) Power the Sensor by 24 VDC output from electronic pump controller.
 - (6) Level sensor /transmitter shall be MJK Expert Model 3400 or approved equal with 80 feet of cable.
- d. Mount the electronic pump controller in the starter panel enclosure, and be visible from the front of the swing-out panel, with the enclosure door opened. The electronic pump controller is as follows:
 - (1) Accept a 4-20 mA, 2 wire level signal, and indicate the wet well level digitally in english units in feet.
 - (2) Provide pump control outputs, with independent adjustment for each pump starting and stopping setpoint. Indicate each level setpoint digitally in direct engineering units.
 - (3) Power to the unit is 120 VAC.
 - (4) Equip controller with hand/off/auto (H.O.A.) switches and pump on indicating lights (one each per pump).

Provide an intrinsically safe barrier relay between the wet well and the control panel.

2.5.3 ALTERNATOR

Provide an alternator control switch, with manual disconnect switch, to operate in connection with level control system. Use alternator control switch to alternate the operation of the pumps and operate both pumps if the water level rises above the

second high water level. Provide a 30 second time delay to prevent both pumps from starting together. Use delay function designed to operate in any condition of start-up in either normal or emergency operational mode.

2.5.4 SEWAGE PUMP ALARM AND CONTROL PANEL

Enclose alarm panel in NEMA 4X enclosure and with a flashing red light that is visible from 15 m (50 feet) away, with long life bulb in guarded enclosure and 150 mm (6 inch) diameter horn. Use horns capable of emitting 120 DB at 3 meters (10 feet). Power alarm horn and light from 12V DC power supply with battery backup. Provide a rechargeable battery rated to power both the horn and light for a minimum of two hours upon loss of main power. Provide circuitry to automatically recharge the battery after main power is restored. Use batteries capable of being fully recharged in no more than 20 hours. Use panel with power on light, push to test button for horn and light and push to silence button for horn and light with automatic reset for next alarm.

2.5.5 AUTOMATIC DIALING ALARM MONITOR (CELLULAR AUTODIALER)

The Pump Controller shall have an integrated cellular autodialer with backup power supply.

- A. The autodialer shall be a microprocessor-based system that shall sense at least two alarm conditions. In addition, power failure shall be sensed internally and shall not require using one of the fault channels. Upon detection of any of the fault conditions or power failure, the unit shall commence dialing the first of eight user selected phone numbers and deliver a message describing the actual alarm conditions.
- B. Alarm notification can be directed to a standard or cellular telephone, a pager, or to an answering machine.
- C. The autodialer shall be configurable locally or remotely.
- D. The autodialer shall have at least one relay contact to silence the high level alarm horn. Autodialer shall be configured to silence the horn, upon alarm acknowledgement by operations personnel.
- E. This message shall be delivered in an electronic digitized voice, utilizing the user's own digitally recorded voice.
- F. The unit shall continue to call the phone numbers in succession until acknowledged by calling the unit back or by depressing a touch-tone key. Once acknowledged, the unit shall enter a programmable delay to allow the alarm condition to be attended to before beginning notification again.
- G. All communications shall utilize GSM cellular phone provided by manufacturer.

- H. Contractor shall provide cellular dialing unit (phone), sim card, and one year of prepaid service by cellular service provider starting from date of project acceptance.
- I. The system shall be DiaLog Scout with integrated cellphone, or equal.

2.5.5.1 Alarms

Provide a test function ability for the alarm system. Provide alarms to activate under the following conditions:

- a. High liquid level as sensed by the level control system.
- b. Loss of main power.
- c. No flow light as sensed by limit switch on the check valve or as sensed by current sensors.
- d. Pump failure via temperature overload or motor heat sensor trip; provide motor high temperature light.
- e. Seal failure with indication light.

2.5.5.2 Circuit Breakers

- a. Provide an individual circuit breaker for each pump.
- b. Include a control circuit breaker and an alarm circuit breaker in the control panel.
- c. Allow for two additional spare 115V single phase 20A circuit breakers for local pole lighting and future spare.
- d. Provide circuit breakers in accordance with UL 489
- e. Conform to UL 67 for circuit breaker mounting.

2.5.5.3 Motor Starter and Overload Protection

Provide an International Electrotechnical Commission (IEC) rated motor starter and thermal overload protection located in the control panel for each pump. Include undervoltage release, manual reset buttons and hand-automatic selector switches.

2.5.5.4 Power Lugs

- a. Size the incoming power lugs for the proper voltage, amperage, and horsepower for each pump station.
- b. Include grounding lugs for the incoming power. Provide a dedicated grounding lug in the control panel for each pump.
- c. Size ground lug and rod according to local and base electrical codes and install by a licensed electrician.
- d. Use UL listed power lugs.
- e. Conform to UL 67 for required power lug mounting.

2.5.5.5 Anti-Condensation Heater

- a. Provide an anti-condensation heater in the control panel that is sized based upon the size of the particular pump station's control panel size.
- b. Power the heater from the control voltage transformer for three phase pump motor units and from the incoming power for single phase pump motor units.
- c. Control the heater by a thermostat, coming on at 16 degree C (50 degree F) and going off at 18 degree C (65 degree F).
- d. Clearly label panel directory for breakers.

2.5.5.6 Trouble Light

Provide a fluorescent trouble shooting light in the panel that is hard-wired into an appropriately sized circuit breaker. It is acceptable for the light and one of the convenience outlets to share the same circuit breaker.

2.5.5.7 Convenience Outlets

- a. Place two duplex convenience outlets in the control panel; utilize one for the battery charger. The battery receives power from the control voltage transformer via the alarm fuse.
- b. Upsize the alarm fuse to 1 to 1.5 amps for the battery charger.
- c. Provide each outlet with its own 20 amp 115/1/60 circuit breaker.

2.5.5.8 Connection for Portable Generator

Provide receptacle for connection for portable generator. Provide manual transfer switch for receptacle matching generator electrical power requirements.

2.5.5.9 Additional Requirements

- a. Provide elapsed time meter for each pump that measures run time in hours to 9999.9.
- b. Do not place junction boxes between pumps, control systems and control panels; provide conduit seals at all wet well penetrations. If this is unavoidable, use NEMA 7 construction.

2.5.6 ELECTRICAL REQUIREMENTS

Install labels to identify switches and controls. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field installed equipment.

2.5.7 INSTRUMENTATION AND CONTROL SYSTEM

Provide a pump control and monitoring system for a pump station specified in Section 40 00 10.

2.6 WET WELL AND VALVE VAULT

2.6.1 WET WELL AND VALVE VAULT

Provide pre-engineered fiberglass reinforced polyester wet well; include a separate concrete valve box. Provide wet well with inside diameters and to the depths indicated on the drawings.

2.6.1.1 Fiberglass Wet Well

Provide as indicated and specified in Section 33 32 13.

2.6.1.2 Cast-in-Place Concrete Valve Box

- a. Construct cast-in-place valve box in accordance with ASTM C478, except as specified herein. Provide cast-in-place concrete structures with a compressive strength of 3,000 psi at 28 days and an air entrainment of 6 percent, plus or minus 2 percent, and a minimum wall thickness of 8 inches. ASTM A615 reinforcing bars. ASTM C443, Type B gaskets for joint connections. Use monolithic base and first riser.

2.7 STATION PIPING

Provide pressure piping, emergency pump connection, air release valves, and related accessories for force main piping outside the sewage wet well and valve vault in accordance with Section 33 30 00, Sanitary Sewers.

2.7.1 DUCTILE-IRON PRESSURE PIPE AND ASSOCIATED FITTINGS

AWWA C151/A21.51, Pressure Class 350.

2.7.1.1 Flanged Pipe

AWWA C115/A21.15, ductile iron.

2.7.1.2 Fittings

AWWA C110/A21.10, flanged. Provide flanged joint fittings within wet well and valve vault as indicated. Provide mechanical joint fittings outside valve vault enclosure as indicated. Use fittings with pressure rating at least equivalent to that of the pipe.

2.7.1.3 Joints

AWWA C115/A21.15 for flanged joints. Use bolts, nuts, and gaskets for flanged connections recommended in the Appendix to AWWA C115/A21.15. Provide ductile iron flange for setscrewed flanges in accordance with ASTM A536, Grade 70-50-05 or 60-42-10, and meeting the applicable requirements of ASME B16.1, Class 125. Use 1310 MPa (190,000 psi) tensile strength, heat treated, and zinc-coated steel setscrews for setscrewed flanges. Conform to the applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11 for setscrewed flange gaskets. Use setscrewed gasket designed to provide for confinement and compression of gasket when joint to adjoining flange is made.

2.7.2 PVC PLASTIC PRESSURE PIPE AND ASSOCIATED FITTINGS

2.7.2.1 Pipe and Fittings Less Than 100 mm (4 inch) Diameter

Use pipe, couplings and fittings manufactured of materials conforming to ASTM D1784, Class 12454-B.

- a. Screw-Joint: Follow dimensional requirements of ASTM D1785 Schedule 80 pipe, with joints meeting requirements of 1.03 MPa (150 psi) working pressure, 1.38 MPa (200 psi) hydrostatic test pressure, unless otherwise shown or specified. Follow ASTM D2464 and ASME B1.20.1 for use with Schedule 80 threaded pipe and fittings. Test pipe couplings when used, as required by ASTM D2464.
- b. Push-On Joint: ASTM D3139, with ASTM F477 gaskets. Fittings for push-on joints: AWWA C110/A21.10 or AWWA C111/A21.11. Iron fittings and specials: cement-mortar lined (standard thickness) in accordance with AWWA C104/A21.4.
- c. Solvent Cement Joint: Use pipe that matches the dimensional requirements of ASTM D1785 or ASTM D2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Use fittings

for solvent cement jointing that match the requirements of ASTM D2466 or ASTM D2467.

2.7.3 INSULATING JOINTS

Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling to effectively prevent metal-to-metal contact between adjacent sections of piping.

2.7.4 ACCESSORIES

Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

2.7.5 FLEXIBLE FLANGED COUPLING

Provide flexible flanged coupling determined by previous service to be acceptable for use in the wastewater environment for sewage as indicated. Use flexible flanged coupling designed for a working pressure of 2.41 MPa (350 psi).

2.8 VALVES AND OTHER PIPING ACCESSORIES

2.8.1 ISOLATION VALVES IN VALVE VAULT

Provide valves that open by counterclockwise rotation of the valve stem. Use valves from one manufacturer.

2.8.1.1 Valves Larger Than 50mm (2 Inches)

Resilient seat gate valves conforming to AWWA C509 with non-rising stems and flanged ends.

Resilient seat eccentric plug valves conforming to AWWA C517 with operating handle and flanged ends.

2.8.2 RUBBER FLAPPER SWING CHECK VALVE

- A. The Series 100 Rubber Flapper Swing Check Valve shall have a heavily constructed cast or ductile iron body and cover. The body shall be long pattern design (not wafer) with integrally cast-on end flanges. The flapper shall be Buna-N having an O-ring seating edge and be internally reinforced with steel.

Flapper to be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position. Flapper shall be easily removed without the need to remove the valve from line. Check valves to have full pipe size flow area. Seating surface to be on a 45° angle requiring the flapper to travel only 35° from closed to full open position for minimum head loss, and non-slam closure characteristic.

Buna-N flapper which creates an elastic spring effect to assist the flapper to close against a slight head to prevent or minimize slamming.

Valve designed for 175 psi differential pressure for water, sewage, oil or gas (higher pressures available). The valve shall be suitable for buried service, in which case, stainless cover bolts must be furnished.

Provide external backflow device sizes 3" (80 mm) and larger to prime or backflush a clogged pump.

Body & Cover	Cast iron	ASTM A126 GR.B
Flapper	Buna-N or other elastomers	FDA approved for potable water contact
Exterior paint	Universal Metal Primer	

- B. An inductive type proximity switch can be mounted on the valve body with its target mounted internally on the flapper. The switch transmit an electrical signal indicating when flapper is fully closed.

2.8.3 IDENTIFICATION TAGS AND PLATES

Provide valves with tags or plates numbered and stamped for their usage. Use plates and tags of brass or nonferrous material and mounted or attached to the valve.

2.8.4 PIPE SUPPORT

Use pipe support schedule 40 galvanized steel piping matching ASTM A53/A53M. Provide either ASME B16.3 or ASME B16.11 galvanized threaded fittings.

2.8.5 MISCELLANEOUS METALS

Use stainless steel bolts, nuts, washers, anchors, and supports for installation of equipment.

2.8.6 QUICK DISCONNECT SYSTEM WITH HYDRAULIC SEALING FLANGE AND RAIL SYSTEM

Use quick disconnect system consisting of a steel base plate for supporting the pumps, a hydraulic sealing flange, pump guide rails and the discharge pipe supports. Provide stainless steel guide rails, brackets and lifting chain for raising and lowering the pump in the basin. Build guides onto pump housing to fit the guide post to assure perfect alignment between pump and guide rails.

2.8.7 WET WELL VENT

Flanged ductile iron pipe and bend, AWWA C115/A21.15.

2.9 EXCAVATION, TRENCHING, AND BACKFILLING

Provide in accordance with Sections for EARTHWORK and EXCAVATION AND FILL], except as specified herein.

PART 3 - EXECUTION

3.1 INSTALLATION

Provide pump station in accordance with drawings and requirements of the respective equipment manufacturers. Dampen and isolate equipment vibration.

3.1.1 EQUIPMENT INSTALLATION

- A. Install equipment in accordance with these specifications and the manufacturer's installation instructions. Grout equipment mounted on concrete foundations before installing piping. Install piping to avoid imposing stress on equipment. Match flanges before securing bolts.
- B. Safety Net: Install lightweight Hatch Safety Net per manufacturer's installation instructions. Safety net shall be designed to be permanently installed and easily retractable in hatch openings. When closed, the net system shall allow people to move freely around hatch opening without danger of falling into the opening. Hatch Safety Net shall allow visibility for inspections and accessibility for limited maintenance and float adjustments. When entry/exit is required, the net can be easily unhooked on all but one side of the opening to facilitate full access to the confined space.

3.1.2 INSTALLATION OF DUCTILE-IRON PRESSURE PIPE AND FITTINGS

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES of Section 33 30 00

SANITARY SEWERS, and with the requirements of AWWA C600 for pipe installation, joint assembly, and valve-and-fitting installation.

Make flanged joint with gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight, avoid strain on flanges, fittings, and other accessories. Align bolt holes for each flanged joint. Use bolts sized for the bolt holes; use of undersized bolts is not permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange.

3.1.3 INSTALLATION OF PVC PLASTIC PRESSURE PIPE AND FITTINGS

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES of Section 33 30 00 SANITARY SEWERS, with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, "Installation."

3.1.3.1 Pipe Less than 100 mm (4 Inch) Diameter:

- a. Make threaded joints by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. Tighten joints with strap wrenches that will not damage the pipe and fittings. Do not tighten joint more than 2 threads past hand-tight.
- b. Push-On Joints: Bevel ends of pipe for push-on joints to facilitate assembly. Mark pipe to indicate when the pipe is fully seated. Lubricate gasket to prevent displacement. Ensure that the gasket remains in position in the bell or coupling while making the joint.
- c. Solvent-weld joints: Comply with the manufacturer's instructions.

3.1.4 VALVES

Installation of Valves: Install valves in accordance with manufacturer's installation instructions. Install gate valves as described in AWWA C500, AWWA C509, and AWWA C515 and with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install check valves as described in AWWA C600 for valve-and-fitting installation. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.

3.1.5 FORCE MAIN

Provide force main and connections in accordance with Section 33 30 00 SANITARY SEWERS.

3.2 FIELD TESTS AND INSPECTIONS

3.2.1 TESTING PROCEDURE

Test piping in accordance with Section 33 30 00 SANITARY SEWERS. Test in operation all equipment to demonstrate compliance with the Contract requirements.

3.2.2 SEWAGE PUMP STATION

Test pumps and controls, in operation and in accordance with the authority having jurisdiction over sewage pumping stations, under design conditions to ensure operation of equipment. Provide appliances, materials, water, and equipment for testing, and bear full expenses in connection with the testing. Conduct testing after equipment is installed, electrical services and piping are installed, liquid is flowing, and the pump station is ready for operation. Correct defects discovered to the satisfaction of the Contracting Officer, and tests repeated, at the expense of the Contractor, until the equipment functions as intended and designed.

3.2.3 STANDARD PUMP FACTORY TEST

Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer's plant prior to shipment;

- A. Minimum 3-point hydraulic performance test
- B. No-Leak seal integrity test
- C. Electrical integrity test

3.3.4 FIELD START-UP AND MANUFACTURER FIELD SERVICE

After installation, a pump station start-up shall be performed by the installing contractor under the supervision of the manufacturer's authorized representative. Additionally, field service shall be provided by an authorized, factory trained representative of the pump manufacturer. Services shall include, but not be limited to, inspection of the completed pump station installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, supervision of all field-testing and activation of the Pump Manufacturer's Warranty. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

END OF SECTION

SECTION 40 00 10

INSTRUMENTATION AND CONTROL SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. It is the intent of this specification to provide a pump control and monitoring system for a pump station. All components specified or required for a complete, operable system shall be included.

1.2 DEFINITION

LCD: Liquid Crystal Display
LED: Light Emitting Diode
COM: Communications
LAN: Local Area Network
PVC: Poly Vinyl Chloride
CMF: Central Monitoring Facility

1.3 SUBMITTALS

- A. Product Data for monitoring and control equipment shall include physical dimensions and data on features, components, ratings, and performance. Include wiring diagram and elevation views of the front display panel/keypad where applicable.
- B. Shop Drawings detailing dimensions, components, location and identification of field connections, arrangement of components and operational characteristics.
- C. Wiring diagrams detailing the installation of the equipment and differentiating between factory installed and field-installed wiring.

1.4 QUALITY ASSURANCE

- A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labelled by UL where applicable.
- B. Listing and Labelling: Provide products specified in this Section that are listed and labelled.
 - 1. The Terms "Listed" and "Labelled": As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labelling Agency Qualifications: A "Nationally Recognized Testing Laboratory: (NRTL) as defined in OSHA Regulation 1910.7.

1.5 WARRANTY

- A. Warranty Period: Two (2) years from the date of Substantial completion and acceptance unless otherwise indicated in other sections of this specification.

PART 2 PRODUCTS

2.1 MANUFACTURER

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:

- A. Pump Control Equipment:
 - 1. Multitrode
 - 2. Flygt
 - 3. OR GWA Approved equal
- B. The pump controller shall be Multitrode Multismart Model MSU3PC2, MSU3MP2 or GWA approved equal.

2.2 PUMP CONTROL EQUIPMENT

The pump controller shall provide user ready automatic control of pumps with an intuitive HMI interface. The pump controller shall contain pre-designed operational parameters that are selected and configured via the user interface (HMI). The minimum features available in the pump controller shall include:

- A. Pump control of up to 6 pumps; including pump grouping and pump alternation.
- B. Intelligent Hand-Off-Auto Control:
 - 1. Hand mode (semi-automatic, non-maintained manual mode), the pump switches off at the deactivation set point and then resets to Auto mode for the next pump run cycle.
 - 2. Hand mode (fully manual, maintained mode). To pump beyond the off (deactivation) set point, the Hand-Off-Auto button must be held down by the user for failsafe control.
- C. Level set point adjustment for pump activation, deactivation and station level alarms.
- D. Level device input capability shall include: 4-20mA analog signal, conductive probe or floats.
- E. Redundant level device input capability with automatic input fault control (input device switching).
- F. Selectable charge (fill) or discharge (empty) modes.
- G. Pre-configured station optimization features shall include:
 - 1. Maximum pump off time

2. Maximum pumps to run
3. Maximum starts per hour
4. Inter-pump start and stop time delays
5. Maximum pump run time
6. Blocked pump detection
7. Well washer control capability
8. Well clean out control capability
9. Pump operation control (profile programming) capability
- H. "Locked level" alarm function to indicate a level device fault.
 1. User-defined % change within a specified time period
 2. Different set point values for low use or high use time periods (user defined)
- I. Pump alternation modes shall include:
 1. Fixed lead pump assignment
 2. Normal alternation
 3. User defined alternation using N:1 ratio
 4. Run most efficient pump using N:1 ratio
 5. Alternation by the number of hours run or the number of starts within a specified time period
- J. Pump decommissioning modes shall include:
 1. Decommissioned pump is automatically removed from the pump controller.
 2. Internal remote monitoring data tag shall flag the decommissioned status of a pump
- K. Up to (6) unique user defined profiles of set points shall be available to control pumps during specific site conditions or events. Features shall include:
 1. Automatic profile change based on date and time
 2. Profile selection option from SCADA (remote control), digital input, logic tag or local display HMI
- L. A datalogger for user-defined faults and events shall include:
 1. Recording of up to 50,000 events to internal flash memory
 2. Download capability of up to 10,000,000 events by writing directly to an SD card or USB
 3. FTP data transfer and download data capability of event and fault logs in the form of a (csv) file for Microsoft Excel analysis
- M. 3-phase supply voltage monitoring and supply fault management for the following conditions:
 1. Under-voltage
 2. Over-voltage
 3. Phase fail
 4. Phase rotation
- N. Monitoring of dc power supply, battery voltage, and internal controller temperature
- O. Energy, power and pump efficiency monitoring: (Available on Multismart Model# MSU3MP2)
 1. kW, kVA, power factor, kWhr, KVAH calculation for each pump
 2. pump efficiency calculation (gallons per kWhr) for each pump

- P. Motor protection features: (Available on Multismart Model# MSU3MP2)
 - 1. 3-phase current monitoring for each pump
 - 2. Over- and under-current trip
 - 3. Ground/earth fault
 - 4. Current phase imbalance fault
 - 5. I2T fault
 - 6. Insulation resistance testing for motor windings
- Q. Flow measurement: (when enabled with software key)
 - 1. Calculated flow via liquid level draw down data
- R. VFD speed control capability. (when enabled with software key)
- S. Fault module capability as follows:
 - 1. Pump hold out function
 - 2. Automatic restart function after fault condition is no longer present
 - 3. Manual reset of fault required (if user intervention of fault reset is selected)
- T. Remote control via remote telemetry monitoring to include the following: (when enabled with software key)
 - 1. Changing the mode of pumps (hand/off/auto operations)
 - 2. Reset of pump faults and station faults
 - 3. Changing pump and alarm set points
 - 4. Changing operational profiles
- U. Security
 - 1. User defined password management for access to programming areas in the controller
 - 2. Automatic data logging of personnel who have entered the programming areas
 - 3. Automatic logging of all unsuccessful login attempts with a date and time stamp
 - 4. Digital input option for controlled access to programming areas
- V. SD and USB type access ports shall be available for the following operations:
 - 1. Firmware upgrades
 - 2. Save and load pump controller configuration
 - 3. Download data logs
 - 4. Export or import MODBUS and DNP3 points list

2.2.1 ADVANCE PROGRAMMING FUNCTIONS

The pump controller shall have the option of interfacing with IEC61131-3 and IEC61499 compliant PLC programming languages to enhance functionality or interact with the pump controller. The pump controller shall have the option of using a simple logic engine to enhance functionality or interact with the pump controller.

2.2.2 INPUT/OUTPUT CHARACTERISTICS

The pump controller inputs and outputs shall be modular and shall be expandable. Available I/O types shall include:

- A. Digital inputs (voltage free input), also configure as counters

- B. Digital outputs (240V, 5A resistive)
- C. Analog inputs (10 bit)
- D. Analog outputs (10 bit)

2.2.3 USER DEFINED DIGITAL INPUTS

Digital Inputs shall be configurable based on specific pump sensor arrangements:

- A. Seal sensor (conductive)
- B. PTC Thermistor
- C. Flygt FLS &CLS
- D. Conductive probe (for liquid level sensing)

2.2.4 DEDICATED PUMP MONITORING INPUTS (AVAILABLE ON MULTISMART MODEL#MSU3MP2)

The pump controller shall provide support for the following pump monitoring inputs:

- A. Insulation resistance test (IRT) with user selectable test voltage up to 1000 VDC.
- B. 3-phase current monitoring, derived from external current transformer devices with a 0.5% input resolution tolerance.

2.2.5 DUOPROBE LEVEL DEVICE SUPPORT

The pump controller shall have an internal atmospheric pressure sensor to allow for atmospheric pressure sensing and signal correction when used in conjunction with the Multitrode Duoprobe pressure transducer level sensing device.

2.2.6 USER INTERFACE

The pump controller shall include a graphical user interface (HMI) display for configuration settings, control operations and advance programming. The following display characteristics shall be provide:

- A. Status indication

The following parameters shall be display on the main screen:

- Liquid level in percentage, meters, feet or other custom defined units
- Set points for pump control and alarms
- Pump status (running or stopped)
- Pump availability
- Pump fault indication
- 3-phase voltage supply values
- Date and time indication
- User configurable options to display pump information and station status

B. Information Screens

The following parameters shall be available via a user key press from the main screen:

1. Hours Run accumulators for each pump and the pump station with the following information:
 - minutes run for last pump cycle
 - total minutes (hourly)
 - total hours today, total hours yesterday
 - total hours this week, total hours last week
 - total accumulated hours
2. Pump Start accumulators for each pump & the station with the following comparisons
 - pump starts this hour, pump starts last hour
 - pump starts today, pump starts yesterday
 - pump starts this week, pump starts last week
 - total accumulated pump starts
3. Flow values (when enabled with software key)
 - station inflow rate
 - pump flow rate
 - total station volume
 - overflow data (including overflow start time, duration, estimated volume)
4. Power and Efficiency (Available on Multismart Model# MSU3MP2)
 - pump efficiency in gallons or litres per KWHr - or KVAh
 - power in kW, KVA
 - power factor
 - energy accumulators per pump in KWHr and KVAH
5. Insulation resistance value for each pump motor in (Ohms) (Available on Multismart Model# MSU3MP2)
6. I/O Status
 - Digital I/O status and accumulated values
 - Analog I/O status and values in (mA) or scaled values
 - 3-phase voltage, frequency, phase angle, power factor
7. Database viewer to review all statistics, data information and available tags in real time
8. Communications information and statistics

C. Control Functions

The pump controller display interface shall be capable of performing the following control operations:

1. Pump control mode for each pump (Hand-Off-Auto)

2. Pump fault reset
3. Level alarm reset

D. Fault screen

The main screen shall include a Fault button which takes the user to a Fault screen and allows them to check all current and unacknowledged alarms. The fault screen will provide fault details along with a date and time stamp for each fault occurrence. A fault reset option shall be presented to the user when alarms can be acknowledged or reset.

E. History Screen

The main screen shall include a History button which takes the user to a History screen which allows them to view the following information:

1. Viewing of all faults and events
2. Information filtering capability

F. Configuration screens

The user configuration screens shall provide capability to change pump control settings as follows:

1. Set up Wizard function to configure the pump controller settings by user input to specific questions.
2. Set point programming of alarms and pump activation/deactivation.
3. Enable or disable alarms.
4. Set alternation mode for pumps.
5. Configure I/O as follows:
 - Assign primary/backup level to any input, e.g. 4-20mA or conductive probe
 - Assign pre-defined or user-defined faults to any digital input
 - Zero and span analog inputs
 - Configure digital output source
 - Configure analog output source
6. Configure faults as follows:
 - display the fault to the local screen only
 - manual reset (local) or remote reset operation before pump becomes available
 - auto-restart (after fault condition clears) with configurable restart time
 - auto-restart user-selectable number of times within time window before locking out
 - customized text for fault and event name
7. Configure station optimization parameters

8. Configure supply protection
 - Under and over voltage alarm points
 - Volts phase imbalance and volts phase rotation set points
 - DC supply alarm set point
9. Configure motor protection (Available on Multismart Model#MSU3MP2)
 - Under current set points
 - Over current set points
 - Ground/earth fault set points
 - Phase failure set points
10. Configure communications ports, speeds and addresses.

2.2.7 CONFIGURATION PROGRAM BACKUP, RESTORE, AND FIRMWARE UPGRADES

The pump controller configuration interface shall allow the user to save and restore pump controller configurations onto a portable SD card or USB storage device. The pump controller shall allow for the import of DNP3 and Modbus point lists and custom logic scripts via the SD or USB ports. The pump controller configuration interface shall allow the user to backup system log files, alarm and event log files, and custom scripts via the SD or USB ports. Firmware upgrades shall be possible by using a firmware upgrade file on a portable SD card or USB storage device.

2.2.8 COMMUNICATIONS

A. Physical

The pump controller shall include the following data communication ports:

1. (2) Ethernet ports (10Mbit/s)
2. (2) RS232 ports (115kBit/s)
3. (2) RS485 ports (115kBit/s)
4. (1) USB device port
5. (1) SD card port

B. Communication Types

The pump controller shall support the following communication types:

1. TCP/IP
2. UDP
3. RS232
4. RS485
5. Private radio over RS232
6. PSTN
7. Wireless LAN
8. Cellular data

9. Cellular voice

C. Communication Protocols (Available with software key)

The pump controller shall support DNP3 (master & slave, level 2 compliant), including:

1. Change of state reporting
2. Native date/time and quality stamps for each data point
3. Event buffering for different classes of data
4. Support for multiple masters and slaves to be configured on the unit
5. DNP Security (for securing communications between master station and RTU)

The pump controller shall support Modbus (master & slave) including:

1. Modbus TCP
2. Modbus RTU
3. Modbus ASCII
4. Support for multiple masters and slaves

D. Performance and Environmental Characteristics

The pump controller shall meet the following performance and environmental characteristics:

1. Central Processing Unit Speed: 566MHz
2. Central Processing Unit RAM Size: 256MByte
3. Central Processing Unit Flash Memory Size: 64MByte
4. Real Time Clock
5. Working temperature -10°C to +60°C
6. Storage temperature -40°C to +90°C
7. Humidity 5% to 95% (non-condensing)
8. IP Rating Controller Base Unit: IP20, NEMA 1
9. I. Display Interface IP65, NEMA 4

E. Warranty

The pump controller shall be provided with a 5 years limited Manufacturer's warranty.

2.3 BACKUP CONTROLLER SYSTEM (LEVEL CONTROL RELAYS):

- 2.3.1 DESCRIPTION: The backup control system shall consist of one or more level sensing relays. The Backup Level Control Relays shall be Mutitrode MTR, MTRA, SAFE-TL or equal.

- 2.3.2 SPECIFICATION: The level sensing relays shall be supplied with the following specifications:
- A. The relay shall accept 2 or 3 level inputs from a conductive level probe or ball floats
 - B. All settings shall be dip switch programmable from the front panel shall be as follows:
 - 1. Conductive probe sensitivity adjustment.
 - 2. Activation Delays.
 - 3. Charge/Discharge selection. (MTR-3 model only)
 - 4. Alarm Delay. (MTRA-3 model only)
 - 5. Alarm Output Flashing/Steady. (MTRA-3 model only)
 - C. Mounting and Installation: DIN Rail or 2 x #6 screws Base Mount

2.4 LEVEL SENSING EQUIPMENT (CONDUCTIVE TYPE PROBE):

- 2.4.1 DESCRIPTION: A Multi-Stage Level Sensing Device designed to detect liquid level at specified intervals in tanks or sumps and interface with an electronic controller for pump control and liquid level display. The Level Sensing Equipment shall be a MultiTrode Probe or equal.
- 2.4.2 CONSTRUCTION: Where the level sensing technique utilizes a sensing device inserted into the liquid, all cavities within each sensor unit assembly shall be PVC injected to seal the unit and prevent any moisture from entering the sensor assembly. Where a sensor unit consists of a multi-sensored probe, each sensor on the probe shall be rotated 90 degrees horizontally from the previous sensor along the probe length to eliminate tracking between sensors. Level sensing probes shall be pressure injected with an epoxy resin at final assembly to encapsulate all internal components and connections, thereby creating a rigid, sealed, homogeneous unit.
- 2.4.3 CABLE: The flexible cable used for the Level Sensing Probe shall be comprised of PVC/PVC multi-conductor construction with a common oversheath that is water and oil resistant. The multi-conductor cable shall be identified with numbering and text along the entire length of the outer sheath at required intervals. Individual conductors of the multi-conductor cable shall be numbered and colored for easy identification, as well as connection to the pump controls.
Cables shall be secured to the top of probe bodies by synthetic rubber compression fittings for strain relief. Flexible cables shall be rated to physically support the combined weight of the level sensing probe and any suspended cable connected to the probe.
- 2.4.4 MOUNTING AND INSTALLATION: Mounting connections shall be stainless steel. The mounting assembly for probes shall include a device available to maintenance personnel to clean the level sensing probe at desired maintenance intervals.

2.4.5 FAILSAFE FUNCTIONALITY: Two wires shall be run across the length of the probe, one red and one black. Each wire shall connect to each other on the bottom of the probe. When used with a MultiSmart Pump Controller or Safe Smart Relay, the connection of these wires to the designated inputs on the controls will provide fail-safe functionality (monitoring for the probe).

2.5 CONTROL PANEL CONSTRUCTION & ASSEMBLY

2.5.1 Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:

A. Control Panel Equipment:

1. Multitrode
2. Square D
3. Products of other manufacturers assembled to provide all specified functions, including reliability equal to or exceeding that of the manufacturers listed above.

2.5.2 General Requirements:

- A. Control Panels shall be manufactured in accordance with ISO 9000-2001 specifications and shall be so constructed for the application of a UL Listing Label by an approved UL Control Panel Assembly Facility.
- B. All electrical connections shall be properly inspected and torqued in compliance with ISO specifications. External connections to the control panel shall be by way of numbered terminal blocks.
- C. Control Panels shall be properly checked and load tested with power applied. A control panel test log shall be supplied with the control panel.
- D. Control Panels shall be supplied from a UL approved control panel assembly facility with all of the required labels properly attached.

2.5.3 Control Panel Enclosure Environmental Rating:

- A. Control Panel Enclosure rating shall be specified in accordance with the project requirements or the contract drawings as either NEMA 3R, 12, 4 (Painted Steel) or 4X (Stainless Steel).

2.5.4 Control Panel Enclosure Specific Construction Requirements:

- A. Enclosure shall be sized according to physical and functional device requirements.
- B. Enclosure seams shall be continuously welded and ground smooth.
- C. Enclosure door opening flange trough shall exclude liquids and contaminants.

- D. Enclosure shall include an integral body grounding stud and sub-panel mounting studs.
- E. Enclosure shall be wall mounted, unless otherwise specified.
- F. Enclosure door shall have hidden hinges for a clean, aesthetic appearance.
- G. Enclosure door opening angle shall be standard, full access, 135 degree opening radius.
- H. Enclosure door shall be interchangeable and removable by pulling a captive hinge pin.
- I. Enclosure door shall have a high-impact thermoplastic data pocket mounted on the inner side of the enclosure door.
- J. Enclosure door shall have a seamless, foam-in-place, one-piece gasket to provide an oil-tight, dust-tight seal against contaminants.
- K. Enclosure shall have a three-point latching system with a zinc die-cast handle that is painted with black textured polyester powder paint.
- L. Enclosure handles shall be capable of being padlocked.
- M. Steel sub-panel shall be white.
- N. When enclosure cut-outs for instruments and other devices are required, holes shall be cut, punched, or drilled and finished with rounded edges.
- O. A door stiffener shall be used where applicable to prevent door deflection under instrument loading or operation.

2.5.5 Instrument Location Requirements:

- A. Instruments or control devices designated for sub-panel (back) mounting shall be located in a manner that will allow for maintenance and adjustment.
- B. Instrument mounting height shall not exceed 6'-6" to the top of the instrument and shall not be lower than 3'-0" to the bottom of the instrument (unless otherwise specified).

2.5.6 Wiring Requirements:

- A. Wiring for AC and DC control circuits shall be Type SIS or Type MTW stranded copper and shall be sized for the applied voltage and current. Unless otherwise noted, control circuit wiring shall not be smaller than No. 16 AWG.
- B. Cable wiring for analog signal circuits shall be twisted, shielded pairs of stranded copper conductors that shall not be smaller than No. 20 AWG.
- C. Wiring for special signalling equipment such as communications, digital data, and multiplexed signals shall be provided by the equipment supplier.
- D. Wiring shall be numbered and marked at each termination point.
- E. Terminal blocks for internal or external wiring shall be DIN rail mounted, individual screw compression type terminals with machine printed labels.

2.5.7 Nameplate Requirements:

- A. Nameplates are defined as inscribed, plastic plates mounted above or near a panel face mounted component. Unless otherwise noted, nameplates shall be engraved, rigid, laminated plastic with an adhesive back. Nameplate color shall be white with black letters.
- B. Component Labels are defined as printed, vinyl labels mounted above, below or near a sub-panel (back) mounted component for identification. Printed vinyl labels shall be white in color with black letters and an adhesive back.

2.5.8 Grounding:

- A. Control Panel enclosure shall be properly grounded in accordance with the National Electrical Code and local code requirements.
- B. Each analog signal loop shall only have its shield wire connected to ground at a single point for the loop. Shields shall be grounded at control panels where signals are input to the receiving device and not at the source of the transmitting device.

2.5.9 Electrical Transient (Surge) Protection:

- A. All electrical and electronic components of the Control Panel shall be protected against damage due to electrical transients induced in interconnecting lines from lightning discharges and surges in nearby electrical systems.
- B. The transient surge protector shall be rated for 25kA per phase or larger.

2.5.10 Circuit Breakers:

- A. Power Circuit Breakers shall be thermal magnetic type designed for AC current with a minimum interrupting capacity of 15,000 amperes.
- B. Control Circuit Breakers shall be in accordance with section UL 489 with a minimum interrupting capacity of 10,000 amperes.

2.5.11 Control Power Transformers:

- A. Control Power Transformers required to provide control system and accessory power shall be machine tool type control transformers with epoxy encapsulated coils or resin impregnated coils, high quality silicon steel laminations, copper magnet wire, moulded-in terminals and 55° C rise (Class 10 insulation system).

2.5.12 Voltage/Phase Monitor:

- A. The voltage-phase monitor shall continually measure the voltage of each of the three phases of the incoming power to the equipment and provide protection for three phase motors, as well as sensitive electronics, etc. The phase monitor shall sense the following conditions: under- and over-voltage, voltage unbalance, phase loss and phase reversal.

2.5.13 Control Relays:

- A. Control relays shall be square base type, 120VAC or 12VDC (based on design schematic).
- B. Control relays shall be 4PDT (4 Pole, Double Throw) with normally closed/normally open contacts rated at 120VAC, 5 amps minimum.
- C. Control relays shall include an integrated test button and relay energized flag indicator.

2.5.14 Full Voltage Magnetic Motor Controller:

- A. The motor controller shall be a NEMA rated, full voltage, non-reversing, across the line contactor and overload relay combination.
- B. The motor overload relay shall be an ambient compensated type with inverse-time-current characteristic and shall be provided with heaters or sensors in each phase matched to nameplate full load current of the specific motor to which it connects .

2.5.15 GFCI Convenience Receptacle:

- A. There shall be a 120VAC, 15 Amp GFCI rated convenience receptacle mounted on the dead front swing door of the control panel. Receptacle circuit shall be protected by a thermal magnetic circuit breaker.

2.5.16 Enclosure Condensation Heater:

- A. There shall be a 120VAC, 50 watt enclosure heater inside the control panel.
- B. The heater shall be a silicone rubber, insulated strip type enclosure heater.
- C. The heater shall be Chromalox Model #SL-B-2-5-55P, or approved equal.

2.5.17 Local Alarm (Flashing Light):

- A. There shall be a Flashing Alarm Light mounted on top of the control panel enclosure for local alarm indication. The flashing alarm light shall be supplied according to the following specifications:

- B. UL Recognized for use with UL NEMA Type 3R, 4, 4X, 12 & 13 Enclosures.
- C. Shatter Resistant Lexan globe, U.V. Stabilized and Flame Retardant.
- D. The Flashing Alarm Light shall be by Ingram Products, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment according to manufacturer's written instructions.
- B. Mount control equipment according to manufacturer's instructions.
- C. Install wiring between control devices as specified. Bundle, train and support wiring in enclosures.
- D. Identify components along with power and control wiring.

END OF SECTION

MECHANICAL/PLUMBING

STANDARDS AND REFERENCES

2009 International Building Code
2009 International Mechanical Code
2009 International Plumbing Code

GENERAL

The project is intended to provide new Sewage Pumping Station (SPS) at Chalan Mike Laguana Street in Chalan Pago, Guam.

SCOPE OF WORK

- Provide two parallel pumps with alternate operation and to include all necessary equipment and accessories such supports, foundation, valves, pipes and fittings for configured discharge with improve hydraulic efficiency.

PROCESS MECHANICAL

A. PUMPS

The maximum allowable velocity is 4.5 feet per second (fps) for each force main as this velocity will reduces maintenance costs and prevents sedimentation. The minimum pumping flow rate is based on minimum flow velocity of 2 fps. The maximum and the minimum flow required for each pump station shown in table below. The system will pump raw wastewater. All pumps shall be from the same manufacturer.

Pump shall have cast iron body, impeller shall also be cast iron with stainless steel shaft.

Pumps:

Area Served	Quantity	Maximum Flow, gpm	Minimum Flow, gpm
ChalanKantonLadera	1 + 1	160	80
ChalanKantonLadera	1 + 1	160	80
ChalanAyuyu	1 + 1	160	80
Chalan Leonardo Tenorio	1 + 1	160	80
Johnny S. Taitague	1 + 1	160	80

New pump control will consist of one level transducer, two float switches and the new SCADA compatible pump controller with modem capable of communicating either wireless or by wired data service connection with GWA central SCADA. To be installed inside the wet well, the level transducer shall provide level control signals and protection to automatically control the pump's on and off operation during regular and peak flow. The two float switches shall provide back-up protection control against extreme high level to prevent spill and against extreme low to stop and prevent damage to the pump in case the transducer control fails to provide signals for critically low level and critically high level wet well conditions.

B. WET WELL

Wet well size is directly related to frequency of pump operation. To prevent pump short cycling, it is recommended to have 10 starts per hour or 1 start every 6 minutes. This will increase pump life.