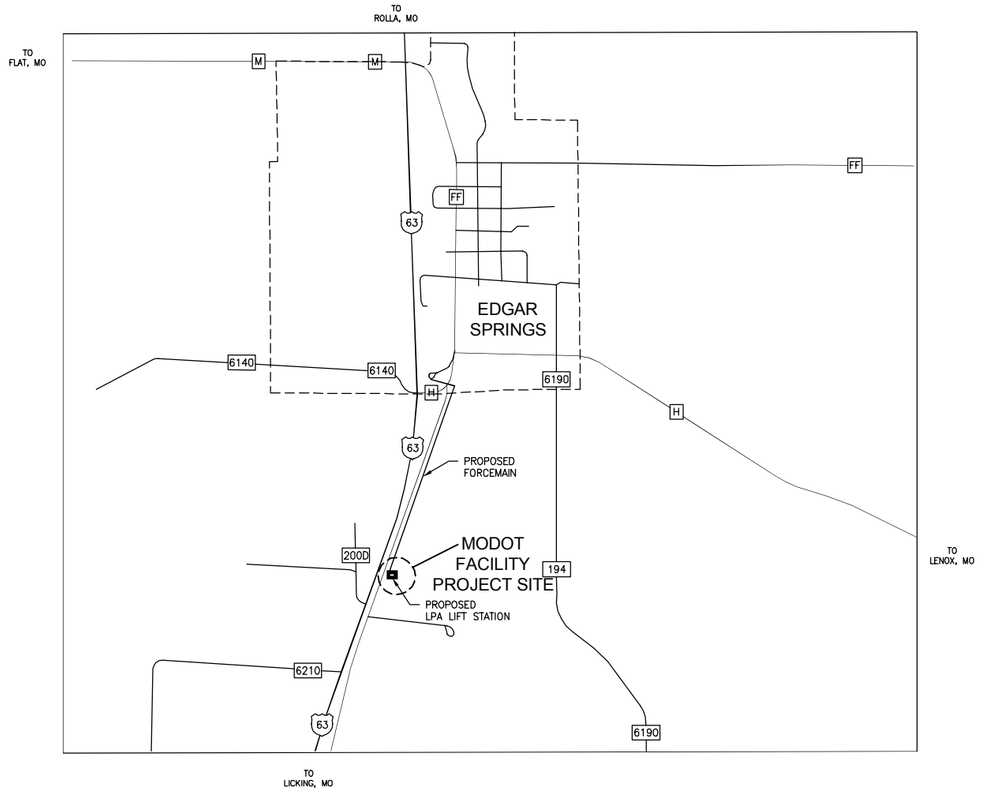
LIFT STATION AND SEWER SYSTEM CONNECTION
at
Edgar Springs Maintenance Buildings Lift Station
For
Missouri Department of Transportation
Central District

SITE MAP



VICINITY MAP
(NOT TO SCALE)

DRAWING LIST

		REV
GENERAL:		
T–001	TITLE SHEET	0
CIVIL:		
C–101	FORCEMAIN ALIGNMENT PLAN	0
C–102	LIFT STATION PLAN	0
C–103	FORCEMAIN CONNECTION AT CITY LIFT STATION PLAN	0
C–104	FORCEMAIN PROFILE	0
C–105	SANITARY PROFILE	0
C–301	LIFT STATION DETAILS	0
C–302	FORCEMAIN DETAILS	0
C–303	SPECIFICATIONS	0
C–304	SPECIFICATIONS	0

UTILITY CONTACTS

WATER & SEWER	PWSD #1 – PHELPS CO. EVERETT PERKINS 573–435–6720
OWNER	MISSOURI DEPARTMENT OF TRANSPORTATION ALLEN WANKUM 573–690–1172

GENERAL CONDITIONS

1. THESE DRAWINGS ARE PROVIDED FOR PRICING AND GENERAL CONSTRUCTION. CONTRACTORS SHALL VERIFY EXISTING CONDITIONS AT TIME OF BIDDING AND NOTIFY OWNER'S REPRESENTATIVE IMMEDIATELY WHEN DISCREPANCIES ARE DISCOVERED.
2. ALL CONSTRUCTION DEBRIS MUST BE DISPOSED OF BY THIS CONTRACTOR.
3. ANY PERMITS REQUIRED TO START AND COMPLETE THIS PROJECT SHALL BE OBTAINED AND PAID FOR BY THIS CONTRACTOR.
4. ALL EXISTING SURFACES INDICATED TO REMAIN AS EXISTING FINISHED SURFACES OR SUBSTRATES OF NEW FINISHES ARE TO BE REPAIRED TO ORIGINAL CONDITIONS IF DAMAGED BY WORK PERFORMED UNDER THIS CONTRACT, AT NO EXTRA COST TO OWNER.
5. MINIMAL LAY DOWN AREA IS AVAILABLE ADJACENT TO THE BUILDING: COORDINATE SPACE REQUIREMENTS AND LOCATION FOR CONSTRUCTION STAGING/PARKING WITH MoDOT.
6. THIS CONTRACTOR SHALL MAINTAIN A SCHEDULE AS AGREED TO WITH THE CLIENT. CONTRACTOR TO PROVIDE DETAILED CONSTRUCTION SCHEDULE AT THE TIME OF BIDDING.
7. SEED AND MULCH ALL AREAS DISTURBED BY CONSTRUCTION, PER MoDOT SPECS.
8. ALL EXISTING UTILITIES INDICATED ON THE DRAWINGS ARE ACCORDING TO THE BEST INFORMATION AVAILABLE TO THE ENGINEER; HOWEVER, ALL UTILITIES ACTUALLY EXISTING MAY NOT BE SHOWN. UTILITIES DAMAGED THROUGH THE NEGLIGENCE OF THE CONTRACTOR TO OBTAIN THE LOCATION OF SAME SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT HIS EXPENSE.

LEGEND & ABBREVIATIONS

	EXISTING SIGN	X	ELEVATION SPOT
MH	EXISTING MANHOLE	555.55	EXISTING ELEVATION
G.S.V.	EXISTING GAS SERVICE VALVE	555.55	PROPOSED ELEVATION
WV	EXISTING WATER SHUTOFF VALVE	TBA	TO BE ABANDONED
		TBR	TO BE REMOVED
WSV	EXISTING WATER SERVICE VALVE	TBR&R	TO BE REMOVED AND REPLACED
W.M.	EXISTING WATER METER	MH	MANHOLE
	EXISTING FIRE HYDRANT	ATG	ADJUST TO GRADE
	EXISTING FLAG POLE	UIP	USE IN PLACE
	EXISTING FLOOD LIGHT	STA	STATION
PP	EXISTING POWER POLE	ACC	ASPHALTIC CEMENT CONCRETE
	EXISTING GUY WIRE	SV	SEWER VENT
	EXISTING POST	FH	FIRE HYDRANT
	EXISTING FENCE	CL	CENTER LINE
	EXISTING TREE	Q	FLOW (CFS)
C.O.	EXIST. CLEANOUT	HGL	HYDRAULIC GRADE LINE
MH	NEW MANHOLE	CONC.	PORTLAND CEMENT CONCRETE
	ASPHALT TO BE REMOVED & REPLACED	@	AT
		∠	ANGLE
	CONCRETE TO BE REMOVED & REPLACED	PG	PROFILE GRADE
		RCP	REINFORCED CONCRETE PIPE
	STONE TO BE REMOVED & REPLACED	PVC	POLYVINYL CHLORIDE PIPE
	PROFILE CENTER LINE EXISTING	EL	ELEVATION
W W	EXIST. WATER LINE	U.N.O.	UNLESS NOTED OTHERWISE
G G	EXIST. GAS LINE	VERT.	VERTICAL
C C C	EXIST. CABLE TV	HOR.	HORIZONTAL
SA SA	EXIST. SANITARY SEWER	PT	POINT OF CURVATURE
FM FM FM FM	NEW FORCEMAIN		POINT OF TANGENCY
SA SA	NEW SANITARY SEWER	SHT.	SHEET
T T	EXIST. TELEPHONE LINES	RAD./R	RADIUS
E E	EXIST. UNDERGROUND ELECTRIC	DIA/Ø	DIAMETER
	EXIST. STRUCTURE	OIP	OLD IRON PIPE
	NEW STRUCTURES	O.C.	ON CENTERS
	EXIST. CENTER LINE OF ROAD	R/W	RIGHT–OF–WAY
	EXIST. EDGE OF PAVEMENT	PCC	PORTLAND CEMENT CONCRETE
	PROPERTY LINE	EXIST.	EXISTING
	EXIST. CONTOUR	W/	WITH

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PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
0	1/25/17	ISSUE FOR CONSTRUCTION	JFM

CDG ENGINEERS
One Campbell Plaza
St. Louis, Missouri 63139
T. 314 781 7770
F. 314 781 9075
Missouri State Certificate of Authority # 1271

STATE OF MISSOURI
JOSEPH F. MUELLER
NUMBER E-27607
REGISTERED PROFESSIONAL ENGINEER
1/25/17

JOSEPH F. MUELLER
ENGINEER - E027607

Voss
January 24, 2017

TITLE SHEET
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

DRAWING NO.
T-001

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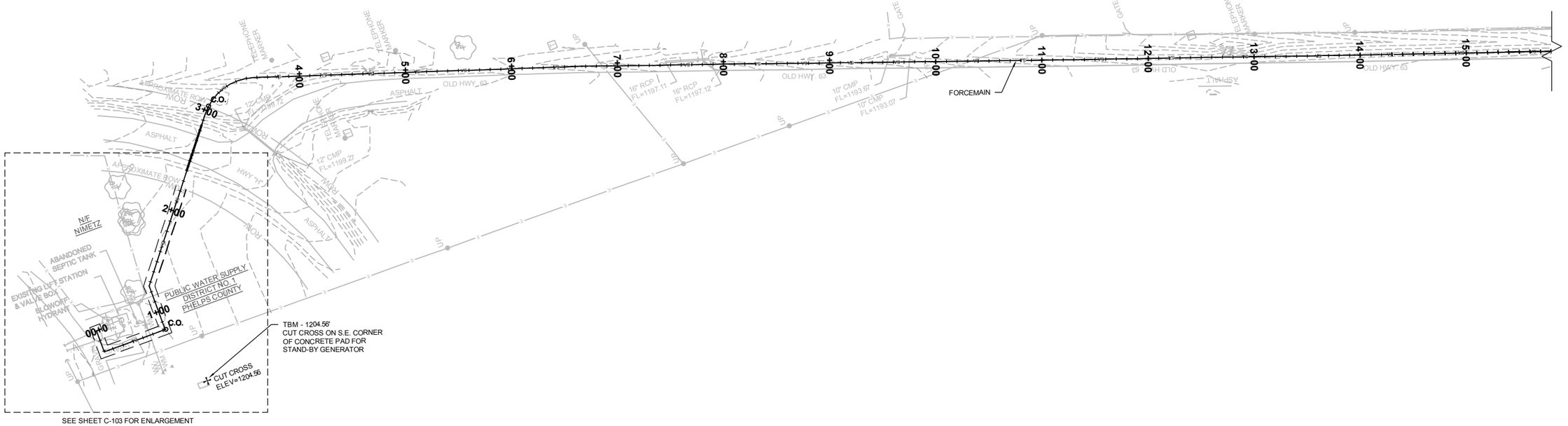
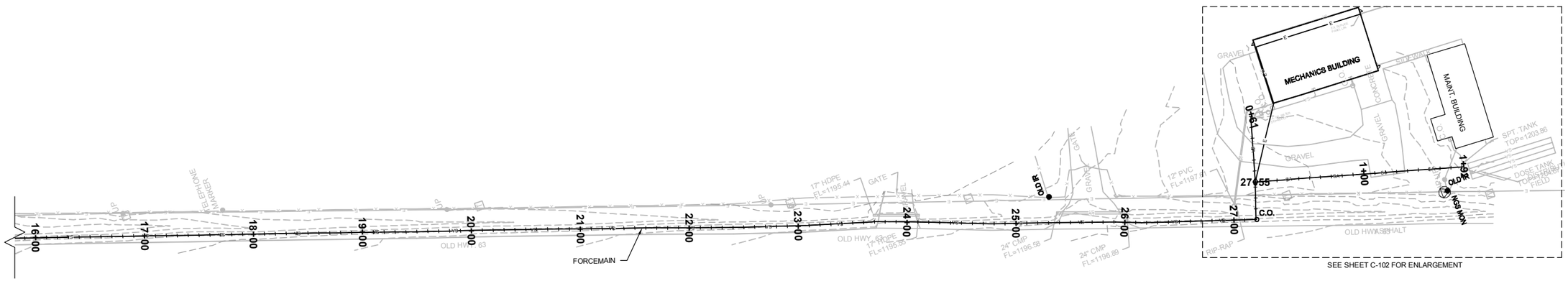


SEE SHEET C-103 FOR ENLARGEMENT

FORCE MAIN SHALL BE PLACED TEN FEET EAST OF EAST EDGE OF PAVEMENT WHERE PRACTICABLE. WATER LINES SHALL BE LOCATED, AND FORCE MAIN LOCATION ADJUSTED, IF NECESSARY, TO MAINTAIN TEN FEET OF HORIZONTAL SEPARATION AND 24" OF VERTICAL SEPARATION AT CROSSINGS.



SEE SHEET C-102 FOR ENLARGEMENT

FORCEMAIN ALIGNMENTPLAN

SCALE: 1" = 50'

N

0 50' 100' 150'

1" = 50'-0"

PLOT SCALE FACTOR 0.5

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1/25/17

JOSEPH F. MUELLER
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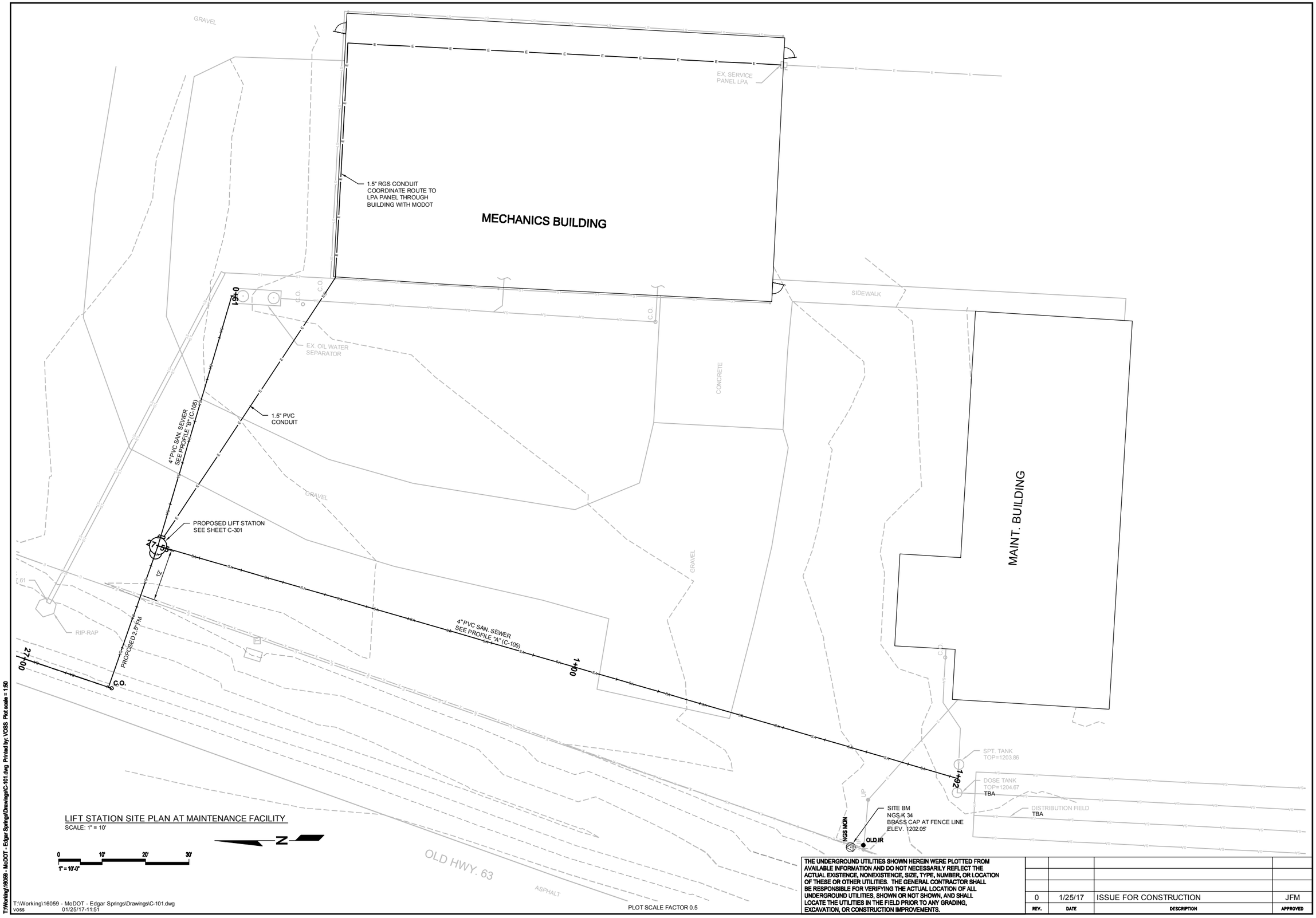
January 25, 2017

FORCEMAIN ALIGNMENT PLAN
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

DRAWING NO.
C-101



LIFT STATION SITE PLAN AT MAINTENANCE FACILITY
SCALE: 1" = 10'

0 10' 20' 30'
1" = 10'-0"

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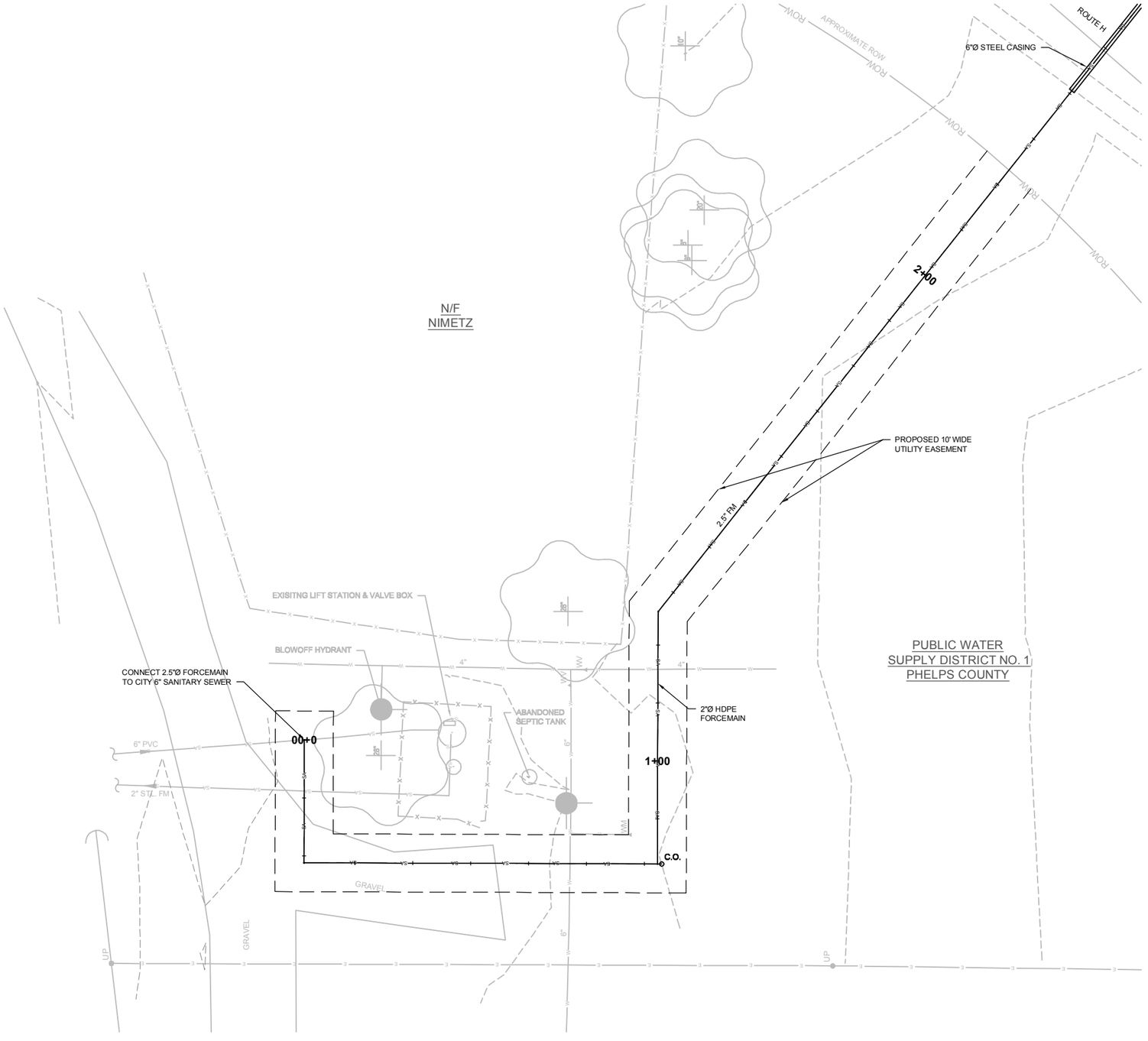
LIFT STATION PLAN
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

DRAWING NO.
C-102



FORCEMAIN CONNECTION AT CITY LIFT STATION
SCALE: 1" = 10'

0 10' 20' 30'
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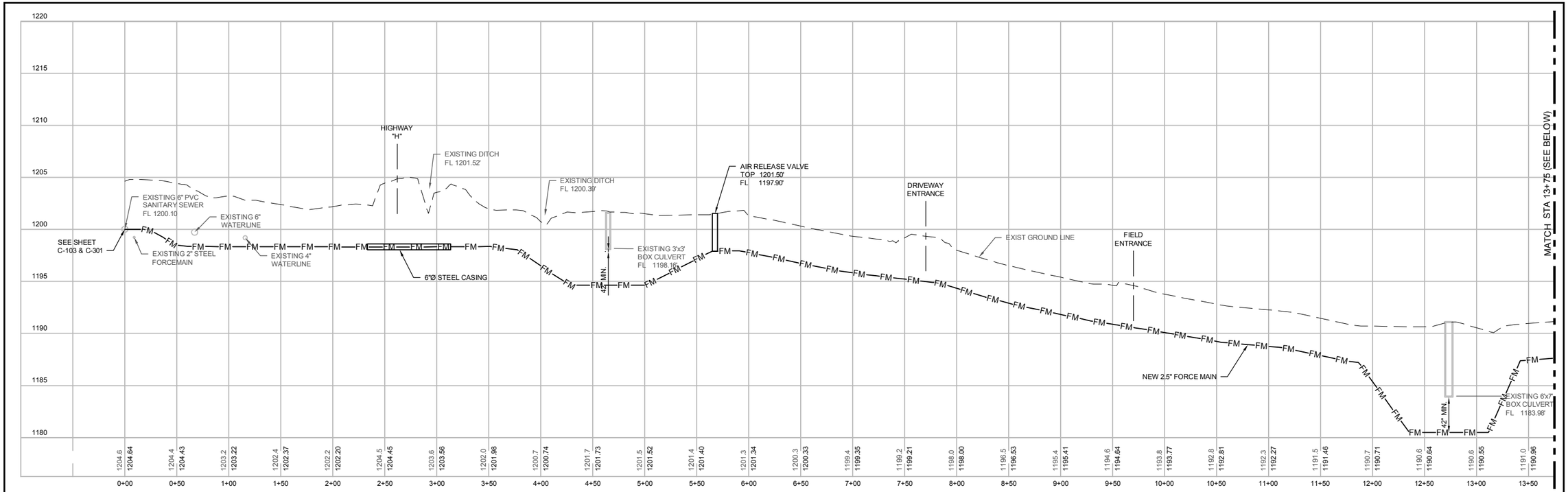
FORCEMAIN CONNECTION AT CITY LIFT STATION PLAN
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

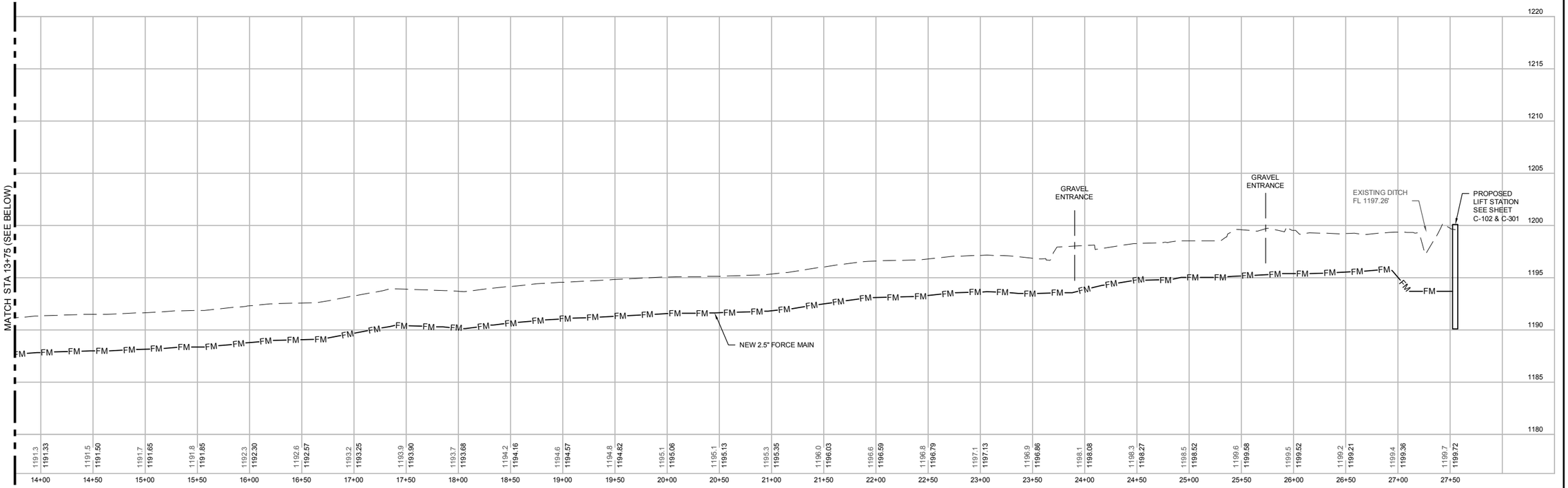
DRAWING NO.
C-103



INSTALL FORCE MAIN 42" DEEP INCREASE DEPTH; WHERE NECESSARY, TO MAINTAIN POSITIVE GRADE TO AIR RELEASE VALVE, AND AT LEAST 24" CLEARANCE BETWEEN FORCE MAIN AND WATERLINES, AT CROSSINGS.

FORCEMAIN PROFILE

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1' = 5'



FORCEMAIN PROFILE

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VERTICAL SCALE: 1' = 5'

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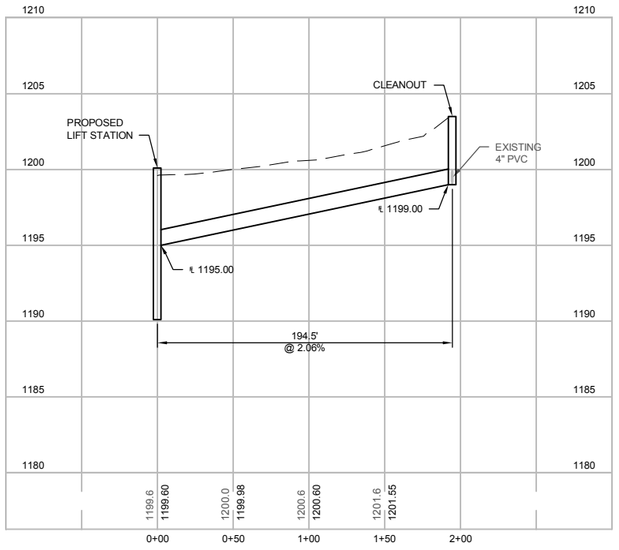
January 24, 2017

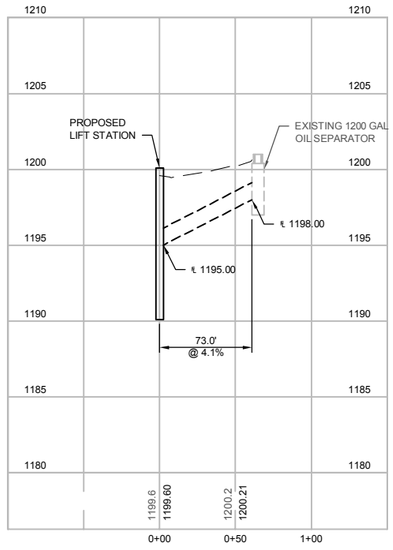
FORCEMAIN PROFILE
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

DRAWING NO.
C-104



MAINTENANCE BUILDING
SANITARY SEWER "A" PROFILE
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1' = 5'



FROM OIL WATER SEPARATOR
SANITARY SEWER "B" PROFILE
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1' = 5'

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SANITARY PROFILE
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LIFT STATION & SEWER SYSTEM
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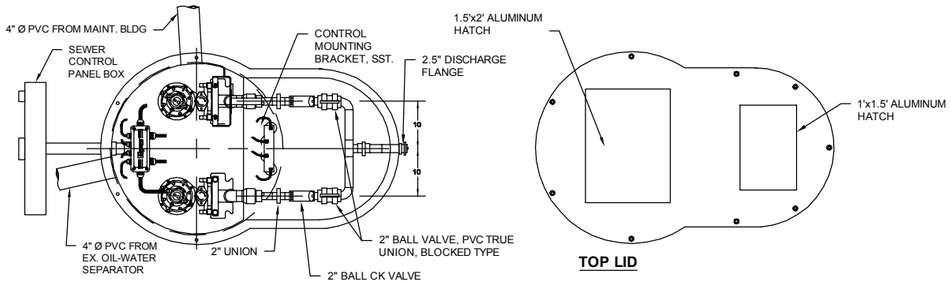
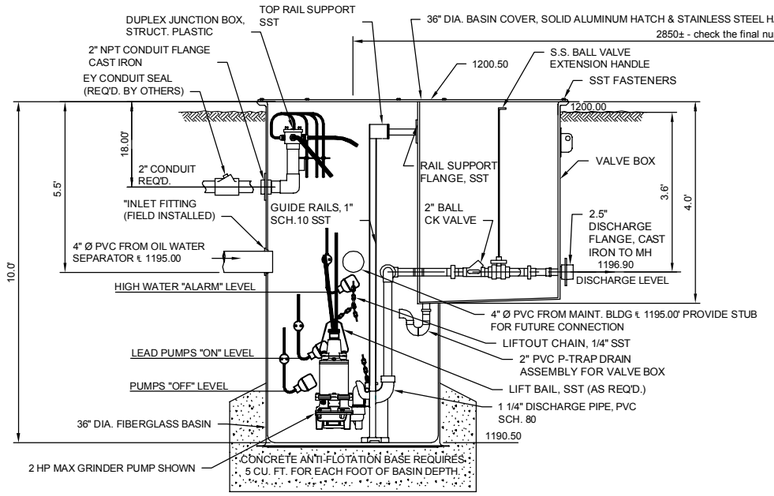


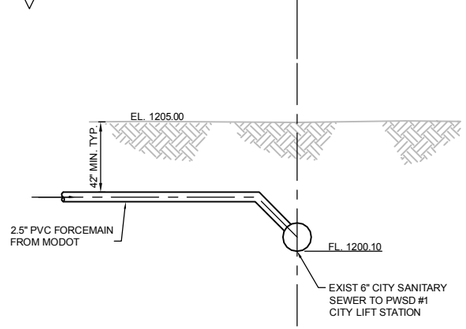
TOP LID

GENERAL NOTES:

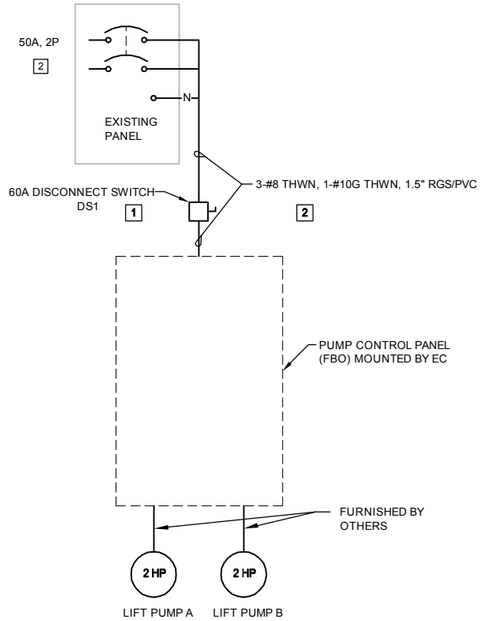
1. CONTRACTOR TO FIELD VERIFY DEPTH OF 4-INCH SANITARY SEWER LATERAL AT SEPTIC TANK & OIL SEPARATOR TO CONFIRM DEPTH OF CONNECTING FLOWLINE ELEVATION TO WETWELL.
2. SEE C-302 AND C-303 FOR LIFT STATION PUMPS AND CONTROL PANEL SPECIFICATIONS.
3. ROCK REMOVAL QUANTITIES ESTIMATED FOR EXCAVATION OF THE LIFT STATION IS 10 CY. QUANTITY BEYOND THIS VOLUME IS THE CONTRACTOR'S COST.
4. LIFT STATION WILL BE DELIVERED WITH INTERNAL PIPING AND VALVES.



MODOT MAINT. FACILITY LIFT STATION-DUPLEX

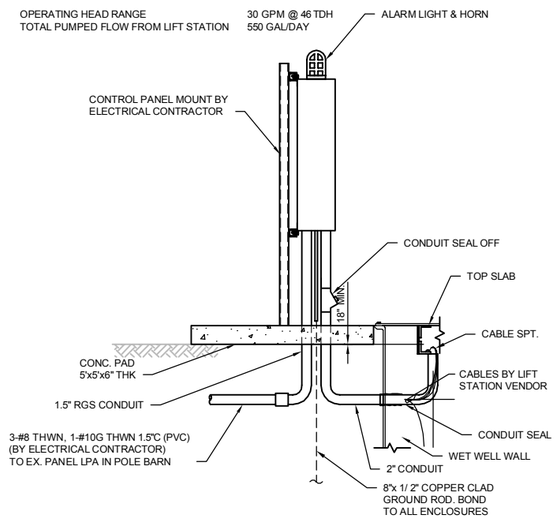


FORCEMAIN CONNECT TO CITY SEWER AT LIFT STATION

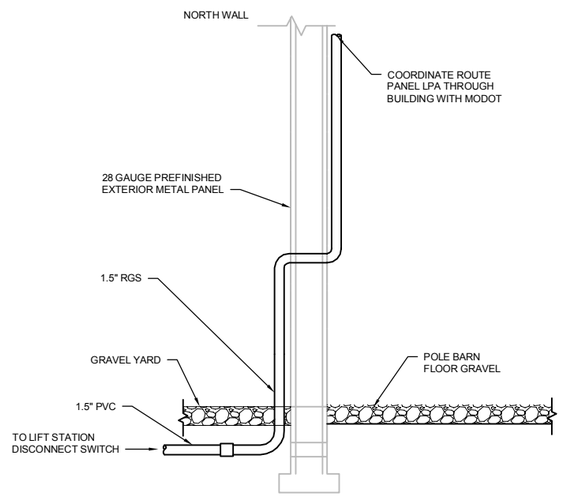


LIFT STATION OPERATING RANGE

OPERATING HEAD RANGE	30 GPM @ 46 TDH
TOTAL PUMPED FLOW FROM LIFT STATION	550 GAL/DAY



LIFT STATION CONTROL PANEL
N.T.S.



CONDUIT RISER DETAIL AT NW CORNER EXISTING POLE BARN
N.T.S.

LIFT STATION PLAN & SECTION
N.T.S.

ELECTRICAL GENERAL NOTES:

1. ALL WORK SHALL CONFORM WITH THE NATIONAL ELECTRICAL CODE, ALL STATE AND LOCAL CODES AND ORDINANCES, AND O.S.H.A.
2. PROVIDE CONDUIT SEAL OFFS AT ALL BUILDING PENETRATIONS AND AT ALL CONTROL PANELS AND DISCONNECT SWITCHES.
3. PROVIDE CONDUIT SEAL OFFS AT ALL BELOW GRADE CONDUITS ROUTED TO PUMP MOTORS.
4. ALL EXTERIOR MOUNTED ELECTRICAL DEVICES AND EQUIPMENT SHALL BE IN WEATHERPROOF ENCLOSURES AND U.L. LISTED FOR WET LOCATION AND NEMA 4X LISTED.
5. PROVIDE FIRESTOPPING TO MAINTAIN FIRE RATINGS AT ALL PENETRATIONS OF RATED CONSTRUCTION.
6. ALL SAFETY SWITCHES SHALL HAVE A GROUNDING BAR.
7. ALL FEEDERS SHALL HAVE A SEPARATE COPPER GROUNDING CONDUCTOR INSTALLED.
8. PROVIDE ALL NECESSARY WALL CUTTING/PENETRATIONS AND ALL OF THE REPATCHING NECESSARY FOR THE PROPER EXECUTION OF THIS WORK.

ELECTRICAL KEYED NOTES:

1 FURNISH AND INSTALL 240V, 60A, 3P, NEMA 4X, NON-FUSED DISCONNECT SWITCH. DISCONNECT SWITCH SHALL BE LOCKABLE IN THE "ON" AND "OFF" POSITIONS. DISCONNECT SHALL BE MOUNTED ON THE SAME RACK AS THE CONTROL PANEL.

2 FURNISH AND INSTALL 3-#8 THWN,1-#10 THWN IN 1.5" CONDUIT (PVC UNDERGROUND/RGS ABOVE GROUND; SEE RISER DETAIL) FROM EXISTING 2 POLE, 50A CIRCUIT BREAKER IN EXISTING PANEL TO DISCONNECT SWITCH AND DISCONNECT SWITCH TO PUMP ASSEMBLY. CONTRACTOR TO VERIFY EXISTING PANEL AND LOCATIONS.

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MoDOT

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Voss
January 24, 2017

LIFT STATION DETAILS
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

DRAWING NO.
C-301

PLOT SCALE FACTOR 0.5

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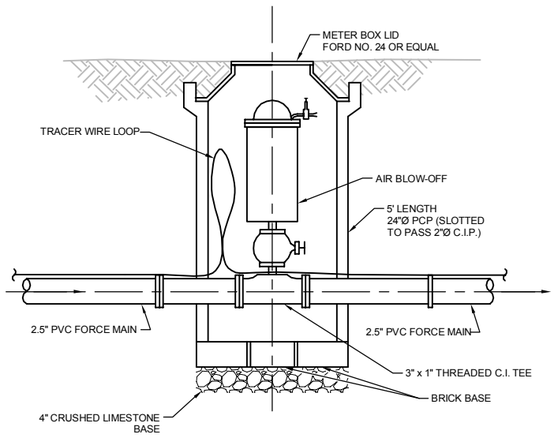
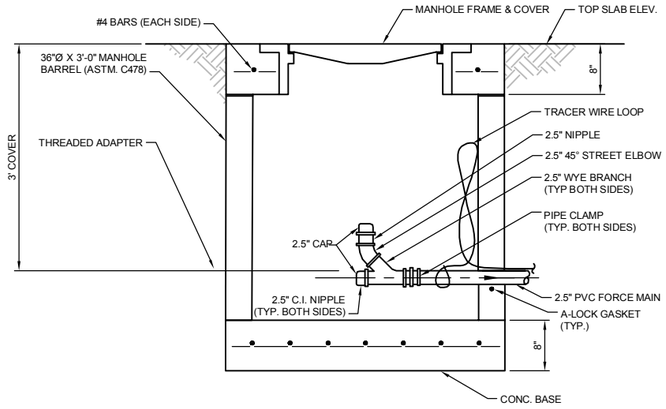


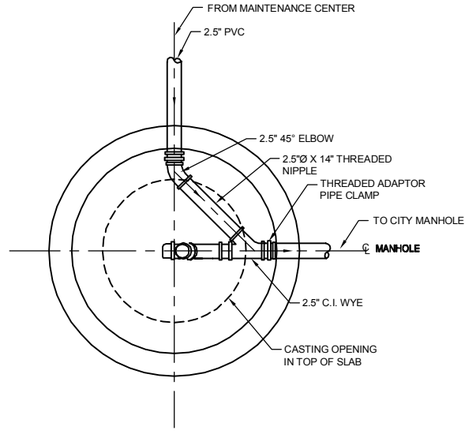
AIR RELEASE DETAIL (1 REQ'D.)
N.T.S.

AIR RELEASE VALVE & VAULT NOTES:

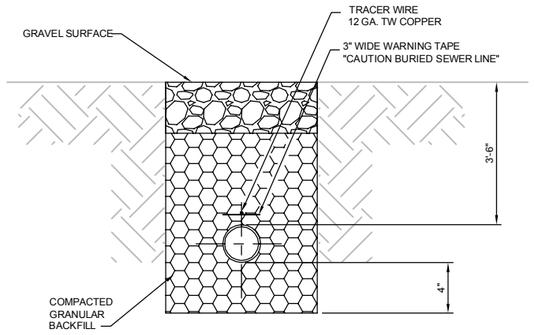
1. SEWAGE AIR RELEASE VALVES SHALL BE VALMATIC "VM-48BW", GA. INDUSTRIES "FIGURE 925" OR ENGINEER APPROVED EQUAL. INLET SHALL BE 2" NPT UNLESS OTHERWISE NOTED ON THE PLANS OR PROFILES. OUTLET SIZE SHALL BE 1/2" NPT AND AIR RELEASE ORIFICE SHALL BE 3/16".
2. IF HEIGHT OF VAULT CAUSES FRAME AND COVER TO BE ABOVE GRADE, PERFORM GRADING TO PROVIDE A SMOOTH TRANSITION. DO NOT LOCATE VAULT TO OBSTRUCT DITCH. IF NECESSARY, OFFSET ALIGNMENT AT VAULT TO AVOID PLACING STRUCTURE IN DITCH FLOWLINE. ROTATE TOP RING AND COVER TO AVOID DITCH FLOW LINE.
3. ALL VALVE VAULTS SHALL HAVE A MARKER POST LOCATED AT THE RIGHT OF WAY. MARKER POSTS SHALL BE USA BLUE BOOK "RHINO 3 RAIL STOCK NO. 70457" WITH DECAL INDICATING SEWER FORCEMAIN "STOCK NO. 70474".



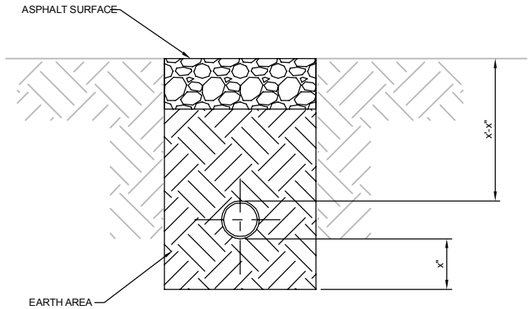
FORCE MAIN JUNCTION CLEANOUT (3 REQ'D.)
N.T.S.



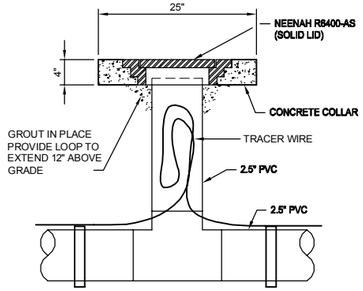
FORCE MAIN JUNCTION BOX/CLEANOUT PLAN
N.T.S.



FORCE MAIN TRENCH DETAIL
THROUGH GRAVEL DRIVEWAY
N.T.S.



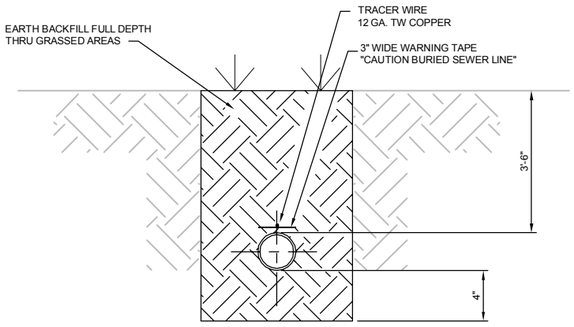
FORCE MAIN BORED UNDER OLD 63
N.T.S.



TRACER WIRE TEST STATION
N.T.S.

TRACER WIRE TEST STATION NOTES:

1. INSTALL TEST STATIONS AT LOCATIONS ALONG SEWER FORCE MAIN AT INTERVALS NOT TO EXCEED 600 FEET. AIR VALVE VAULTS AND CLEANOUT MANHOLES SHALL BE USED AS TEST STATIONS.
2. AT TRACER WIRE TEST STATION THE TRACER SHALL BE LOOPED WITH ENOUGH WIRE TO EXTEND 12" ABOVE GRADE. THE LOOP SHALL BE PLACED IN AN ORGANIZED FASHION WITHIN THE TEST STATION WHICH DOES NOT INTERFERE WITH ENTRY OR MAINTENANCE.
3. ALL TEST STATIONS SHALL HAVE A MARKER POST LOCATED AT THE RIGHT OF WAY MARKER POSTS SHALL BE USA BLUE BOOK RHINO 3-RAIL STOCK NO. 70457 WITH DECAL INDICATING SEWER FORCE MAIN STOCK NO. 70474.
4. TRACER WIRE TO SPLICED W/COPPER OR BRONZE SPLIT BOLT CONNECTOR.



FORCE MAIN TRENCH DETAIL
THROUGH GRASSED AREA
N.T.S.

THE UNDERGROUND UTILITIES SHOWN HEREIN WERE PLOTTED FROM AVAILABLE INFORMATION AND DO NOT NECESSARILY REFLECT THE ACTUAL EXISTENCE, NONEXISTENCE, SIZE, TYPE, NUMBER, OR LOCATION OF THESE OR OTHER UTILITIES. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE ACTUAL LOCATION OF ALL UNDERGROUND UTILITIES, SHOWN OR NOT SHOWN, AND SHALL LOCATE THE UTILITIES IN THE FIELD PRIOR TO ANY GRADING, EXCAVATION, OR CONSTRUCTION IMPROVEMENTS.

REV.	DATE	DESCRIPTION	APPROVED
0	1/25/17	ISSUE FOR CONSTRUCTION	JFM

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PLOT SCALE FACTOR 0.5

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STATE OF MISSOURI
JOSEPH F. MUELLER
NUMBER E-27607
REGISTERED PROFESSIONAL ENGINEER

JOSEPH F. MUELLER
ENGINEER - E027607

Voss
January 24, 2017

FORCE MAIN DETAILS
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

DRAWING NO.
C-302

GRINDER PUMP SPECIFICATIONS

PUMP STATION
The contractor shall base his bid on Keen KGS(X)2 series pumps or equal as specified.

The pump supplier shall also supply the control panel, guide rails, float switches, check and gate valves, and lifting chain as shown in the plans. The pump supplier shall also provide manufacturer's authorized start-up on site, and use the same visit to instruct operations personnel in the use of the equipment and controls.

The pump supplier shall operate a repair facility within 100 miles of the pump station, maintain an inventory of spare parts, and have their own staff of mobile field technicians available 24 hours a day.

GRINDER PUMP
Each grinder pump shall be a **heavy duty pump** used as a grinder. Each grinder pump shall contain special cutters to reduce sewage to a fine slurry. The grinder unit shall be capable of macerating all material in normal domestic and commercial sewage, including reasonable amounts of foreign objects such as sanitary napkins, disposable diapers, thin rubber, small wood, plastic, and the like to fine slurry that will easily pass through the pump and 1-1/4" NPT discharge. **KGSX2 or KHGSX2 Series** pumps and motor assembly shall be FM3615 listed for Class 1, Division 1, Group C & D hazardous location service. The stationary cutter and the rotary cutter shall consist of **hardened stainless steel.** The cutter materials shall provide maximum corrosion and abrasion resistance. The remaining portion of the grinder pumps, with the exception of seal materials and wet end, shall be similar to the heavy duty pumps used in larger pump stations for daily operation. Pump motors and all associated wet well equipment shall be FM rated explosion proof for Class 1, Division 1, Groups C and D.

REQUIREMENTS
Furnish and install two (2) submersible wastewater grinder pump(s). Each pump shall be equipped with a maximum 2 HP, submersible electric motor connected for operation on 230 volts, 1 phase, 60 hertz service, with 15 feet of submersible cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be supplied with a mating cast iron 2 inch discharge connection and be capable of delivering 35 GPM at 103.5 feet TDH. Shut off head shall be 110 feet (minimum). Each pump shall be fitted with 15 feet of galvanized lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

PUMP DESIGN
Grinder pump(s) shall be in the following configuration:

Dual guide bar mounting - 2" Discharge.

The KGS(X)2 Grinder pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. No portion of the pump shall bear directly on the sump floor.

PUMP CONSTRUCTION
Major pump components shall be of grey cast iron, ASTM A-48, Class 30B, 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 primer and a airdry enamel finish to the exterior of the pump.

Sealing design shall incorporate machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional 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.

COOLING SYSTEM
Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

CABLE ENTRY SEAL
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 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. **Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.**

MOTOR
The pump motor construction shall be per NEMA MG-1 1.15 standard and shall be of the submersible type, rated 2 HP, 3450 RPM. The motor shall be for 60 Hz, either 200 or 240 volt, single-phase operation. Single-phase motors shall be capacitor start, capacitor run type for high starting torque. Start & run capacitors, and electronic relay for operating the motor will be found in the control box. Major operating temperature must not exceed Class B ratings.

The stator winding shall be of the open type with Class F construction. Any other construction shall be considered not equal. The stator shall be pressed into the cast iron motor housing. Proprietary **KEEN I.C.E.** oil ensures industry-low operating temperatures. **KEEN I.C.E.** oil is a synthetic blend with wear-additives, specifically engineered for submersible pump motors. Winding housing shall be filled with clean, high dielectric oil that lubricates bearings and seals, transferring heat from windings and rotor to the outer cast housing. Maximum skin temperature of motor assembly shall not exceed a T-4 rating per FM3615 standards. **Any motor assembly T-code per FM3615 standard that exceeds a T-4 rating shall be considered not equal. Air-filled motors, which do not have the superior heat dissipating capabilities of oil-filled motors, shall not be considered equal.**

Single-phase motors shall have automatic reset overload protection attached to the top end of the motor windings to stop the motor if the motor winding temperature reaches 130 degrees C by way of (2) temperature sensors wired to the motor control center. **On-winding overload protection shall be considered not equal.** The high temperature shut-off will cause the pump to cease operation, should a control failure cause the pump to run in a dry wet well or any condition that may cause the pump to run outside of the specified operating temperature range.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.10. 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.

BEARINGS / SHAFT
The motor shall have two heavy-duty ball bearings and one sleeve bearing to support the pump shaft, taking radial and thrust loadings. Bearings shall be designed to a ABEC© System 1 or better. The upper bearing shall be a Conrad type, single row, deep groove ball bearing designed to adequately handle the required radial loads. The lower bearing shall be a single-row angular contact ball bearing designed to adequately compensate for the axial loads and radial forces. Bearings shall be designed to deliver a minimum L-10 bearing life of 100,000 hours when operation is within the limitations of the manufacturer's performance curve. The bearings shall be lubricated in oil and will not require maintenance as described in ANSI/HI 1.4-2010 A.6.

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 hydro-dynamically 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 **ceramic** seal ring and one positively driven rotating **carbon** 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 special applications, other seal face materials shall be available.

The following seal types shall not be considered acceptable or 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 effect 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 dry without damage while pumping under load**.
Seal lubricant shall be FDA Approved, nontoxic.

IMPELLER
Pump impeller shall be 300 series stainless steel and threaded onto an AISI 416 stainless steel shaft. The impeller shall be of the semi-open type to provide an unobstructed passage through the volute for the ground solids. Impeller must be dynamically balanced to specifications ISO 1940G 6.3 standard.

VOLUTE
Pump volute(s) shall be single-piece grey cast iron, ASTM A48 Class 35B, non-concentric design with smooth passages large enough to pass any media that may enter the impeller. Minimum inlet and discharge size shall be as specified.

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

A leakage sensor shall detect water in the stator chamber. This sensor is a small float switch used to detect the presence of water in the stator chamber. **Use of voltage sensitive solid state sensors and trip temperature above 125°C (260°F) shall not be allowed.**

The thermal switches and leakage sensor shall be connected to a monitoring unit and operate alarm functions as described in the control panel specifications.

SINGLE PHASE DUPLEX GRINDER PUMP CONTROL PANEL SPECIFICATION

CONTROL PANEL
A complete pump control system including pumps, pump control panel and related accessories shall be provided by the pump supplier to ensure full system capability. The control panel shall be manufactured by a current UL508A and UL698A listed control panel manufacturer regularly engaged in the manufacture of controls for the municipal water industry with a minimum of ten years' experience in control panel design and manufacturing. All devices in the panel shall be UL listed and/or recognized where applicable and shall be mounted and wired in accordance with the most current edition of UL508A, UL698A and NFPA.

The control panel shall include a factory assembled and tested system including enclosure, overcurrent protection, controllers, relays, operator and control devices and interconnection wiring as specified herein. Controls shall not be assembled on site. All power, control and logic functions shall be fully tested prior to shipment.

AutoCAD submittal and as-built drawings shall be provided. The submittal wiring diagrams shall be submitted to the engineer for review and approval prior to panel fabrication. The drawings shall be in standard ladder format complete with: JIC standard electrical symbols, ladder rungs, cross referenced relay contacts, wire numbers, construction notes, terminal strip connection details, inner door layout, and a complete bill-of-materials. Manufacturers catalog data sheets shall be submittal for all major equipment listed in the bill-of-materials with the submittal package. Final as-built drawings shall be provided upon project completion. Two sets of as-built drawings shall be provided in the enclosure print pocket and a waterproof, reduced size shall be laminated in clear plastic and permanently fastened to the inside of the panel door.

UTILITY POWER
The incoming utility service for the control panel shall be 230VAC, 1-phase, 60 hertz. This shall be confirmed by the contractor prior to the bid.

SYSTEM OPERATION
The basic operation of the pumps shall be a pump down, lead/lag, common off system with a high level alarm. The pumps shall alternate on each off cycle. Each pump shall be provided with a three position, maintained, Hand-Off-Auto switch complete with a phenolic engraved ring legend. The position commands are as follows:

HAND: In this position, the applicable pump will run continuously without regard to the level sensing command until the switch is turned to Off or Auto.

OFF: In this position, the applicable pump will not run.

AUTO: In this position, the applicable pump will be controlled by the float switches. These switches will sense the appropriate level and initial start and stop commands to the pumps via interposing time delay relays to achieve a staggered start sequence of the pumps. Where the wet well is indicated as a Class I, Division 1 or 2, Group D hazardous location, the level sensing device shall be interposed with intrinsically safe relays installed per UL698A, NEC 504, and all other applicable codes.

ALARMS
In the event of a high level, the alarm system shall operate the alarm light and horn as described herein.

ENCLOSURE
The enclosure shall be a NEMA 4X weatherproof, engineered thermoplastic enclosure. The enclosure door shall have gaskets of a rubber composition with a retainer or seamless foamed in place to assure a positive weatherproof seal. The outer door shall have a padlock provision. All hardware shall be corrosion resistant. An enclosure back panel and full size inner swing door shall be supplied manufactured of 12 gauge mild steel and finished with a primer coat and two coats of baked on white enamel. All hardware mounted to the back panel shall be with machine thread and tapped holes; sheet metal screws or zip screws are not acceptable. The inner door shall be large enough to fill the entire opening of the enclosure for mounting equipment and protection of personnel from live internal wiring. Circuit breakers cutouts shall be provided to allow operation of breakers without entering the compartment. All control switches, pilot lights, and other operational devices shall be mounted on the external surface of the inner door. The inner door shall have a "dead back" feature in order to avoid accidental shock hazard. No screws shall be used to secure the inner door to the enclosure in order not to violate the NEMA type rating of the enclosure. All panel wiring and equipment layout shall be performed per NEMA, JIC, and UL508A and 698A specifications. NEC gutter spacing shall be observed. A minimum of six inches of additional DIN rail shall be provided for future mounting expansion.

IDENTIFICATION
All components on the back panel shall be clearly identified with machine printed labels that correspond to the control drawings. Labels shall NOT be positioned on removable devices or wire duct. All conductors shall be labeled at both ends of every wire with machine printed, self-adhesive, repositionable coated vinyl cloth wire markers that correspond to the control drawings. Labels and wire markers shall be similar and equal to Brady B498, Phoenix, or approved equal.

The control panel shall be complete with applicable voltage identification, warning labels and an ID label that provides all pertinent data applicable to sizes and ratings as required per NEC, UL508A and UL698A. All operator devices shall be complete with plastic engraved ring legends that correspond to the control drawings. Ring legends shall have black letters on a white background EXCEPT emergency stop devices which shall have white letters on a red background.

WIRING
All wiring shall be soft annealed, solid or stranded, tinned copper, concentric, compressed concentric or combination unilay stranding per UL 1063, ASTM B-787 type MTW or TEW rated for 600VAC at 90 degree C minimum. Control wiring shall be a minimum of 16AWG; power conductors shall be sized for the load served per NEC and UL508A, minimum 12AWG. All colors and conductor sizes shall be noted on the control drawings. Splicing or tap wiring is not acceptable except at device terminals or terminal blocks.

For aesthetics and safety, all wires terminating to doors shall be provided with spiral wrap, cable ties and fasteners. Cable ties shall be securely fastened; fasteners shall not penetrate the enclosure. Wire duct shall be used on the back panel installed in vertical or horizontal runs only with AC wiring separated from DC signal wiring. NEC gutter spacing shall be observed in all cases.

POWER EQUIPMENT

MAIN LUG
A power distribution block sized for the incoming power conductors shall be provided for the main power connection. Each pole of the block shall be provided with a clear cover for operator protection. The block shall be located with adequate space for wire bending and landing the incoming power leads. A separate service entrance disconnect switch shall be provided and installed by others.

GROUND BUSS/LUGS
A ground lug sized for the incoming power ground shall be provided and located near the power distribution block. Separate ground lugs sized for the pump ground wire shall be provided and located near the pump power wire terminations. A ground buss for control equipment grounding shall also be provided.

LIGHTNING ARRESTOR
An outdoor rated lightning-transient protector with a LED to indicate loss of protection shall be provided. The device shall have a nominal discharge current of a minimum of 20kA. It shall be rated for a Type 2 installation and CSA listed to ANSI/UL1449 3rd edition. The lightning arrestor shall be similar and equal to Intermatic AG Series, Square D 6671 SKS Series, or approved equal. It shall be provided loose for mounting on the exterior of the fused utility service entrance disconnect by the installing contractor.

VOLTAGE MONITOR
A socket mount, plug-in style voltage monitor shall be supplied to protect the motors from low voltage, high voltage, and rapid cycling. The motor starters and control circuit shall be de-energized upon sensing any of these faults and shall automatically restore service upon return to normal. The unit shall have an LED for status indication and ease of troubleshooting. The output contact shall be form C rated for 10 amps. The voltage monitor shall be similar and equal to Time Mark, Diversified, or approved equal.

CIRCUIT BREAKERS
Individual properly sized thermal magnetic circuit breakers shall be provided for each load served. Circuit breakers shall be indicating type, providing 'on-off-trip' positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating 'trip'. Breakers shall be designed so that a fault on one pole automatically trips and opens all legs; field installed handle ties shall not be acceptable. Combination circuit breaker and overload devices shall not be allowed. Each motor circuit breaker shall be adequately sized to meet the pump motor operating characteristics and shall have a minimum of 10,000 amps interrupting capacity for 230VAC and 18,000 amps at 480VAC. The control circuit and other branch circuits shall be individually controlled by separate one-pole, heavy-duty breakers. Circuit breakers shall be similar and equal to Eaton GD Series, ABB TMax Series, or approved equal.

MOTOR STARTERS AND START KITS
The pump single-phase start kit shall be supplied by the pump manufacturer to ensure a coordinated motor starting system. These components shall be installed and wired into the pump control panel starter circuit prior to shipment. A magnetic full voltage non-reversing, across-the-line horsepower rated motor contactor complete with an electronic overload shall be provided for each motor. Auxiliary contacts shall be provided as required by the control system. The overload relays shall be sized for the full load amp draw of the motors and service factor. Overload relays shall be set to Class 10 trip characteristics for all pump motors and Class 20 for all blower motors. Where indicated, overload relays shall be provided with ground fault sensing and protection. Motor starters shall be similar and equal to Eaton XTCE Series, ABB A Series, or approved equal. Overload relays shall be similar and equal to Eaton C440 Series, ABB EXXDU Series, or approved equal.

CONTROL EQUIPMENT

CONDENSATION HEATER AND THERMOSTAT
A 100 watt, 120VAC condensation heater shall be provided to protect the panel from the effects of condensation and low temperatures. The heater shall be touch-safe, convection type and DIN rail mounted. It shall be located near the bottom of the enclosure for optimum performance. A separate DIN rail mounted adjustable thermostat shall be provided. The thermostat shall be located in an area of the enclosure that is representative of the average temperature and not directly above the heater. For operator safety, flexible type strip heaters and those with integral non-adjustable thermostats shall not be allowed. In no instances shall the strip heater be mounted on the inner door. Condensation heater and adjustable thermostat shall be similar and equal to Stego, Pfannenberg or approved equal.

TERMINAL BLOCKS
Terminal blocks shall be provided for all field control connections. They shall be DIN rail mounted, have current capacity equal to the load served, and suitable for a minimum of 12AWG wire at not less than 300VAC. Each terminal block shall be clearly labeled with a unique machine printed marker that corresponds to the control drawing; hand marking of terminals shall not be allowed. Field connection terminal strips shall be suitable for Class 1 field wiring. Terminal blocks shall be similar and equal to Phoenix UT4, Entrelec M4/6, or approved equal.

OPERATOR DEVICES
All pushbuttons, switches and pilot devices shall be 22mm, NEMA type 4/4X. Pushbuttons shall be black in color, momentary, with a flush operating head. Selector switches shall be maintained, knob style operators. Contact blocks shall be rated for 10 amps. Pilot lights shall be 120VAC, LED type with colors as indicated. All contact blocks and pilot lights shall be finger safe. Operator devices shall be similar and equal to Eaton M22 Series, Idec HW Series, or approved equal.

A three-position, maintained 'Hand-Off-Auto' switch shall be provided for each pump and mounted on the inner door. This switch may be an LED green illuminated style or a separate green pilot light may be supplied to indicate 'Pump Run' status. The switches shall be complete with required contact blocks and an engraved position indicating ring legend plate.

If not provided on a manufacturers pump monitoring relay, a red pilot light shall be provided for each pump indicating 'Pump Fail' as a result of a pump motor thermal trip. A 'Pump Fail Reset' pushbutton shall be provided to reset this latching circuit. The pilot lights and pushbutton shall be complete with an engraved ring legend plate and mounted on the inner door.

If not provided on a manufacturers pump monitoring relay, an amber pilot light shall be provided for each pump indicating 'Pump Seal Fail' as a result of a pump motor seal leak. A seal leak failure shall not stop the motor unless required by the pump manufacturer. The pilot lights shall be complete with an engraved ring legend plate and mounted on the inner door.

ALTERNATING RELAY
A 120VAC automatic electronic alternating relay shall be provided for alternating the pumps on each successive call. It shall be provided with LEDs to indicate the position status and a toggle switch to select pump 1, pump 2 or to allow automatic alternation. This switch shall be used to manually force the selected pump to run on each call in the event a pump is taken out for service while allowing the operable pump to run. The alternating relay shall also have a built-in de-bounce feature that prevents the relay from changing state if the switch or float contact bounces momentarily. The alternating relay shall be similar and equal to SymCom ALT, Diversified ARB, or approved equal.

CONTROL RELAYS
Where required, control relays shall be general-purpose plug-in full-featured relays with IEC style 'finger safe' DIN rail mount bases. Relay bases with open, pressure-plate style terminals that are not of finger safe design shall not be allowed. Relays shall have a neon indicating lamp, visual flag status indicator and test button. Relays shall have the number of poles indicated on the control drawings and be rated a minimum of 10 amps at 120VAC. Control relays shall be similar and equal to Eaton D3 Series, Square RPM Series, or approved equal.

PUMP MONITORING RELAYS
Pump thermal trip and seal leak monitoring shall be provided for each pump. Where this device is not supplied by the pump manufacturer, provisions must be included in the panel in the form of a latching temperature relay and a separate conductance actuated moisture sensing seal leak relay.

The latching temperature switch relay shall monitor the normally-closed low temperature switch located in each pump motor. One relay shall be provided for each pump. The relay shall incorporate a bistable relay that retains its state during power failures and be complete with LEDs indicate the status of the relay. A separate inner door mounted red 'Pump Fail' pilot light and 'Pump Fail Reset' pushbutton shall be provided. The latching temperature relay shall be similar and equal to Diversified SPM Series, or approved equal.

The shaft seal of the pump motor shall be monitored with a conductance actuated moisture sensing relay. Leaks are detected by sensing the conductivity of the contaminating fluid through probes installed in the seal cavity. When the seal begins to leak, the seal failure relay will energize the output relay. The sensitivity of the pump input shall be field adjustable. The relay shall be complete with LEDs to indicate the status of the relay. One relay shall be provided for each pump. A separate inner door mounted amber 'Seal Leak' pilot light shall be provided. The seal leak relay shall be similar and equal to Diversified SPM Series, Time Mark, or approved equal.

INTRINSICALLY SAFE RELAYS
For installations where the wet well is classified as a Class I, Division 1 or 2, Group D hazardous location, an intrinsically safe barrier shall be provided for the level sensing device for interfacing between the hazardous and non-hazardous areas. The barrier shall be suitable for the level sensing device, and shall be UL913 listed. It shall be DIN rail or surface mountable with finger safe terminals. It shall have LEDs to indicate the status of the relay. The control drawings must reference UL698A markings and requirements for proper installation.

ALARM SYSTEM
A red strobe alarm light shall be mounted on the top, exterior of the enclosure and shall be NEMA 4/4X rated. It shall be hermetically sealed, xenon U tube, rated for 5 million flashes with tamper resistant mounting hardware.

The alarm horn shall be mounted on the exterior of the enclosure, NEMA 4 rated with a minimum 90db medium loud warble tone at extra fast rate in a panel mount case. The alarm horn shall be provided with a two-position 'Mute-Auto' switch mounted on the inner door.

Both the alarm light and horn shall automatically reset when the fault condition ceases to exist

A two-position, maintained 'Mute-Auto' switch shall be supplied for the alarm horn and mounted on the inner door. The switch shall be complete with required contact blocks and an engraved position indicating ring legend plate.

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January 24, 2017

SPECIFICATIONS
CIVIL DRAWINGS
LIFT STATION & SEWER SYSTEM
EDGAR SPRINGS MAINTENANCE BUILDINGS

CDG PROJECT NO.
16059

DRAWING NO.
C-303

FIBERGLASS BASIN/WETWELL WITH "KEY HOLE" STYLE ATTACHED VALVE BOX

SCOPE
This specification is intended to describe the minimum design and manufacturing requirements for Filament Wound Fiberglass Reinforced Plastic Sump Basins and Wetwells.

REFERENCED STANDARDS

- ASTM D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- ASTM D3753, Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wet wells.
- AWWA C950, Fiberglass Pressure Pipe.
- ASME RTP-1 MN3-321

DESIGN

GENERAL
Desing of flat bottoms shall account for both limiting stress and deflection. Design shall be based on industry standard lamination analysis for the flass reinforcement layers and resins system. Design shall determine cylinder and flat bottom thicknesses.

LAMINATE PROPERTIES
The minimum flexural modulus in the circumferential direction shall be 2,000,000 psi and in the longitudinal directions shall be 1,000,000 psi.

WALL THICKNESS
Wall thickness shall vary with basin/wetwell height. Calculated wall thicknesses shall be based on the following site assumed conditions:

- ASTM D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- ASTM D3753, Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wet wells.

Calculations shall employ a Luchers' safety factor of 2.

DESIGN

RESIN
Resins used shall be commercial grade unsaturated polyester type, suitable for the intended service as indicated by usage history or resin manufacturer's recommendation.

CURE SYSTEM
Resin promotion and catalyst system used shall follow resin manufacturers' guidelines.

FILLERS AND ADDITIVES
No fillers or resin extenders of any type shall be utilized. A maximum of two percent by weight of any commercial grade thixotropic agent may be added to resins for the purpose of viscosity control.

REINFORCING MATERIALS
Reinforcing material shall be commercial grade "E" type glass fibers in the form of chopped strand mat, chopped roving, woven roving or continuous roving. Uni-directional glass shall be used in addition to any other glass used. Glass fibers shall be treated with a coupling agent that facilitates bonding between the reinforcement and the resin.

LAMINATE

GENERAL
Basin laminates shall consist of three layers (inner surface, interior layer and structural layer)

INNER SURFACE
The inner surface shall consist of a resin rich layer with no exposed fibers.delines.

INTERIOR LAYER
The interior layer shall consist of a resin rich reinforced layer with a nominal fiber content of 30 percent. Reinforcements shall be chopped strand mat or chopped roving.

STRUCTURAL LAYER
The structural layer shall be chop-hoop filament wound consisting of chopped stand and continuous roving reinforcement oriented in the hoop direction. As required, uni-diectional roving shall be incorporated into this layer to enhance longitudinal properties. The exterior surface shall be relatively smooth and with no exposed fibers or sharp projections. Nominal fiber content on the structural layer shall be a minimum of 62 percent.

APPURTENANCES

TOP FLANGE
The basin shall have a top flange that is 3" larger in the diameter than the interior diameter of the tank.

BOTTOM
The bottom of the wetwell shall be built to withstand full exterior water column with a maximum deflection $\frac{3}{8}$".

BOTTOM ANTI-FLOATATION FLANGE
The bottom anti-float flange shall be minimum of 3" larger in diameter than the wetwell and be constructed to withstand the maximum uplifting force that could be exerted with an empty wetwell and full water column outside the tank.

BASIN/WETWELL
Shall be designed to withstand H-20 traffic load when properly installed.

ATTACHED VALVE BOX
Shall be "Key Hole" style. Valve box bottoms shall be designed to drain any accumulated liquid toward the wetwell, and exit the dry well into the wetwell through a simple drain, or check valve drain assembly. The attached valve box shall be attached in a manner as to be structurally sound and properly aligned with wetwell. The valve box shall be sized in width and depth to accept the piping required to meet the specification.

COVER ATTACHMENTS
Stainless steel threaded inserts shall be installed in the top flange of the basin/wetwell to accommodate attachment of cover. The inserts shall be $\frac{3}{8}$ inch diameter in a bolt pattern as required to secure cover.

QUALITY ASSURANCE

VISUAL ACCEPTANCE
The inner surface shall be free of exposed fiber, crazing and delamination. No Blisters larger than $\frac{1}{2}$ inch or wrinkles more than $\frac{1}{8}$ inch in depth will be allowed.

LAMINATE CURE
Laminate cure shall be indicated by means of Barcol hardness measured in accordance with ASTM D2583. The average Barcol hardness shall not be less than 90 percent of the resin manufacturer's recommendation for clear resin castings.

WORKMANSHIP
All workmaship and materials throughout shall be of the highest quality available.

INSTALLATION
Installation instructions shall be laminated into the wall of each basin/wetwell. The installation must comply with the installation instructions.

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DRAWING NO.
C-304

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