MEGHAN PUMP STATION
SAWS Job No. 19-1006
SAWS Solicitation No. CO-00388

ADDENDUM NO. 1
January 6, 2021

To Bidder of Record:

This addendum, applicable to work referenced above, is an amendment to the bidding documents and as such will be a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the addendum number and issue date in the space provided in the submitted bid proposal.

RESPONSES TO QUESTIONS

QUESTION 1: Will there be specs for material and execution?

RESPONSE: These specifications have been added to the SAWS website.

QUESTION 2: Ref Plan Page G3 - Water Plant Note #12 - "All internal plant piping shall be ductile iron pipe or welded steel pipe (WSP)…." Ref Plan Page C4 – Piping Note #1 – "All Pipe to be weld steel (WS) unless otherwise noted". Please verify which note takes precedence on this project? Is ductile iron pipe allowed just where noted on sheet C4 or allowed for all plant piping?

RESPONSE: Piping Note No. 1 on Sheet C4 takes precedence.

QUESTION 3: Ref Plan Page C4 – The Metering station piping is called out 8" WS-PW. Ref Plan Page M3 – Meter Station Details. Piping note #1 – "All pipe shall be ductile iron (DI) unless others noted." Please verify if the Metering Station Piping is ductile iron pipe or welded steel pipe.

RESPONSE: Remove and replace Sheet M3 with the attached Sheet M3. Notable revisions include revising Piping Note No. 1 and revising the piping fittings.

QUESTION 4: Ref Plan Page C4. Small Piping Line Chart No. L6. 2-1/2" C900 DR18 is not made (C900 pipe starts at 4" Size). Will Sch80 PVC Pipe & Fittings be an acceptable material to use in this location?

RESPONSE: No, Sch80 PVC will not be acceptable. Remove and replace Sheet C4 with the attached Sheet C4. Notable revisions include changing the piping material for L6 to copper. Remove and replace Section 15600 with the attached Section 15600. Notable revisions include revising the requirements copper tubing.

QUESTION 5: Ref Plan page C4. Please provide a specification for the ¾" HPDE Air Lines.

RESPONSE: Remove and replace Section 15600 with the attached Section 15600. Notable revisions include adding a section for flexible HDPE for the HDPE air lines.

QUESTION 6: Do you anticipate extending the bid due date?

RESPONSE: The bid due date is not anticipated being extended.

QUESTION 7: What additional details are you willing to provide, if any, beyond what is stated in the bid documents concerning how you will identify the winning bid?

RESPONSE: The San Antonio Water System (SAWS) Board of Trustees or its designee have determined that the Competitive Bidding method of procurement will be utilized for this project. The construction contract will be awarded to the lowest responsible bidder. This procurement shall conform to Section 2269 of the Texas Government Code.

QUESTION 8: Was this bid posted to the nationwide free bid notification website at www.mygovwatch.com/free?

RESPONSE: No, it was not posted to mywatch.com

QUESTION 9: Other than your own website, where was this bid posted?

RESPONSE: The solicitation was also advertised to Hart Beat newspaper.

QUESTION 10: Please provide a flange bolt spec to use with the steel pipe.

RESPONSE: Refer to Section 05501.

QUESTION 11: Please provide a spec for the 24" HDPE storm sewer.

RESPONSE: Remove and replace Section 02500 with the attached Section 02500. Notable revisions include adding Language for HDPE storm sewer.

QUESTION 12: Can you provide a specification for the ¾" HDPE for the air lines? Refer to plan page C4.

RESPONSE: A section for the HDPE air lines has been added to Section 15600, attached in Addendum No. 1.

QUESTION 13: Lightning Protection Specification Section 16502 1.1 A1 specifies lightning protection is to be provided for the Elevated Storage Tank. This project has a Ground Storage tank. Please clarify that the lighting protection required is indeed for the Ground Storage Tank.

RESPONSE: Lightning protection is required for ground storage tanks.

QUESTION 14: Will the Control Building require Lightning Protection per the usual SAWS Standards?

RESPONSE: The control building requires lightning protection per SAWS standards.

QUESTION 15: Fixture Schedule Type D fixtures does not show on the drawings. Considering the type of fixtures specified for type A, Vapor Tight Fiberglass enclosure, should the Type A be utilized in the Chemical Storage Room and Type D utilized in the Air Compressor Room and the Electrical (MCC) Room?

RESPONSE: Utilize Type A fixtures in the chemical storage room and Type D fixtures in the air compressor and electrical rooms.

QUESTION 16: Fixture Type EX shown in the plans is not listed on the Fixture Schedule. Please confirm Lithonia LHXC-W-1-RW-CH3 combination Exit & Emergency Fixture is desired.

RESPONSE: Provide Lithonia LHXC-W-1-RW-CH3 fixtures where type EX fixtures are shown.

QUESTION 17: Will a pre-packaged pump station be acceptable to bid?

RESPONSE: No, a pre-packaged pump station will not be acceptable to bid.

QUESTION 18: Sheet M1 Page 23 of 72 : GST Accessory Location "8" Overflow/Drain Line" despite "overflow sized by engineer" and "12" or 18" Tank Drain" being shown DD-904-06. What does the 8" reference?

RESPONSE: Remove and replace Sheet M1 with the attached Sheet M1. Notable revisions include revising the overflow and drain to be 12". The drain line shall transition to 18" as shown DD-904-06, Sheet 2 of 3.

QUESTION 19: Overflow Pipe is called out as 12" (per Spec 15240-7 Pg520 of 736) or "Sized by Engineer" DD-904-07 which is correct?

RESPONSE: The overflow pipe shall be 12".

QUESTION 20: Why have a handrail around the Fill Line? DD-904-01 Shows "E" Handrail, at location "Q" for the inlet pipe.

RESPONSE: The handrail will not be required because the diameters of the fill line and suction lines are less than 20" as shown on DD-904-05, Sheet 1 of 1 on Sheet M2.

QUESTION 21: 1.05, D states, "Pumps, as an assembled unit, shall be compliant to NSF/ANSI Standard 61 and meet the requirements of the US Safe Drinking Water Act." and 1.05, E, "Pumps shall include a nameplate displaying NSF-G compliant."

RESPONSE: Yes, the pumps are required to meet the requirements of the specification. Pumps are not required to be certified for NSF/ANSI Standard 61 and NSF-G, but they must be compliant with these standards.

QUESTION 22: 2.4, A lists American Turbine. The issue is that American Turbine doesn't have NSF-61 approval on their pumps but "National Pump Company" does. National Pump Company purchased American Turbine back in 2012. The actual brand name to meet this spec will be National Pump Company. Please formalize or address this in Section 15230.

RESPONSE: Remove and replace Section 15230 with the attached Section 15230. Notable revisions include revising the pump manufacturer list.

QUESTION 23: According to Table 1 of the December 4, 2018 geotechnical report (revised 11/20/19), the borings pertaining to the proposed tank are B-1, B-2, and B-3. However, the Boring Location Plan (Fig. 2) of the report shows the three borings dispersed over a large are – even straddling what appears to be a local road – which leads to the conclusion that only one of these three borings specifically pertains to the proposed tank. Are all three borings (B-1, B-2, and B-3) within or near the proposed tank footprint?

RESPONSE: Borings B-1, B-2, and B-3 are within the proposed tank footprint.

QUESTION 24: Page 6 of the geotechnical report estimates an excavation depth of 10' to 12' "below existing grade." Given that the excavation elevation recommended on the same page is 1434.5', this means that according to the report, existing grade elevations vary from 1444.5' to 1446.5'. However, according to sheets C1 and C3 of the bid drawings (dated September 2020), existing grade elevations within the tank footprint vary from 1436' over most of the footprint, to elevation 1437' on the north side. Can we assume that the site has been regraded since the geotechnical report was written; and that current grade elevations are as shown in Sheets C1 and C3 of the bid drawings? Or alternatively what are the surface elevations at borings B-1, B-2, and B-3?

RESPONSE: The site has been regraded since the geotech report was written. The existing ground contours shown on Sheet C1 and Sheet C3 show the current grading of the site.

QUESTION 25: Is it necessary to design the tank against hydrostatic uplift due to high groundwater or flood levels, and if so, what is the design groundwater or flood elevation?

RESPONSE: Yes, see Section 15240, subsection 2.2.D.

QUESTION 26: What are the voltage and Operating time for the motor operators?

RESPONSE: The operating voltage is 460 volts, 3-phase. The operating time for electric actuators shall be less than 30 seconds per Section 15680, subsection 2.2.c.

QUESTION 27: Will Henry Pratt be accepted as an approved manufacturer for the Air valves and check valves?

RESPONSE: If Henry Pratt is reviewed and deemed to be an approved equal during the submittal phase of the project, it may be approved.

QUESTION 28: Sheet No. M2, Overflow Detail, please confirm the overflow weir cone may be formed from concrete in lieu of being fabricated from 316 S.S.

RESPONSE: Bid pricing shall be based on the 316 stainless steel overflow weir as shown in DD-904-07, Sheet 1 of 1 on Sheet M2. Alternate overflow weir arrangements may be submitted for review in construction.

QUESTION 29: We came across this project and had a quick question about the chlorination equipment. Sheet I7 (72 of 72) calls for an emergency shutoff valve system, but there is no mention of a system in the specifications. Is an emergency shutoff valve system required for this project?

RESPONSE: Yes, the emergency shutoff valve system is required. Provide emergency shutoff valve system in accordance with SAWS standards and chlorine system requirements.

QUESTION 30: Section 15240-3.3-E.3 states testing shall be "at the expense of the Contractor or Owner" please clarify who is responsible for paying for material testing?

RESPONSE: The Contractor shall pay for materials testing. Reference the revised Section 01411 in Addendum No. 1.

QUESTION 31: Spec section 15230, page 8, letter D, number 1 states the pump discharge flanges are to be ANSI 300. However, spec section 15600, page 4, letter C states steel pipe flanges are to be ANSI class 125. Please clarify the flange class.

RESPONSE: The subsection of 15600 referenced in your question refers to stainless steel piping. ANSI 300 pump discharge flanges are required.

QUESTION 32: Would it be possible to include ABB Electromagnetic Flowmeters under the approved manufacturer list?

RESPONSE: Provide pricing for specified items and equipment for the bid. Consideration for alternative equipment will be evaluated after the bid date.

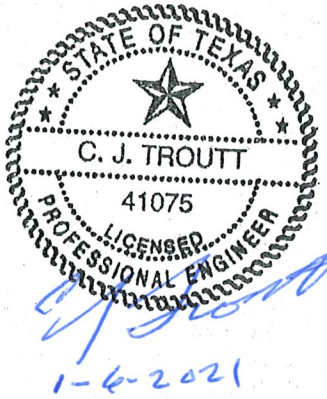
END ADDENDUM 1

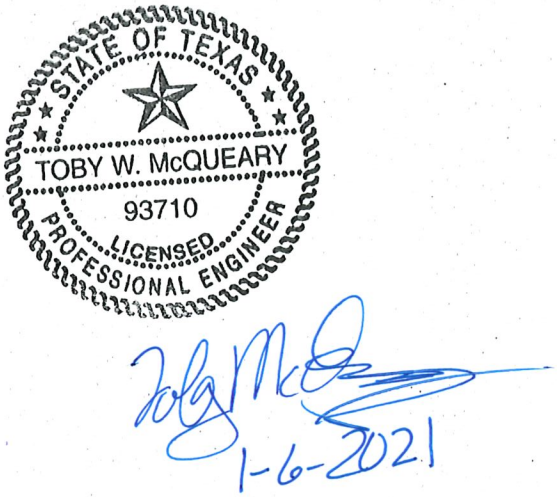
This Addendum, is forty-eight (48) pages in its entirety.

Attachments:

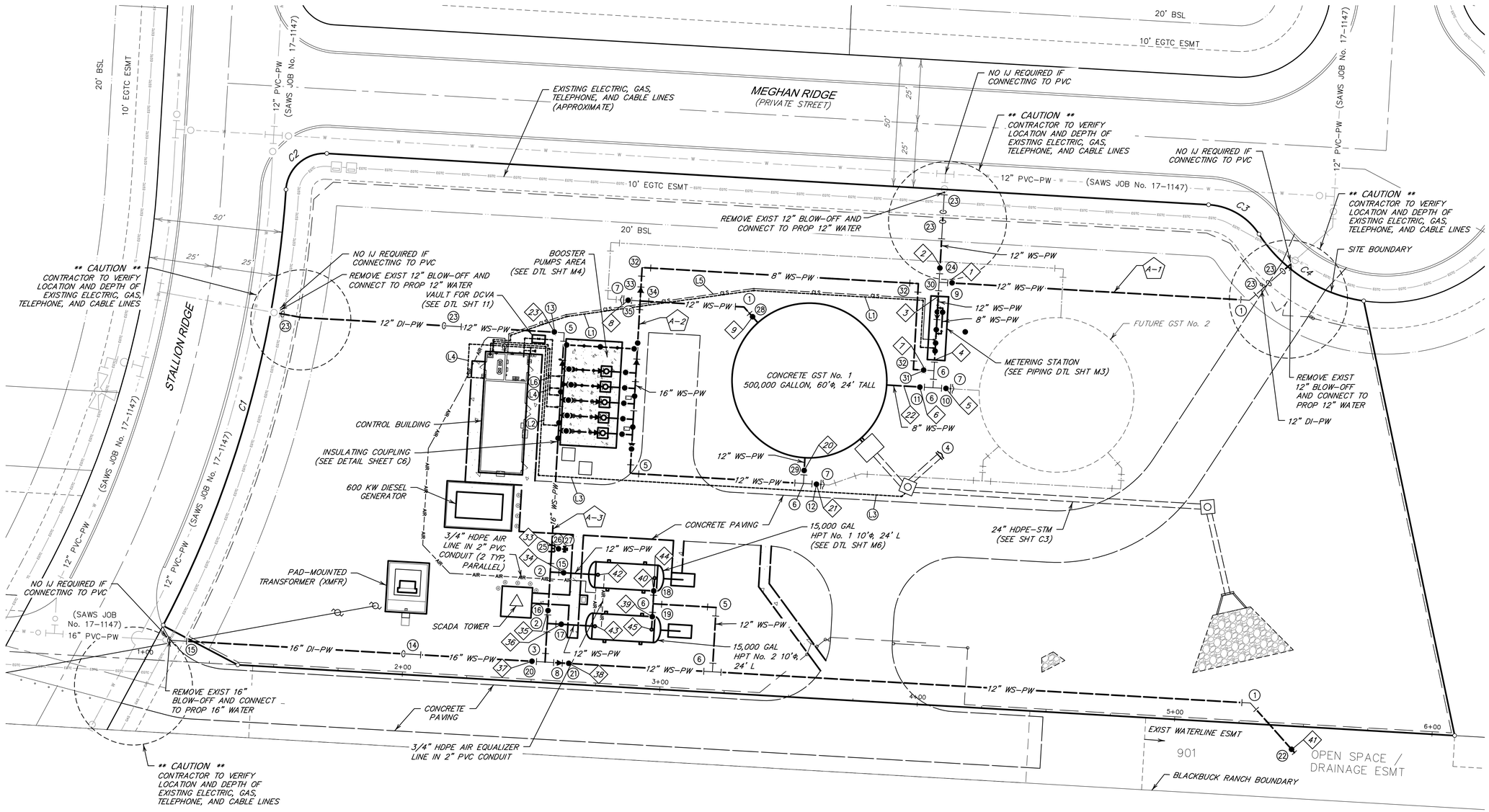
Revised sheets C4, M1, M3, E5, and E23
Revised/added specification sections:

- 01411, Testing Laboratory Services Water Plants
- 02500, Storm Sewers
- 15230, Vertical Turbine Pumps
- 15600, Plant Piping
- 16502, Lightning Protection System





ORIGINAL SCALE IN INCHES FOR REDUCED PLANS



0 10 20 40 60
SCALE: 1" = 20'

PIPING NOTES:

1. All pipe to be welded steel (WS) pipe unless otherwise noted.
2. All buried PVC shall have marker tape.

CATHODIC PROTECTION LEGEND

- KX — Test Station (See Sheet C8)
- A-X — Galvanic Anode Bed (See Sheet C8)

ABBREVIATIONS

B.S.L.	BUILDING SETBACK LINE
E.G.T.C.	ELECTRIC, GAS, TELEPHONE, COMMUNICATIONS
ELEC.	ELECTRIC
ESMT.	EASEMENT
FH	FIRE HYDRANT
OE	OVERHEAD ELECTRIC
PP	POWER POLE
R.O.W.	RIGHT-OF-WAY
TS	TOP OF SLAB ELEVATION
FG	FINISHED GROUND ELEVATION

PLANT PIPING TABLE No. 1

No.	DESCRIPTION
①	12"x45° Welded Bend
②	16"x12" Welded Tee
③	16"x16" Welded Tee
④	24" HDPE Blind Flange, FJ
⑤	12"x90° Welded Bend
⑥	8"x8" Welded Tee
⑦	8" Blind Flange, FJ
⑧	16"x12" Reducer
⑨	12" Gate Valve w/ Valve Box (GTV-01-001)
⑩	8" Gate Valve w/ Valve Box (GTV-02-201)
⑪	8" Gate Valve w/ Valve Box (GTV-02-101)
⑫	12" Gate Valve w/ Valve Box (GTV-02-001)

PLANT PIPING TABLE No. 2

No.	DESCRIPTION
⑬	12" Gate Valve w/ Valve Box (GTV-03-003)
⑭	16"x45° DI Bend w/ Restraints
⑮	12" Gate Valve w/ Valve Box (GTV-04-101)
⑯	16" Butterfly Valve w/ Valve Box (GTV-04-001)
⑰	12" Gate Valve w/ Valve Box (GTV-04-002)
⑱	12" Gate Valve w/ Valve Box (GTV-04-101)
⑲	12" Gate Valve w/ Valve Box (GTV-04-102)
⑳	16" Butterfly Valve w/ Valve Box (BFV-04-002)
㉑	12" Gate Valve w/ Valve Box (GTV-04-003)
㉒	12" Blow-Off Valve (Permanent)
㉓	12"x45° DI Bend w/ Restraints
㉔	12" Gate Valve w/ Valve Box (GTV-01-002)

PLANT PIPING TABLE No. 3

No.	DESCRIPTION
㉕	16"x6" Tee, MJ
㉖	6" Gate Valve w/ Valve Box
㉗	6" Fire Hydrant Assembly (See Detail Sheet M8)
㉘	12" Gate Valve w/ Valve Box (GTV-02-102)
㉙	12" Gate Valve w/ Valve Box (GTV-02-103)
㉚	12"x12" Welded Tee
㉛	12" Gate Valve w/ Valve Box (GTV-01-006)
㉜	8"x90° Welded Bend
㉝	12"x8" Welded Reducer
㉞	12"x12" Welded Cross
㉟	12" Gate Valve w/ Valve Box (GTV-02-002)

SMALL PIPING LINE CHART

No.	DESCRIPTION
L1	2" Sch 80 PVC-PW Sample Water Line to Analyzer
L2	2" Sch 80 PVC-PW Sample Water Line to Analyzer
L3	2" Sch 80 PVC-DR Drain Line to Storm Inlet
L4	2" Sch 80 PVC-PW Line to Emergency Eye Wash / Safety Shower Station & Chlorine Disinfection System
L5	2" Sch 80 PVC-CLS Line to Metering Station
L6	2.5" (Copper Tubing-PW Line to Fire Protection Riser

1

NO.	DATE	REVISIONS	APP.
1	1/5/21	REVISED PER ADDENDUM NO. 1	TWM

SOUTHERLAND CANYONS II, LLC
SPRING BRANCH, TEXAS

MEGHAN PUMP STATION

ENLARGED PIPING PLAN

JONES|CARTER
Texas Board of Professional Engineers Registration No. F-439
4350 Lockhill Selma Road, Suite 100 • San Antonio, Texas 78249 • 210.494.5511

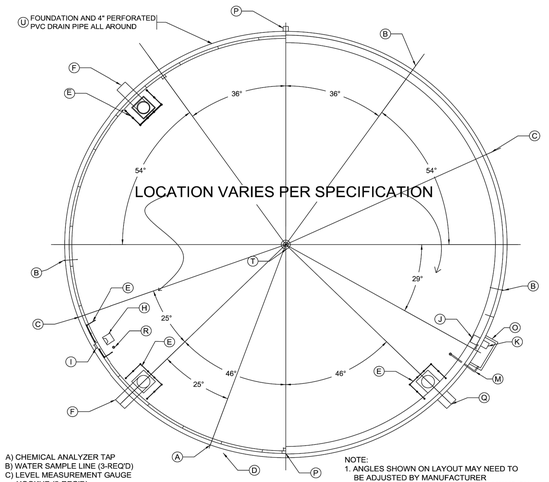
SCALE: 1"=20' DGN. BY: JSB / LAM
DATE: MARCH 2020 DWN. BY: JRB
JOB NO. S0406-0045-00 DWG. NO.
SUBMITTED: SURV. BY:
F.B. NO.

STATE OF TEXAS
TOBY W. McQUEARY
98710
LICENSED PROFESSIONAL ENGINEER
9-16-2020

SHEET NO.
C4
9 OF 72

K:\S0406\S0406-0045-00 Blackbuck Regional Pump Station, San Ant\2 Design Phase\CAD\Blackbuck Booster Station\S0406-0045-00 BBS PIPING.dwg

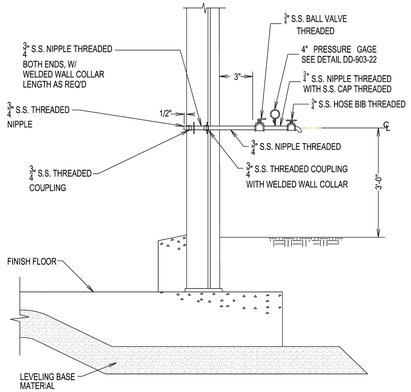
0 1 2 3 4 5 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS



A) CHEMICAL ANALYZER TAP
B) WATER SAMPLE LINE (3-REQ'D)
C) LEVEL MEASUREMENT GAUGE HOOKUP (2-REQ'D)
D) TANK FOUNDATION AND DRAIN
E) HANDRAIL
F) OUTLET PIPE (2-REQ'D)
H) 42" x 36" ROOF HATCH (1-REQ'D)
I) TANK LADDER EXTERIOR & INTERIOR
J) WEIR BOX (1-REQ'D) - IN TABLE
K) OVERFLOW PIPE (1-REQ'D)
M) 12" DRAIN (1-REQ'D)
O) DRAINAGE STRUCTURE
P) 36" SHELL MANWAY (2-REQ'D)
Q) INLET PIPE (1-REQ'D) - IN TABLE
R) 3" FLG. OUTLET (ELECTRODE HOLDER PIPE SUPPORT) (1-REQ'D)
T) CENTER VENT (1-REQ'D)
U) FOUNDATION AND DRAIN ALTITUDE VALVE ASSEMBLY (NOT SHOWN)

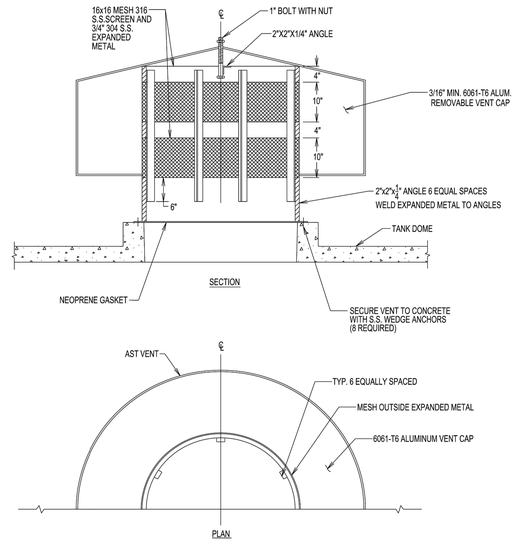
NOTE:
1. ANGLES SHOWN ON LAYOUT MAY NEED TO BE ADJUSTED BY MANUFACTURER IN ORDER TO CENTER PIPING & MANWAYS ON THE PRECAST PANELS.
2. CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF HOMEOWNER'S PROPERTY ADJACENT TO SITE LOCATION.
3. ALL ABOVE GROUND PIPING SHALL BE STEEL PER SAWS SPECIFICATIONS.
4. ISOLATE DISSIMILAR METALS W / INSULATION KITS.

DD-904-01	SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	APPROVED: NOV 2011
SHEET 1 OF 1	TYPICAL RESERVOIR LAYOUT	REVISED: NOV 2011



NOTE:
1. ALL STAINLESS STEEL IS TYPE 316L
2. CHEMICAL ANALYZER TAP AND LEVEL MEASURMENT GAUGES ARE SAME DIMENSIONS EXCEPT FOR HOSE BIB.

DD-904-02	SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	APPROVED: JULY 2011
SHEET 1 OF 1	WATER SAMPLE LINE	REVISED: NOVEMBER 2011



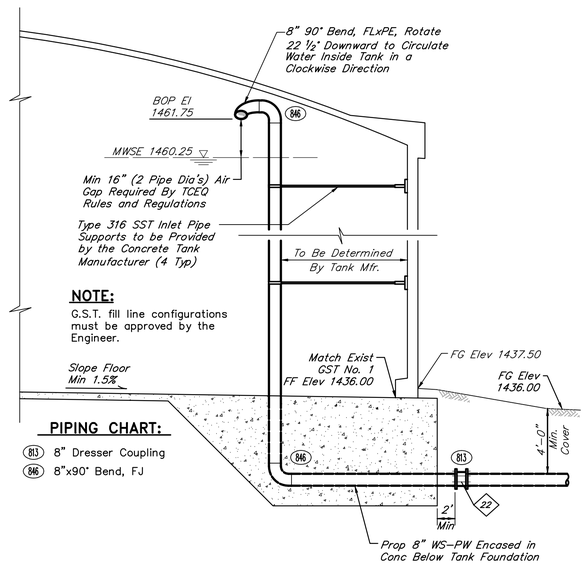
NOTE: VENT SIZE AS REQUIRED BY DESIGN.

AST VENT ONLY
(ALWAYS SAFE TANK VENT)

DD-904-03	SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	APPROVED: JULY 2011
SHEET 1 OF 1	CENTER VENT	REVISED: NOV 2011

PIPING NOTES:

1. Denotes the use of of a restrained joint connection.



NOTE:

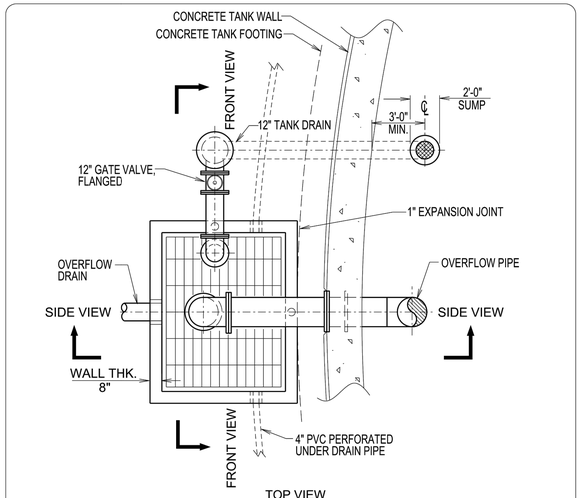
G.S.T. fill line configurations must be approved by the Engineer.

PIPING CHART:

813 8" Dresser Coupling
846 8"x90° Bend, FJ

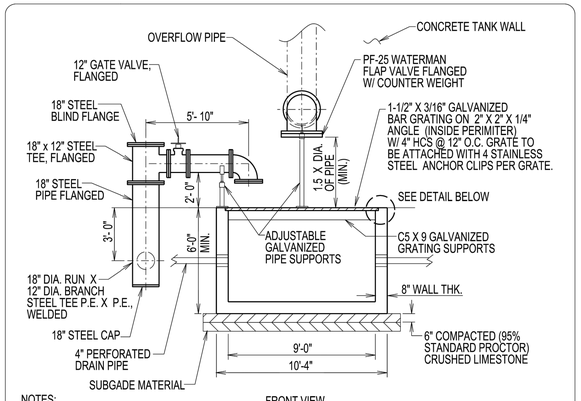
G.S.T. FILL LINE DETAIL

NOT TO SCALE



NOTES:
1. DRAIN BOX (9' X 7' MIN.)
2. DRAINAGE BOX STRUCTURE SIZED AS PER INFLOW AND OUTFLOW CAPACITY CACULATIONS.
3. ALL PENETRATIONS SHALL BE FILLED WITH LINK SEAL AND COVERED WITH NON-SHRINK GROUT.
4. ALL REINFORCING #6 @ 12" O.C. , UNLESS OTHERWISE NOTED.
5. OVERFLOW PIPE AND OVERFLOW DRAIN SHALL BE SIZED BY THE ENGINEER.
6. ALL WELDED STEEL PIPING SHALL BE COATED AND LINED WITH A FUSION BONDED EPOXY COATING, 18-20 MILS. D.F.T. MINIMUM. EXPOSED STEEL PIPING SHALL ALSO RECEIVE A TIE COAT AND A FINISHED COAT.

DD-904-06	SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	APPROVED: MAY 2014
SHEET 1 OF 3	DRAINAGE STRUCTURE	REVISED:



NOTES:
1. DRAIN BOX (9' X 7' MIN.)
2. DRAINAGE BOX STRUCTURE SIZED AS PER INFLOW AND OUTFLOW CAPACITY CACULATIONS.
3. ALL PENETRATIONS SHALL BE FILLED WITH LINK SEAL AND COVERED WITH NON-SHRINK GROUT.
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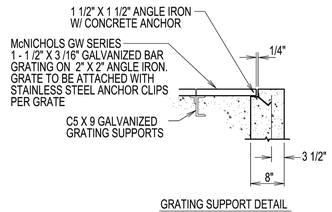
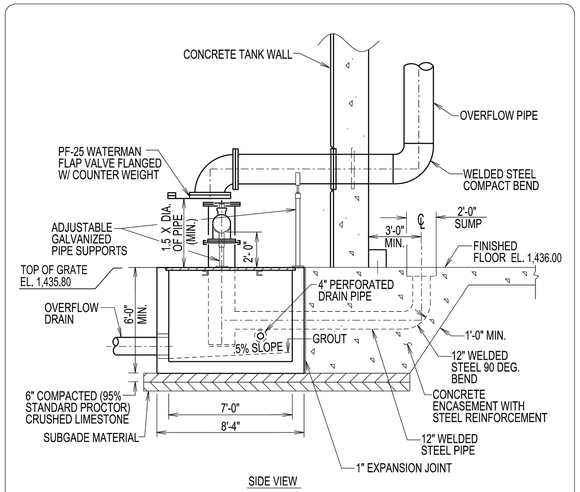


GRATING SUPPORT DETAIL

DD-904-06	SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	APPROVED: MAY 2014
SHEET 2 OF 3	DRAINAGE STRUCTURE - FRONT VIEW	REVISED:



NOTES:
1. DRAIN BOX (9' X 7' MIN.)
2. DRAINAGE BOX STRUCTURE SIZED AS PER INFLOW AND OUTFLOW CAPACITY CACULATIONS.
3. ALL PENETRATIONS SHALL BE FILLED WITH LINK SEAL AND COVERED WITH NON-SHRINK GROUT.
4. ALL REINFORCING #6 @ 12" O.C. , UNLESS OTHERWISE NOTED.
5. OVERFLOW PIPE AND OVERFLOW DRAIN SHALL BE SIZED BY THE ENGINEER.
6. ALL WELDED STEEL PIPING SHALL BE COATED AND LINED WITH A FUSION BONDED EPOXY COATING, 18-20 MILS. D.F.T. MINIMUM. EXPOSED STEEL PIPING SHALL ALSO RECEIVE A TIE COAT AND A FINISHED COAT.

DD-904-06	SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	APPROVED: MAY 2014
SHEET 3 OF 3	DRAINAGE STRUCTURE - SIDE VIEW	REVISED:

GST ACCESSORY LOCATIONS

ACCESSORY	ANGLE
8" Fill Line	93°19'33.2"
12" Overflow/Drain Line	138°19'40.3"
12" Suction Line	183°19'40.3"
12" Suction Line	318°19'40.3"
36" Shell Manway	0°
36" Shell Manway	160°
Pressure Sensing Line	224°52'2.2"
Water Sample Line	113°
Water Sample Line	293°
Water Sample Line	219°8'7.7"
Access Ladder	270°
42"x36" Access Hatch	273°48'44.6"

1 All angles measured clockwise from true north

CATHODIC PROTECTION LEGEND

XX Test Station (See Sheet C8)
4-X Galvanic Anode Bed (See Sheet C8)

NO.	DATE	REVISIONS	APP.
1	1/5/21	REVISED PER ADDENDUM NO. 1	TWM

SOUTHERLAND CANYONS II, LLC
SPRING BRANCH, TEXAS

MEGHAN PUMP STATION

GROUND STORAGE TANK DETAILS SHEET 1 OF 2

JONES|CARTER
Texas Board of Professional Engineers Registration No. F-439
4350 Lockhill Selma Road, Suite 100 • San Antonio, Texas 78249 • 210.494.5511

SCALE: AS SHOWN DGN. BY: JSB / LAM
DATE: MARCH 2020 DWN. BY: JRB
JOB NO. S0406-0045-00 DWG. NO.
SUBMITTED: SURV. BY:
F.B. NO.

STATE OF TEXAS
TOBY W. McQUEARY
68710
LICENSED PROFESSIONAL ENGINEER
9-16-2020

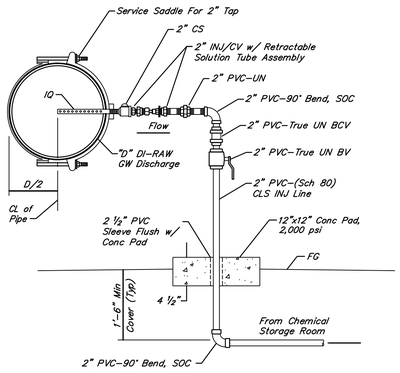
SHEET NO.
M1
23 OF 72

K:\S0406\S0406-0045-00 Blackbuck Regional Pump Station, San Ant\2 Design Phase\CAD\Blackbuck Booster Station\S0406-0045-00 BBS DETAILS.dwg

0 1 2 3 4 5 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

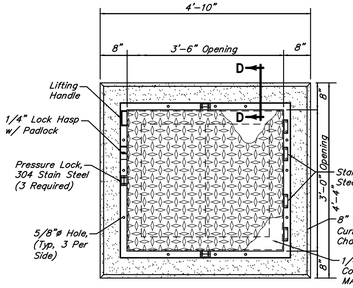
NOTES:

1. All aboveground water and chemical solution lines shall be insulated against UV light and weather.
2. All PVC sleeves shall be sized to minimize the void between the main pipe and the sleeve to a maximum 1/4–inch (1/4") gap.
3. "D" is equal to the pipe diameter.

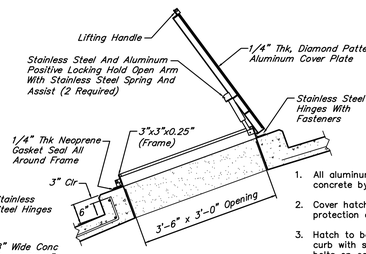


CHLORINE SOLUTION (CLS) INJECTION TAP DETAIL

NOT TO SCALE



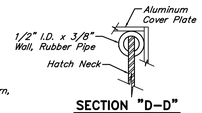
PLAN VIEW



TYPICAL SECTION

NOTES:

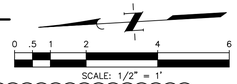
1. All aluminum shall be isolated from concrete by a neoprene gasket.
2. Cover hatch with polyethylene for protection during construction.
3. Hatch to be secured to concrete curb with stainless steel Hilti Kwik bolts on each side of frame with minimum 2–1/4" embedment. (12 required)
4. Roof hatches to be located o that hatch opens away from tank roof accessories.



SECTION "D–D"

MODIFIED F10 – 42"x36"DOME HATCH DETAIL CONCRETE TANK

NOT TO SCALE



PIPING NOTES:

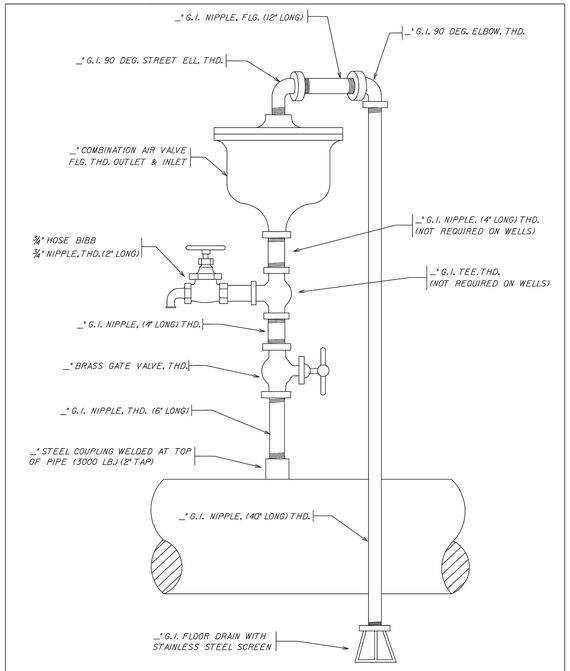
1. All pipe shall be welded steel (WS) pipe unless otherwise noted.
2. Denotes the use of a restrained joint connection.
3. Small diameter piping is shown schematically. Contractor shall field route piping, providing offsets, fittings, etc., as required.
4. All pipe penetrations shall be made through a pipe saddle.

PIPING CHART:

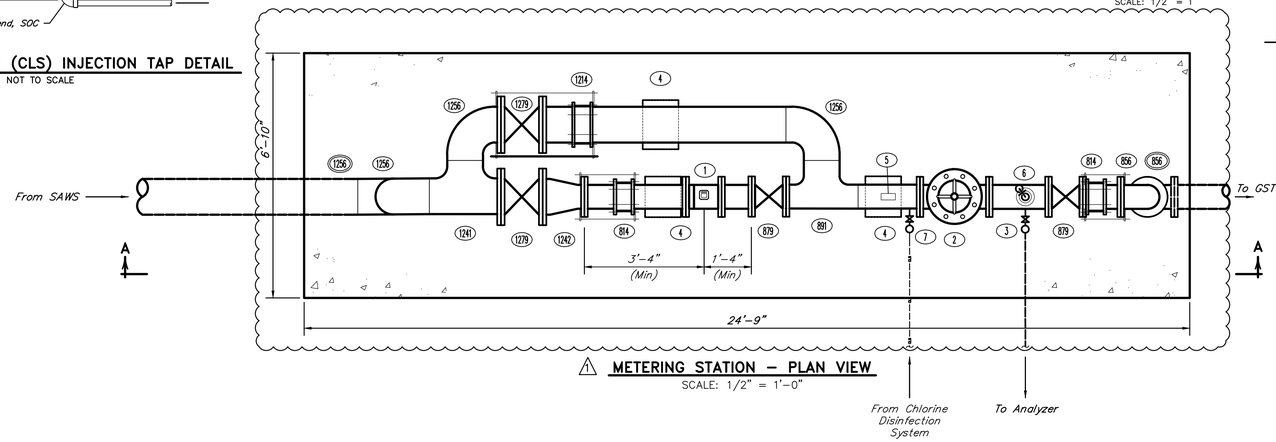
814	8" Restrained Flange Coupling Adaptor
891	8"x8"x12" Bull Head Tee, FJ
856	8"x90° Bend, FJ
879	8" OS&Y Resilient Seat Gate Valve, FJ
1214	12" Restrained Flange Coupling Adaptor
1241	12"x12" Tee, FJ
1242	12"x8" Concentric Reducer, FJ
1256	12"x90° Bend, FJ
1278	12" OS&Y Resilient Seat Gate Valve, FJ

METERING STATION ACCESSORY CHART:

1. 8" Rosemont 8750W Magnetic Flowmeter
2. 8" Cla–Val 58–01 Pressure Sustaining Valve w/Anti–Cavitational Trim
3. 2" Sch 80 PVC Sample Line to Analyzer
4. Concrete Pipe Support (See Detail Sheet S5)
5. Pressure Gauge (0–100 psi) w/ Shut–Off Ball Valve and Low Pressure Switch (See Detail This Sheet)
6. 1/2" Air Release Valve, APCO Model No. 50, w/ 3/32" Orifice, No. 16 Mesh, 316 Stainless Steel Screen
7. 2" Sch 80 PVC–CLS Line From Chlorine Disinfection System

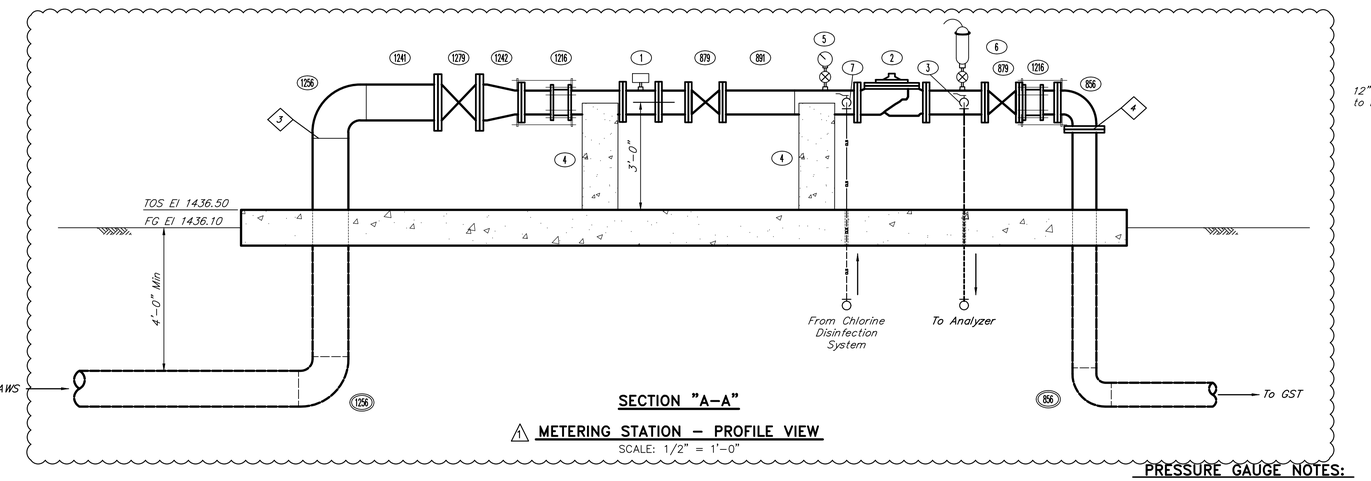


NOTE:
SIZE TO BE VERIFIED BY ENGINEER.



⚠ METERING STATION – PLAN VIEW

SCALE: 1/2" = 1'–0"



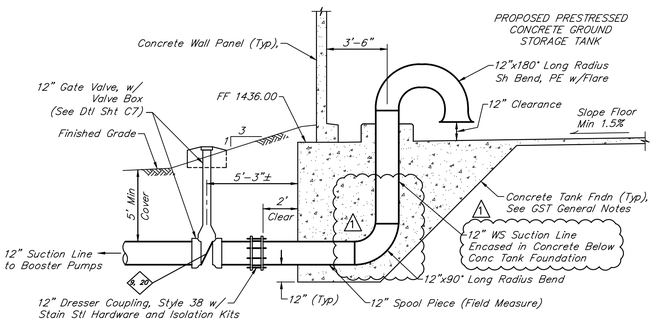
SECTION "A–A"

⚠ METERING STATION – PROFILE VIEW

SCALE: 1/2" = 1'–0"

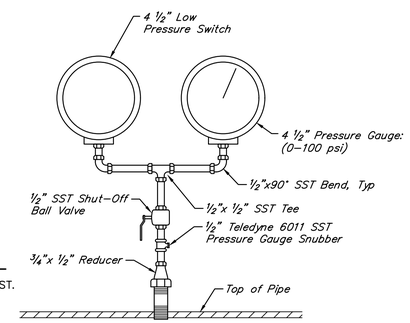
PRESSURE GAUGE NOTES:

1. All pipe and fittings shall be 304 SST.



G.S.T. SUCTION/EQUALIZER LINE DETAIL

NOT TO SCALE



PRESSURE GAUGE DETAIL

NOT TO SCALE

CATHODIC PROTECTION LEGEND

XX Test Station (See Sheet C8)

A–X Galvanic Anode Bed (See Sheet C8)

NO.	DATE	REVISIONS	APP.
1	1/5/21	REVISED PER ADDENDUM NO. 1	TWM

SOUTHERLAND CANYONS II, LLC
SPRING BRANCH, TEXAS

MEGHAN PUMP STATION

GROUND STORAGE TANK & METERING STATION DETAILS

JONES|CARTER
Texas Board of Professional Engineers Registration No. F-439
4350 Lockhill Selma Road, Suite 100 • San Antonio, Texas 78249 • 210.494.5511

SCALE: AS SHOWN DGN. BY: JSB / LAM
DATE: MARCH 2020 DWN. BY: JRB
JOB NO. S0406–0045–00 DWG. NO.
SUBMITTED: SURV. BY:
F.B. NO.

STATE OF TEXAS TOBY W. McQUEARY 98710 LICENSED PROFESSIONAL ENGINEER

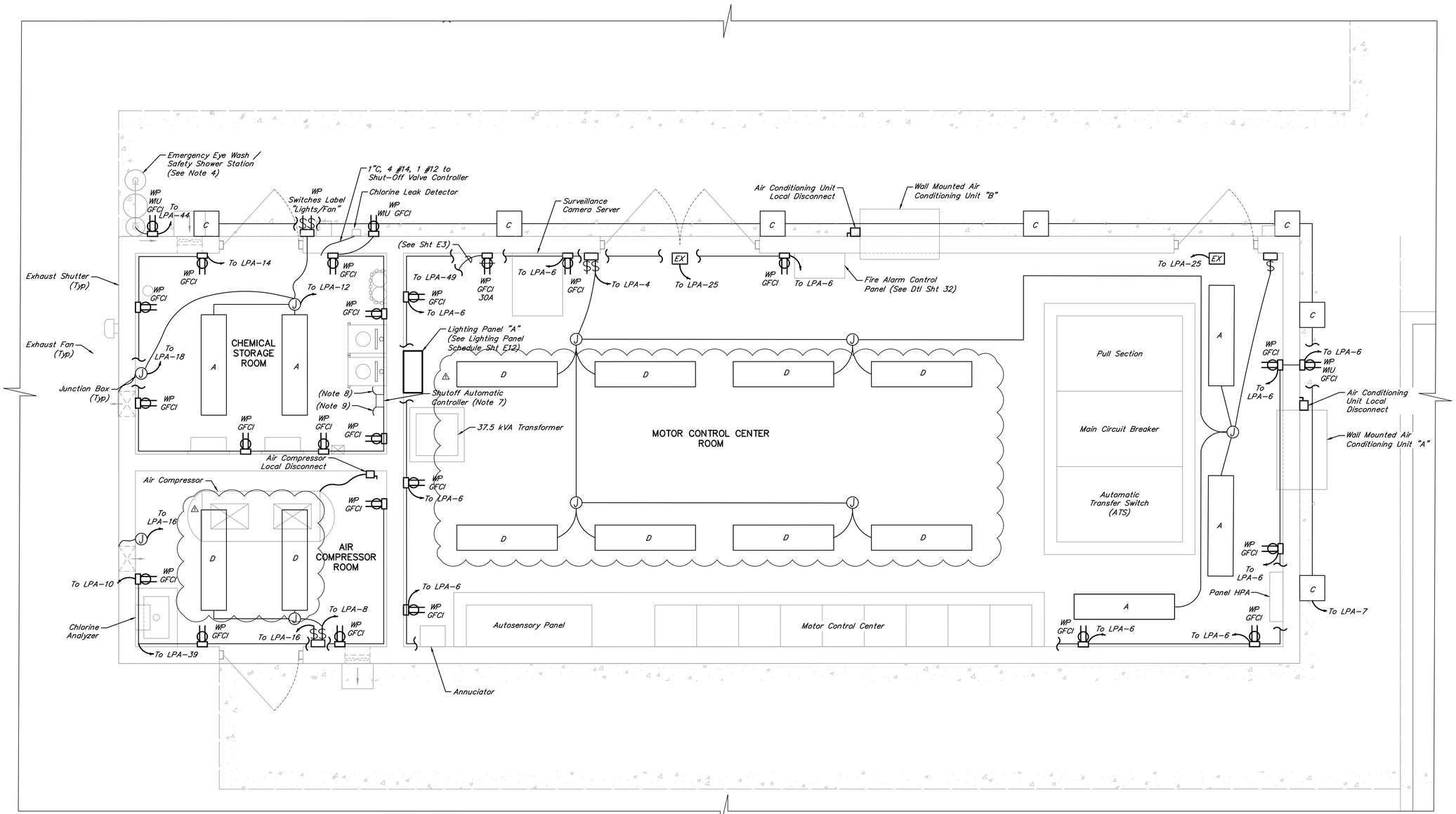
10–19–2020

SHEET NO. M3 25 OF 72

PROPERTY OF SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS | 2" & SMALLER COMBINATION AIR VALVE DETAIL | APPROVED 7-14-00 | REVISED | DD-901-03 | SHEET 2 OF 4

K:\S0406\S0406–0045–00 Blackbuck Regional Pump Station, San Ant\2 Design Phase\CAD\Blackbuck Booster Station\S0406–0045–00 BBS DETAILS.dwg

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS



CONTROL BUILDING LIGHTING LAYOUT

SCALE: 1/2" = 1'-0"

SCALE: 1/2" = 1"

GENERAL NOTES:

1. Routing is diagrammatic only, Contractor shall route conduit best way minimizing bends.
2. Contractor to route conduit at top of walls and support every six feet with stainless steel unistrut and mounting hardware.
3. All conduit wall penetrations shall be sealed with non-cementitious grout.
4. Coordinate final height and location of receptacle with submitted Eye Wash / Shower Station Manufacturer.
5. See Light Fixture Schedule on Sheet E23.
6. The chlorine leak detectors shall be powered by the UPS. Wire 2-#12 and #12 ground inside a 1" conduit.
7. Shutoff Automatic Controller (Spec 15500 Automatic Shutoff Valves) connected to 120 VAC circuit.
8. 1"C with 10 #14 to Auto-Sensory Panel.
9. Conductors to Chlorine Leak Detector.

NO.	DATE	REVISIONS	APP.
1	1/5/2021	REVISED PER ADDENDUM No. 1	CJT

SOUTHERLAND CANYONS II, LLC
SPRING BRANCH, TEXAS

MEGHAN PUMP STATION

ELECTRICAL BUILDING LIGHTING LAYOUT

JONES|CARTER
Texas Board of Professional Engineers Registration No. F-439
4350 Lockhill Selma Road, Suite 100 • San Antonio, Texas 78249 • 210.494.5511

SCALE: 1/2" = 1'-0" DGN. BY: SHUDSON
DATE: MARCH 2020 DWN. BY: SHUDSON
JOB NO. S0406-0045-00 DWG. NO.
SUBMITTED: SURV. BY:
F.B. NO.

STATE OF TEXAS
C. J. TROUTT
41075
LICENSED PROFESSIONAL ENGINEER
1/5/2021

SHEET NO.
E5
44 OF 72

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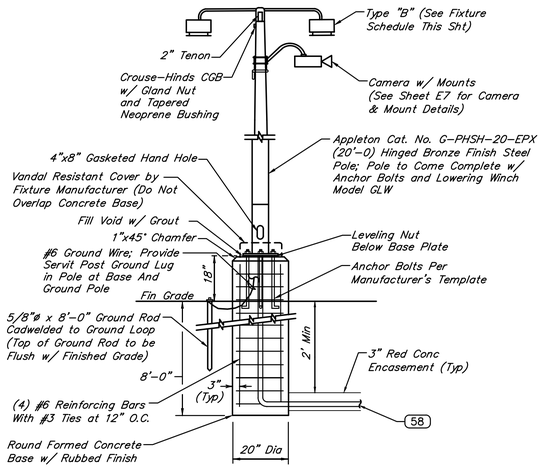
0 1 2 3 4 5 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

FLOODLIGHT NOTE:

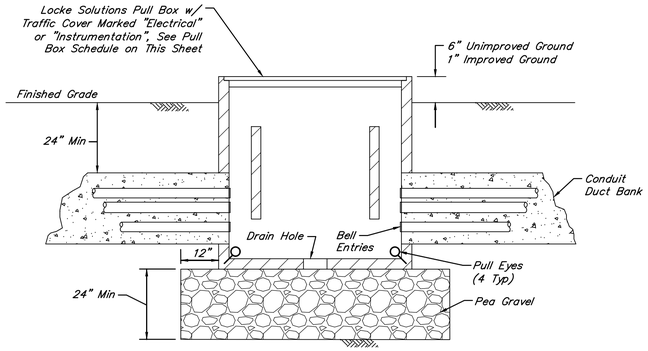
1. Light fixture to be oriented straight down.
2. Contractor shall submit lighting pole layout with height and location of mounting bracket.



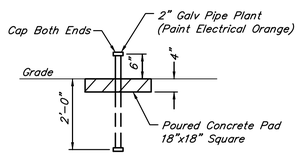
FLOODLIGHT POLE DETAIL
NOT TO SCALE

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	VOLTAGE	MOUNTING	LAMP TYPE	REMARKS
A	ECO LIGHTING SOLUTIONS ECOVP2TLED1840	120	CEILING	LED	VAPOR TIGHT LINEAR LED LIGHT FIXTURE W/FIBERGLASS HOUSING
B	APPLETON AMLED77-BUI1-D W/POLE TOP SLIPFITTER AND VANDAL SHIELD (G-AM-6-VS)	120	SLIP-FITTER	LED 13,500 LUMENS	AREAMASTER W/VANDAL SHIELD, SEE DETAIL THIS SHT.
C	LITHONIA OLW-23	120	WALL	LED 2720 LUMENS	2 LAMP ENCLOSED
D	LITHONIA STL4 X8L E21 LP850	120	CEILING	LED	2 LAMP ENCLOSED
EX	LITHONIA LHXC-W-1-RW-CH3	120	WALL	EXIT	EMERGENCY EXIT



ELECTRICAL PULL BOX INSTALLATION
NOT TO SCALE



DUCT BANK MARKER DETAIL
NOT TO SCALE

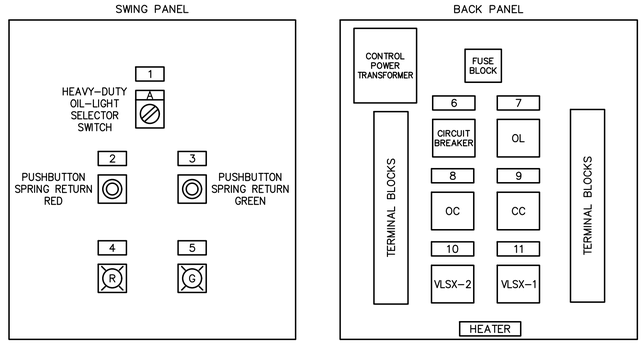
Engrave Proper Booster Pump Number as Applicable

CABINET NAMEPLATE
BP-#
DISCHARGE VALVE CONTROL CABINET

LEGEND NAMEPLATES
A HAND-OFF-AUTO

DEVICE NAMEPLATES

1	SELECTOR SWITCH SS-HOA	5	GIL VALVE CLOSED	9	CC CLOSE CONTRACTOR
2	PB3 OPEN VALVE	6	208VAC 3-PH POWER CIRCUIT BREAKER	10	VLSX-2 VALVE OPEN INDICATION AUXILIARY RELAY
3	PB4 CLOSE VALVE	7	OL OVERLOAD DEVICE	11	VLSX-1 VALVE CLOSED INDICATION AUXILIARY RELAY
4	RIL VALVE OPEN	8	OC OPEN CONTRACTOR	12	CONTROL POWER TRANSFORMER

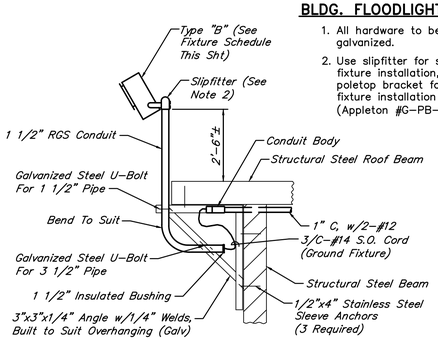


PANEL LAYOUT

BOOSTER PUMP DISCHARGE VALVE (MOV) CONTROL CABINET
TYPICAL FOR BP-1, 2, 3, 4, 5

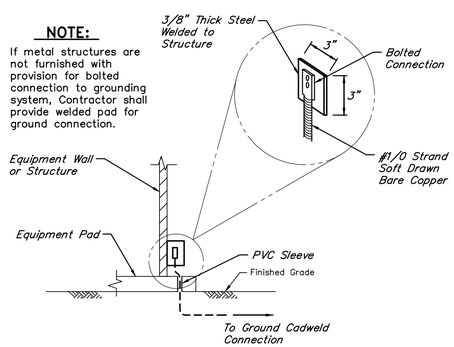
BLDG. FLOODLIGHT NOTES:

1. All hardware to be hot dip galvanized.
2. Use slipfitter for single fixture installation, use poletop bracket for two fixture installation (Appleton #G-PB-2).



BUILDING FLOODLIGHT INSTALLATION
NOT TO SCALE

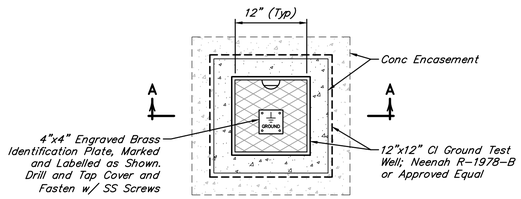
NOTE:
If metal structures are not furnished with provision for bolted connection to grounding system, Contractor shall provide welded pad for ground connection.



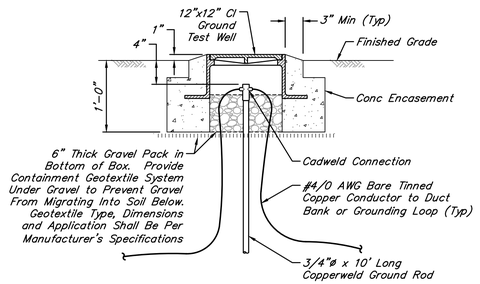
TYPICAL STRUCTURE GROUND DETAIL
NOT TO SCALE

PULL BOX SCHEDULE

PULLBOX	LID MARKING	INSIDE DIMENSIONS (LxWxH)
PB-1	ELECTRICAL	5' x 5' x 3'
PB-2	INSTRUMENTATION	5' x 5' x 3'
PB-1 (6 TYP)	INSTRUMENTATION	1'-6" x 2' x 3'



PLAN VIEW



SECTION "A-A"

GROUND TEST WELL WITH CADWELD CONNECTION DETAIL
SCALE: 1" = 1'-0"

CABINET NAMEPLATE
BP-#
CONTROL CABINET
Engrave Proper Booster Pump Number as Applicable

DEVICE NAMEPLATES

1	CS2
2	PB2 BP EMERGENCY STOP
3	BP MOTOR SPACE HEATER DISCONNECT SWITCH

MISC. NAMEPLATES

4	BP-1 AT SUPERVISORY CONTROL PA MUST BE IN THE "MCC" POSITION FOR CS2 TO OPERATE

LEGEND NAMEPLATES

A	START

INTERIOR BACK PANEL
12 POINT TERMINAL BLOCK
TB
3
2 POLE KNIFE-SWITCH DISCONNECT

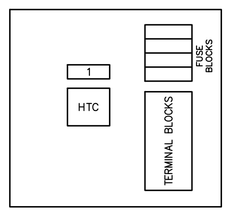
SWING PANEL
4
1
A
2
RED MUSHROOM-HEAD PUSHBUTTON, MAINTAINED POSITION
HEAVY-DUTY OIL-TIGHT SELECTOR SWITCH

PANEL LAYOUT

BOOSTER PUMP (BP) CONTROL CABINET
TYPICAL FOR BP-1, 2, 3, 4, 5

CABINET NAMEPLATE
BP-#
HEAT TRACE CONTROL CABINET
Engrave Proper Booster Pump Number as Applicable

DEVICE NAMEPLATES
1 HEAT TRACE CONTACTOR



PANEL LAYOUT

HEAT TRACE CONTROL CABINET
TYPICAL FOR BP-1, 2, 3, 4, 5

NO.	DATE	REVISIONS	APP.
1	1/5/2021	REVISED PER ADDENDUM No. 1	CJT

SOUTHERLAND CANYONS II, LLC
SPRING BRANCH, TEXAS

MEGHAN PUMP STATION

ELECTRICAL DETAILS SHEET 3 OF 5

JONES|CARTER
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SCALE: AS SHOWN DGN. BY: SHUDSON
DATE: MARCH 2020 DWN. BY: SHUDSON
JOB NO. S0406-0045-00 DWG. NO.
SUBMITTED: SURV. BY:
F.B. NO.

STATE OF TEXAS
C. J. TROUTT
41075
LICENSED PROFESSIONAL ENGINEER
1/5/2021

SHEET NO. E23
62 OF 72

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SECTION 01411
TESTING LABORATORY SERVICES WATER PLANTS

1.0 GENERAL

1.1 PAYMENT

a. The Contractor will employ and pay for services of an independent testing laboratory to perform specified testing for the proposed precast, prestressed concrete ground storage tank. This work will be paid for under the lump sum Bid Item No. 4.

b. The Contractor will employ and pay for services of Arias Goeprofessionals, Inc. as an independent testing laboratory to perform all specified testing for the proposed Meghan Pump Station, with the exception of the testing described under bullet a. of this same section. No separate payment will be made. Include the cost of work in other contract bid prices.

c. Employment of a testing laboratory in no way relieves the Contractor of his obligation to perform the work according to the contract documents.

d. The Contractor will take all bacteriological tests and carry them to a Texas Commission on Environmental Quality approved laboratory.

1.2 RELATED WORK

a. General Conditions of the Contract for Construction. Inspections and testing required by laws, ordinances, rules and regulations, or orders of public authorities are the responsibility of the Contractor.

b. Specification Sections. Contained in the various specification sections are requirements for certification of products, testing, adjusting and balancing of equipment, and other tests and standards.

1.3 WORK INCLUDED

Testing is required as specified.

2.0 TESTING LABORATORY

2.1 QUALIFICATIONS

a. Standards.

(1) Meet "Recommended Requirements for Independent Laboratory Qualifications," latest edition, published by American Council of Independent Laboratories.

(2) Meet basic requirements of ASTM E-329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."

(3) Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection, with memorandum of remedies of any deficiencies reported by inspection.

2.2 DUTIES

a. Cooperate with the Engineer and Contractor; provide qualified personnel promptly on notice.

b. Perform specified inspections, sampling and testing of materials, and methods of construction:

(1) Comply with specified standards, ASTM, other recognized authorities, and as specified.

(2) Ascertain compliance with requirements of the contract documents.

c. Promptly notify the Engineer and Contractor of irregularities or deficiencies of work which are observed during performance of services.

d. Promptly prepare and distribute reports of inspections and tests as follows:

(1) Engineer: Two (2) copies

(2) Contractor: One (1) copy

(3) Owner: One (1) copy

e. Include the following information for each test as well as additional data specified in the applicable section:

(1) Date of Test

(2) Location of Test

(3) Specified Standards

(4) Test Results

(5) Remarks

2.3 LIMITS OF AUTHORITY

The laboratory is not authorized to:

a. Release, revoke, alter, or enlarge on requirements of the contract documents.

b. Approve or accept any portion of the work.

c. Perform any duties of the Contractor.

3.0 CONTRACTOR'S RESPONSIBILITIES

a. Cooperate with laboratory personnel and provide access to the work or to manufacturer's operations.

b. Provide to laboratory, preliminary representative samples of material to be tested in required quantities.

c. Furnish labor and equipment:

(1) To provide access to the work to be tested.

(2) To obtain and handle samples at the site.

(3) To facilitate inspections and tests.

(4) For laboratories exclusive use for storage and curing of test samples.

d. Notify the laboratory at least 48 hours in advance of operations to allow for his assignment of personnel and scheduling of tests.

e. Arrange with the laboratory and pay for additional samples and tests required for the Contractor's convenience.

END OF SECTION

SECTION 02500
STORM SEWERS

1.0 GENERAL

1.1 SCOPE

This section covers the construction of storm sewers and inlets.

1.2 RELATED WORK

a. Division 2, Site Work.

(1) Excavation, Trenching and Backfilling for Utilities

(2) Cement-Sand Backfill

(3) Concrete Drainage Structures

(4) Concrete Construction for Structures

1.3 MEASUREMENT AND PAYMENT

No separate payment will be made for materials used or work performed under this section. Include the cost of such work in contract prices for the items in the bid form and specified in other sections of this work

1.4 SUBMITTALS

For pre-cast reinforced concrete box sections, submit shop drawings for the following items:

a. Typical box cross-sections showing steel design for each different depth of cover and earth pressure used.

b. Number of joints and laying length of each joint for the entire length of project.

2.0 PRODUCTS

2.1 STORM SEWER PIPE

a. Reinforced Concrete Pipe. Shall conform to ASTM Specification C-76, Class III, in accordance with sizes and types indicated on drawings and bid form.

b. Nonreinforced Concrete Pipe. Shall be standard or extra strength as indicated and shall conform to ASTM Specification C-14 or AASHTO Standard M-86.

c. Corrugated Steel Culvert Pipe. AASHTO Designation M-36 corrugated steel pipe shall have annular or helical corrugations; full circular or pipe-arch cross-sectional shape; and shall be fully bituminous coated.

d. Precast Reinforced Concrete Box. Provide box section conforming to ASTM specification C-1433-04 and the appropriate depth of cover over the box as shown on the plans.

e. High Density Polyethylene Pipe. Provide HDPE pipe section conforming to the requirements of cell classes 33500C or 335510C per ASTM specification D-3350 except that carbon black shall not exceed 5% for 12 inch through 60 inch diameters.

2.2 COATINGS

a. Bituminous Material. Corrugated Steel Pipe - AASHTO Designation M-190.

2.3 PIPE JOINT MATERIAL

a. Cold Compound Joints. Talcote No. 0.52 or Gulf State No. GS 702 or 722. Primer shall be of the type recommended by the manufacturer of the compound used.

b. Neoprene or Rubber Gasket Joints. ASTM C-443. All pipe 24" and larger must have neoprene or rubber gasket joints.

c. Corrugated Steel Couplings. Pipe coupling bands shall be made of same base metal as pipe and shall conform to standard specification of AASHTO Designation M-36. Couplings shall be asphalt coated with material conforming to AASHTO Designation M-190.

d. Precast Concrete Box. Use double-stick sealing strips 1½-inches wide and 42-inches long by Ram-Nek.

e. HDPE Pipe. Furnish corrugated HDPE smooth lined gravity sewer pipe with integral bell and “o”-ring gasketed spigot. The bell shall overlap a minimum of two corrugations of the spigot end when fully engaged. Join two straight cut pipe ends by either a double “o”-ring gasketed bell-bell coupler or an external double wide coupler with 4 stainless steel bands and tensioning locking mechanisms or approved equal.

2.4 INLET MATERIAL

a. Cast Iron. Cast iron shall conform to ASTM Specification A-48 for Class 20 gray cast iron. Castings shall be clean and perfect, free from sand, blow holes or other defects. Holes in cover must be free from plugs and shall be clean. Bearing surfaces of inlet frames and grates or plates are to be machined so that even bearing may be had when grates or plates are seated in the frames.

b. Brick. Brick made from clay or shale shall meet ASTM Specification C-32, Grade MS, except that not more than 16 percent (16%) maximum individual brick absorption will be permitted. Use only first quality, sound, hard burned, perfect shaped bricks. Brick made from concrete shall meet ASTM Specification C-55, Grade N-II.

c. Mortar. Mortar shall conform to ASTM Specifications C-270, Mortar Type S using Portland cement.

d. Aggregate for Mortar. Aggregate shall conform to ASTM Specification C-144.

e. Cast-in-Place and Pre-Cast Inlets. As specified in Concrete Construction for Structures.

3.0 EXECUTION

3.1 EXCAVATION

The trench and bottom shall be constructed in accordance with the Section Excavation, Trenching and Backfilling for Utilities and with details shown on the drawings.

3.2 PIPE BEDDING

Pipe shall be laid on bedding as detailed on the drawings.

3.3 PIPE INSTALLATION

Contractor will, at his own expense, provide a means acceptable to the Engineer for maintaining proper alignment and grade of the work. No pipe shall be installed in trench until excavation has been completed, bottom of the trench shaped, and proper bedding material place and approved for condition, line and grade by Engineer. Pipe shall be laid accurately to line and grade with spigot or tongue end of concrete pipe pointing in direction of flow. Pipes shall be fitted together and matched so that when laid they will form a sewer or culvert with a smooth and uniform invert.

Where shown on plans or approved by Engineer, pipe and culverts may be jacked, bored or tunneled as specified in Jacking, Boring, and Tunneling Pipe.

3.4 CONCRETE PIPE JOINT INSTALLATION

a. Neoprene or Rubber Gasket Joints - 24-Inch Pipe and Larger. Joints shall conform to ASTM Specification C-361. Rubber gaskets meeting ASTM Specifications C-443 shall be used in jointing concrete pipe. Ends of pipe must be accurately made and designed for use with gaskets.

   Lay pipe sections in trench to true alignment and grade. Take exceptional care in placing pipe and making field joints. Properly lubricate groove end of pipe and rubber gasket with flex soap or equal. Mineral lubricants will not be permitted. Then stretch gasket over spigot end of pipe and carefully seat in groove. Do not twist, roll, cut, crimp, or otherwise injure gaskets or force them out of position during closure of joint. Joints in pipe 12 inches and over shall be pulled "home" by suitable winch, come-along or jack, three (3) tons minimum capacity. Joint rebound shall be corrected before backfilling of pipe. Pipe below 12-inches in diameter shall be pulled or pushed "home" by suitable means. Remove foreign matter or dirt from pipe, and keep clean during and after laying.

3.5 CORRUGATED STEEL COUPLING INSTALLATION

The space between the pipe and connecting bands shall be kept free from dirt and grit so that the corrugations fit snugly. The connecting band while being tightened shall be tapped with a soft headed mallet of wood, rubber or plastic to take up slack and insure a tight joint. The annular space between abutting sections shall be filled with bituminous material after jointing.

a. Standard Field Joints. Unless otherwise specified, field joints shall be made with outside bands, each band consisting of one (1) or two (2) pieces. The type, size, and gage of the band and the size of angles and bolts shall be as indicated, or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

b. Rubber-Type Gasketed Joints. Gaskets used with circular pipe having not over five (5) percent ellipse shall be made of ⅜-inch (⅜") thick by 6½-inch (6½") minimum width closed-cell expanded synthetic rubber, fabricated in the form of a cylinder with a diameter approximately 10 percent (10%) less than the nominal pipe size. The gasket

material shall conform to the requirements of ASTM Specification C-443. Connecting bands shall be of the angle-lug, rod-and-lug, or U-bolt type. The type, size and gage of band and the size of angles, bolts, rods, and U-bolts shall be as indicated, or where not indicated, shall be as specified in the applicable standards or specifications for the pipe. Installation of gaskets shall be in accordance with the recommendations of the gasket manufacturer in regard to the use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be placed over one (1) end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the ends of the pipe sections equally. Connecting bands shall then be centered over the adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket shall be closely observed to see that it is seating properly in the corrugations.

3.6 INLET INSTALLATION

Undercut inlets 12 inches and place a full 12 inches of 1½ sack cement-stabilized sand under proposed inlets to bring base to proper line and grade.

All inlets shall be constructed to line and grade and at locations shown on plans and as established by Engineer. Box section of inlets may be constructed of Class "A" concrete or brick. Brick inlets shall be ½-inch (½") mortar on inside. Walls for brick inlets shall be minimum eight-inches (8") thick. Regardless of materials used for box section, floor slab and beam for inlet shall be Class "A" concrete. All inlet leads shall be neatly cut off at inside face of inlet wall and pointed up with mortar. Brick shall be thoroughly wet immediately before using.

When box section of inlet has been completed, floor of inlet shall be shaped by filling with mortar to conform to sections shown on detailed drawings.

Cast iron inlet plate frames and manhole rings shall be accurately adjusted to line, grade, and slope and grouted in place with mortar.

3.7 BACKFILL

a. Pipe Sewers and Culverts. The trench shall be backfilled in accordance with the Section - Excavation, Trenching and Backfilling for Utilities and with details shown on the drawings.

HDPE Installation. Install and backfill HDPE pipe in accordance with AASHTO Section 30 – Thermoplastic Pipe. Install cement stabilized sand bed for a minimum depth of 6 inches below the pipe. Backfill trench with cement stabilized sand to a minimum of 12 inches above the top of the pipe or as shown on Plans. Avoid unequal pressure on pipe while backfilling.

b. Inlets. Backfill around that portion of inlet that will be underneath proposed pavement with cement-sand. Place cement-sand in eight-inch (8") lifts and mechanically compact to 95 percent (95%) AASHTO Density, Test Method T-99. Place additional backfill from select local material in eight-inch (8") lifts and mechanically compact to 95 percent (95%) AASHTO Density, Test Method T-99.

END OF SECTION

SECTION 15230
VERTICAL TURBINE PUMPS

PART 1.0 – GENERAL

1.1 SCOPE

A. Provide all labor, materials, and equipment as shown and specified to furnish and install vertical turbine pumps, electric motors, pump columns, shafts, bases, bearings, suction barrels, and all appurtenances, complete in place, and operable.

1.2 RELATED SECTIONS

A. All sections of the contract documents and technical specifications are related sections. Failure to review contract documents and technical specifications does not relieve the Contractor supplier or manufacturer of complying with the requirements herein.

1.3 REFERENCES

A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. Anti-Friction Bearing Manufacturers Association (AFBMA)
4. Hydraulic Institute (HI)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. National Electric Code (NEC)
7. National Electrical Manufacturers Association (NEMA)
8. Steel Structures Painting Council (SSPC)
9. American Water Works Association (AWWA)
10. National Sanitation Foundation (NSF)

1.4 SUBMITTALS

A. Provide submittal data, manuals and drawings as specified in Section 01340, Shop Drawings.

B. Pump Data
1. Certified pump curves shall identify shut-off head, duty point, and range at which the pump operates without vibration and cavitation. For pumps that are to be operated by variable speed units, provide a minimum of five curves with at least three different speeds between the maximum and minimum RPM of the pump.
2. Certified pump curves shall identify the torque versus speed requirements for the pump and motor.
3. Net positive suction head (NPSH) requirements
4. Brake horsepower
5. Pump inertia
6. Pump thrust
7. Pump efficiency and pump speed

8. Materials used in fabrication of all pump components including dimensions, weights, coating requirements, and cross sectional views
9. Factory performance test results and certifications
10. Performance test results with permanent pump installed and vibration analysis
11. Names and addresses of the nearest factory authorized service organization
12. Elevation drawings noting sizes, depths, lengths, and dimensions; foundation and anchoring details; total weight of pump unit including pump, column, head, and motor
13. Factory non-witness test requiring Engineer approval prior to shipment
14. Minimum submergence requirements
15. Manufacturer's specification
16. Engineering data
17. Minimum submergence required over suction bell
18. Impeller diameter
19. Diameter of pump can and suction can design
20. Critical Speed
21. L-10 bearing life calculations for radial thrust bearings at pressure heads and flow rates shown
22. Parts diagram
23. Bill of Materials furnished

C. Motor Data
1. Horsepower
2. Electrical characteristics
3. Bearing life ratings
4. Insulation ratings
5. Weight
6. Thrust Bearing
7. Wiring Diagram
8. Space Heaters
9. Dimensions

D. Instruction Books
1. Service and maintenance manual
2. Service parts list
3. Outline drawing

E. Manufacturer's Certifications
1. Submit manufacturer's certification that Contract Documents have been examined by the manufacturer for proposed electrical, mechanical, and structural systems affecting performance of the pumping equipment, and that the equipment will thoroughly and efficiently meet the specified performance requirements.
2. Submit manufacturer's certification that the maximum power requirement, if used, shall not exceed the motor rating under operating conditions on the pump characteristic curve.
3. Submit seal manufacturer's certification that the seal is designed for service and application specified and is installed and aligned properly.

1.5 QUALITY ASSURANCE

A. Pumping units shall be specifically designed for heavy duty, continuous use, and municipal/industrial grade. Irrigation or agricultural grade units are not allowable. Use new materials of high grade, and with properties best suited to the work required.

B. Pumping units and motors shall be the product of manufacturers with at least 10 years of successful experience in the design, manufacturing and application of pumping units of the type, size and performance capabilities as specified. The pump manufacturer shall have at least three similar size pumps of the model, type, and size of pump in service and operational for at least five years. Manufacturers shall provide a list of references for those pumps.

C. All components of the pump shall be supplied, assembled, and warranted by one of the approved pump manufacturers. Pump components shall not be acquired from separate entities and assembled as a final product by a manufacturer's representative. All pumps shall be supplied by the same manufacturer.

D. Pumps, as an assembled unit, shall be compliant to NSF/ANSI Standard 61 and meet the requirements of the US Safe Drinking Water Act.

E. Pumps shall include a nameplate displaying NSF-G compliant.

F. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of Work.

G. Store material to permit easy access for inspection and identification. Keep all materials off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Store and maintain equipment in accordance with manufacturer's direction.

H. Factory Tests
   1. Pump Test
      a. The pump manufacturer shall perform a non-witness factory performance test of the entire pump assembly to demonstrate compliance with the specifications and to verify guaranteed performance of the pump. A calibrated factory driver may be used in lieu of the job driver.
      b. The factory test shall include the actual flow, total dynamic head, pump horsepower, and pump efficiency for all the duty points listed.
      c. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow.
      d. Test pump and recirculate water for at least one hour under simulated service conditions.
      e. The test shall also check for excessive vibration and leaks in all piping and seals.
      f. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.
   2. The Contractor shall submit the factory test results and certification to the Engineer for approval before the pump is released for shipment.

I. In-Place Test
   1. Perform a complete pump test including flow rates, motor amperage, and all other information normally checked on a maintenance- type pump test on an existing booster pump. Run the pump test at:
      a. 100 psi discharge
      b. 122 psi discharge
      c. 128 psi discharge

1.6 OPERATION AND MAINTENANCE DATA

A. The manuals shall be prepared specifically for this installation and shall include all required cut sheets, drawings, equipment lists, descriptions, etc. In addition to the requirements of Section 01340, Shop Drawings, the manuals shall include the following at a minimum:
   1. Complete column assembly, pumping equipment, suction can, discharge head, oiler, parts list, test reports, maintenance data and schedules, spare parts information, and cross-referenced to exploded view of assembly drawings
   2. Dimensional drawings for all provided components with their respective weights

PART 2.0 – PRODUCTS

2.1 GENERAL

A. Provide vertical, multistage, turbine pumps complete with pump bowl, electric motor, column assembly, discharge head, bearings, and all accessories and appurtenances necessary to provide a complete operating pumping system. Select pump and motor combination on overall efficiency. Pump and all components shall conform to AWWA, ANSI B58. 1-1961 "American Standard for Vertical Turbine Pumps" and the Hydraulic Institute Standards for Centrifugal Pumps.

2.2 PERFORMANCE

A. When operating at the maximum output speed of the motor, under load and including slip (at 60Hz), the pumping units shall meet all minimum conditions listed in the table below. Pump capacity, head and efficiency defined in the data corresponding to Design Point One shall be the “guaranty point”.

Design Conditions	**Units**	**BP-03-301, 401, 501**	**BP-03-101**	**BP-03-201**
Location	N/A	Booster Pump Station	Booster Pump Station	Booster Pump Station
Number of Pumps Required	Ea	3	1	1
Liquid Being Pumped	N/A	Treated Potable Water	Treated Potable Water	Treated Potable Water
Temperature	°F	32 to 105	32 to 105	32 to 105
Specific Gravity	N/A	1	1	1
Variable or Constant Speed	N/A	Constant	Constant	Constant
Maximum Motor Size	HP	125	50	50
Maximum Pump Operating Speed	RPM	1800	1800	1800
Pump Bowl Max. Diameter	Inch	12	10	10
Discharge Flange Diameter	inch	12	6	6
Shaft Bearing Lubrication	N/A	Pumped Liquid	Pumped Liquid	Pumped Liquid
Type of Impeller	N/A	Enclosed	Enclosed	
Type of Shaft	N/A	Open	Open	Open
Minimum Shaft Diameter	inch	1 1/2	1 1/4	1 1/4
Number of Suction Barrels	Ea	3	1	1
Minimum Suction Barrel Diameter	inch	18	18	12
Shut Off Head	ft	482	329	329
Max NPSHr	ft	15	20	20
Duty Point No. 1				
Design Flow (1st Design Point)	gpm	1,050	300	300
Total Dynamic Head (1st Design Point)	ft	300	300	300
Minimum Bowl Efficiency (1st Design Point)	%	80	79	79
Duty Point No. 2				
Design Flow (2nd Design Point)	gpm	1,277	417	47
Total Dynamic Head (2nd Design Point)	ft	231	231	231
Minimum Bowl Efficiency (2nd Design Point)	%	76	74	74

B. The pump shall have a Capacity vs Head curve with an increasingly rising slope steeper or equal to the slope of the line between the two duty points.

C. Select equipment which is designed and built for continuous service at all points within the specified range of operation, without overheating, without cavitation, and without excessive vibration or strain.

D. Select a pump and impeller that meets the performance requirements using an impeller that is at least one size smaller than the largest impeller size that can be furnished with that pump size.

2.3 ACCEPTABLE MANUFACTURERS

A. The following is a list of acceptable manufacturers for BP-03-101 & 201.
1. Flowserve
2. Ruhrpumpen
3. National Pump

B. The following is a list of acceptable manufacturers for BP-03-301, 401, & 501.
1. Flowserve
2. Ruhrpumpen
3. Fairbanks Morse/Pentair

C. Listing as an acceptable manufacturer will not relieve the manufacturer from conforming to these Specifications.

2.4 PUMP COMPONENTS

A. Pump Bowl Assembly
1. Provide pump bowls fabricated of fine grained, high tensile strength iron, ASTM A 48, Class 30 or better, with smooth surfaces devoid of blow holes and other irregularities. Use clean, sound casting without defect. Do not plug, weld or otherwise repair defects.
   a. The pump bowl assembly shall be designed for use with a water lubricated enclosed bearing column.
   b. Pump interior and exterior to be lined/coated with an NSF approved fusion bonded epoxy.
   c. Pump bowl wear rings shall be constructed of 400 series stainless steel.
   d. Pump bowl bearings shall be constructed bronze.
   e. The bowls shall be hydrostatically tested at 1.5 times the pressure produced at shut-off head.
   f. The bowls shall be smooth and free of sharp projections and be connected by flanged and bolted construction. Bowl shall be porcelain enameled on the bowl interior or epoxy-lined.
2. Install impellers of the enclosed type.
   a. Impeller shall be enclosed type constructed of nickel-aluminum-bronze.
   b. The impellers shall be machined and finished smooth to insure proper performance. They are to be balanced prior to assembly.
   c. They shall be securely fastened to the shaft with SS Type 416 tapered lock collets, threaded lock collets or double keys.
   d. The impellers shall be adjustable vertically by external means at the driver location.
   e. Wear rings shall be 400 series SS. Impeller wear rings shall be a minimum of 50 BHN different than the bowl 400 series SS wear rings.
   f. Pump shaft shall be constructed of SS Type 416 HT material. It shall be supported by bronze bearings above and below each impeller.
3. Employ a bronze suction case bearing, packed with insoluble grease, and protected against entry of sand or other abrasives.
4. Provide sufficient lateral in the pump bowls to allow operation at shutoff head.

5. Provide bearing support for shaft above and below each impeller.
6. Bearings and Lubrication:
   a. Antifriction self-cooled thrust bearings, minimum 100,000 hours L-10 bearing life.
   b. Thrust bearing to be insulated from magnetic currents.
   c. Thrust bearings shall be designed for the necessary up thrust and RPM as specified by the pump manufacturer.
   d. Manufacturer's standard guide bearing type, minimum 100,000 hours L-10 bearing life.
   e. Bearings shall be lubricated by an oil reservoir with oil level sight glass. Sight glass shall be marked with the proper static and operating levels.
   f. Oil fill and drain openings with opening plugs shall be provided.
   g. No cast-in bearings will be allowed, so that a spare rotating assembly could be easily installed.

B. Column

1. Two-piece, non-metallic bumpers shall be provided that securely attach to the column pipe to prevent the pipe from contacting the casing. The O.D. of the bumpers shall be 1/2-inch to 1-1/2-inch greater diameter than the diameter of the column pipe.
2. Column pipe shall be coated and lined with fusion-bonded epoxy, white in color, certified to NSF/ANSI 61.
3. Column pipe shall be assembled in such a way as to minimize or eliminate damage to the coating. Damage to the coating or locations absent of coating shall be field-repaired. During column assembly, all exposed threads and other locations absent of coating shall be field-coated in full compliance with the coating manufacturer's printed instructions.
4. Pump supplier needs to strap the column pipe to prevent the couplings from stripping out.
5. All shaft joints shall be designed so that they will not loosen during forward or reverse rotation of the shaft.
6. Shaft diameter shall be sized to meet that required for the nameplate horsepower rating and to prevent distortion and vibration over the continuous operating speed range of 70% to 100% of full speed. The size of the shaft shall be no less than determined by the applicable ANSI/AWWA standards and shall be such that elongation due to hydraulic thrust will not exceed the actual clearance of the impellers in the pump bowls.
7. Column pipe shaft bearings shall be compatible with the operating conditions and fluid properties provided.
8. The line shafts shall be of SS Type 416, turned and ground.
9. SS line shaft couplings with a safety factor of 1.5 times the shaft safety factor shall join the line shafts. These threaded couplings shall have left-hand threads to tighten during pump operation.
10. The shaft joints shall be torqued with supplier provided torque wrenches tightened to accomplish a completed butt joint.
11. Shaft thread compound shall be tested, verified, and provided by the installer with documented and Owner approved application procedures.

C. Shaft

1. All shaft joints shall be designed so that they will not loosen during forward or reverse rotation of the shaft.
2. Shaft diameter shall be sized to meet that required for the nameplate horsepower rating and to prevent distortion and vibration over the continuous operating speed range of 70% to 100% of

full speed. The size of the shaft shall be no less than determined by the applicable ANSI/AWWA standards and shall be such that elongation due to hydraulic thrust will not exceed the actual clearance of the impellers in the pump bowls.

3. Column pipe shaft bearings shall be compatible with the operating conditions and fluid properties provided.
4. The line shafts shall be of SS Type 416, turned and ground.
5. SS line shaft couplings with a safety factor of 1.5 times the shaft safety factor shall join the line shafts. These threaded couplings shall have left-hand threads to tighten during pump operation.
6. The shaft joints shall be torqued with supplier provided torque wrenches tightened to accomplish a completed butt joint.
7. Shaft thread compound shall be tested, verified, and provided by the installer with documented and Owner approved application procedures.

D. Discharge Head

1. The discharge head shall be of fabricated steel of the proper configuration and construction for the application including to support the pumping unit and motor.
2. Fabricated steel discharge heads should have 300-lb ANSI discharge nozzle flanges.
3. The top of the discharge head shall have a registered fit for mounting driving motor.
4. The head shaft shall be 416SS and shall be turned and ground. The head shaft or top shaft shall not exceed 10 feet in length. The pump manufacturer shall include a method of adjusting the pump impellers at the top of the head shaft. On vertical hollow-shaft drivers, this should be at the top of the motor. On vertical solid shaft motors, this shall be through an adjustable flanged coupling between the motor shaft and the pump top shaft. In either case, this method shall provide a positive locking device.
5. The pump shall be supplied with a sub-base plate, which shall be grouted in place to which the pump discharge head shall be bolted. This mounting plate will facilitate removal and reinstallation of pumps without releveling and grouting.
6. Pumps shall be provided with water-pressurized, flushed, stretch nipple mechanical seal housing. Mechanical seals to be by Chesterton, Flex-A-Seal, John Crane or approved equal. The flush water shall be secured via a tee off of the solenoid valve actuated pre-lube system for the pump.
7. The discharge head shall be attached to the steel well sole plate via minimum 3/4-inch 304 SS anchor bolts sole plate and matching the bolt pattern required for the discharge head. The sole plate shall be fabricated of a minimum 2-inch-thick steel plate and factory-machined to the manufacturer's specified flat surface with faces parallel, in accordance with pump manufacturer's recommendations to match the discharge flange. The sole plate shall incorporate an O-ring seal groove and anchor bolt locations as indicated on the Contract Drawings. The inside diameter of the sole plate shall match the requirements of the pump.
8. All tapped openings and flanges shall be sealed to accommodate a variation in pressure conditions from 400 psig to -29 in. Hg (full vacuum) within the discharge head and column pipe.
9. The discharge head shall be configured with openings for maintenance.
10. Pump discharge head shall be equipped with lifting lugs.

E. Seal Arrangement

1. Provide a balanced single cartridge mechanical seal with a vent and flush port on gland, floating seal rings and a static O-ring. The adjusting studs and nuts shall be stainless steel for the mechanical seal housing. The materials shall be 316 stainless steel for all metal components,

graphite-loaded sintered silicon carbide for the rotating seal ring, sintered silicon carbide for the stationary seal ring, hastellow C-276 for the spring, and Viton or Fluoroelastomer for the O-ring.

2. Provide ¾-inch diameter galvanized pipe from pump head to a point along the ground to carry any water that leaks past the seal to the ground away from the pumps.
3. When using a mechanical seal, the lower end of the vertical hollow shaft motor shall be furnished with a steady bushing between the motor drive shaft and the motor quill.

2.5 ELECTRIC MOTOR

A. Pump Motor Characteristics

1. NEMA Design B squirrel-cage, induction, shell type design, housed in a TEFC enclosure, inverter duty, suitable for 460V,3 phase, 60 HZ.
2. The motor shall be designed for an ambient temperature of 40°C. Stator winding and stator leads insulated with moisture resistant inverter duty insulation which will resist a temperature of at least 356°F. The magnet wire shall be specially made for inverter duty and the end turns and phase-to-phase insulation shall be increased. Motors not used in conjunction with VFDs may use class F non-hygroscopic insulation.
3. The motor shall be a premium efficiency model with a full load. The rotor and stator shall be built of low loss steel, and the thrust bearings shall be shielded against non-sinewave power if VFDs are used.
4. The rotor and stator shall be built of low loss steel.
5. The motor shall have a refined balance and stress relieved rotor assembly.
6. Designed for continuous duty, capable of sustaining a minimum of 6 starts per hour, evenly spaced. The motor shall meet or exceed the requirements of NEMA MG1 Table 12.
7. Capable of operating at liquid temperature of 104°F in conformance with Factory Mutual requirements without overheating or operating in the service factor.
8. Non-overloading over the entire range of the pump operating curve within the nameplate horsepower.
9. The motor shall include properly sized space heaters. Provide a conduit box for the power leads.
10. Size the motor to be non-overloading at the any point on the characteristic curve of the pump, including run-out. Provide a motor with a power draw that does not exceed the nameplate rating while the pump is operating between the normal minimum and maximum system curves, using a service factor of 1.15. Do not exceed the total capacity of the motor, including service factor, while the pump is operating between the normal minimum and emergency, run-out system curves.
11. Provide in addition to the manufacturer's standard data a certified dimensional print, performance curves, reed critical frequency data, speed vs. torque vs. amps curves.
12. Refer to Section 16013 - ELECTRIC MOTORS under Division 16, Electrical for motor information not specified in this section.

B. Motor Protection System (For Motors 200HP or Larger)

1. Have the motor manufacturer furnish a complete motor monitoring and protection system consisting of solid state monitoring to be installed in the MCC and independent probes integral to the pump/motor wired to the conduit box.
2. Provide solid state monitoring units designed for mounting within the MCC such as the Multilin or approved equal. More than one monitoring unit may be required for temperature and vibration. Design the monitoring systems to accept inputs from the sensors specified and outputs to independent contacts which close to alarm each condition, or separate independent output terminals suitable for direct connection to interposing relays for alarm contact development. Provide a separate normally closed alarm contact, rated at 120V, 5A inductive,

which opens on any failure. Use monitor systems suitable for operation from a 115VAC unregulated, unlimited power supply. Supply any additional equipment or appurtenances required to provide other current and voltages as necessary. Configure the monitoring systems to accept separate isolated normally open contacts which close to indicate pump running and to reset after pump trip. The system shall be able to protect against high and low supply voltage, unbalanced line voltage, single phase conditions, abnormally high ambient temperatures, blocked ventilation, starting overload, and running overloads.

3. Have sensors independently wired to the monitoring system. Make provision for the following sensors for each motor:
   a. Motor thrust bearing vibration transducer on upper bracket. Install a solid-state Piezo-electric displacement sensitive seismic switch with 4-20mA output signal tied to the controller installed in the MCC. The system shall have the ability to sound an alarm or shut-down the motor, indicate the magnitude of the vibration remotely, incorporate a time delay to eliminate nuisance tripping, and have a remote reset capability.
   b. Thrust bearing temperature thermistor.
   c. Stator temperature thermistors (one per phase).

2.6 SUCTION BARREL

A. Provide suction barrels for pump with adequate number of bowls and suitable length to accommodate suction barrel. Reference plans, section 2.2(A) of this specification, and HI standards for dimension requirements of suction barrel.

B. Provide suction barrels of fabricated steel. Fabricate the barrels of the diameter and wall thickness required, and of suitable lengths to accommodate the number of bowls specified.

C. Barrels shall be hot-dipped galvanized in accordance with ASTM A123 and ASTM A153 after fabrication.

D. Barrels shall be one piece from the suction flange connection to the base of the pump head.

E. The suction barrel shall be designed and provided by the manufacturer of the pumps and meet the latest HI standards.

F. Suction barrels with anticipated maximum flows in excess of 3,000 gpm shall have internal straightening vanes and an inlet pipe splitter plate the entire length of the inlet, as required by HI latest standards.

G. All suction barrels shall have the top flange installed in the factory and the level should be verified in the field prior to pouring concrete. Each top flange shall have a drilled and tapped bolt pattern that is equal to a standard 150 lb flange. Bolt holes shall straddle the centerline of the suction barrel inlet. The bolting to attach the discharge head to the suction barrel shall be Type 304 stainless steel and furnished by the barrel manufacturer. The top surface shall have a O-ring groove with O-ring for sealing purposes. A gasket will not be acceptable.

H. The barrel inlet shall be as shown on the plan sheets and shall be flanged with an AWWA C207-94 Class D steel flange.

I. The barrel length shall be as shown on the plan sheets and per HI standards. Provide a bottom cap plate in equal thickness to the top flange. Four evenly spaced, 3” x3” x 3/8” angles, with a 1-inch hole in each,

shall be welded to the outside diameter on the barrel to assist the installing Contractor in mounting and aligning the suction barrel.

J. The barrel shall be fitted with two ¾-inch couplings to serve as a vent for the barrel.

2.7 ACCESSORIES

A. Nameplates
1. Provide each pump and motor with a stainless steel nameplate securely affixed in a conspicuous place.
2. Do not paint over nameplate.
3. Nameplates shall be imprinted.
4. Pump Nameplate
   a. Each pump nameplate will show the duty point, at rated speed in revolutions per minute, serial number, impeller number, and number of stages.
5. Motor Nameplate
   a. See Electric Motor section in Division 16.

B. Vortex Suppressor/Basket Strainer
1. When shown, pumps shall have a vortex suppressor/basket strainer installed on the pump's suction except for pumps installed in suction barrel constructed with internal vanes and anti-cross in suction barrel bottom. The vortex suppressor/basket strainer shall be constructed to meet the following requirements:
   a. Performance requirements
      i. Approach velocity
         A) 3.0 feet per second, maximum, at design flow
      ii. Net open area
         A) 65%
   b. Design requirements
      i. Basket-type with solid bottom plate and internal straightening vanes.
      ii. Screen
         A) 0.120-inch woven wire cloth on 5/8-inch centers
      iii. Materials
         A) Wire cloth to be 316 stainless steel material.
         B) All other materials to be 304 stainless steel with a minimum thickness of 3/16-inch.
      iv. Mounting
         A) Bolted to the pump suction bell using 5/16-inch minimum diameter 18-8 SST bolts. "Clips" are not acceptable

2.8 COATING SYSTEM

A. Provide a factory applied primer, coatings shall be as specified, to the pump bowls exterior, motor, discharge head exterior, and column exterior.

B. Provide a high solids epoxy lining on the pump discharge head exterior

C. Provide a fusion-bonded epoxy lining inside the pump bowls.

2.9 LIFTING, ALIGNMENT, AND ACCESS

A. Provide lifting lugs capable of supporting the weight of the entire pump and motor.

B. Provide the motor support pedestal with an accurate, machine-registered fit for alignment of the driver.

C. Provide suitable openings for each access to the seal.

PART 3.0 – EXECUTION

3.1 INSPECTION

A. Install all equipment and connecting piping in accordance with Manufacturer's instructions. Prior to testing and start-up, FPR and manufacturer's representative to inspect to verify the system is complete.

B. Inspect and verify that structures or surfaces on which equipment will be installed have no defects which adversely affect installation.

C. Promptly report defects which may affect Work to Engineer.

3.2 INSTALLATION

A. Clean all new piping prior to testing.

B. The top flange of suction barrels and soleplates shall be leveled to within 0.002 of an inch per foot of diameter of the flange.

C. Install products in accordance with manufacturer's written instructions.

D. Provide sufficient clearances for thermal expansion and contraction.

E. Install pump sole plates using Type 316 stainless steel Hilti adhesive anchors if anchoring to a concrete structure, or Type 316 stainless steel hex head bolts, nuts, and washers if anchoring to a suction barrel.

F. Tolerances for plumbness shall be in accordance with Hydraulic Institute standards.

3.3 FIELD PAINTING

A. Field painting shall conform to the requirements of Section 09920.

B. Motor and discharge head exterior shall be field coated by removing factory primer and applying a final protective coating.

C. Number the pumps with 6-inch or larger stencils using black alkyd paint. Pump numbers are to correspond to wiring in MCC.

3.4 FIELD PERFORMANCE TEST

A. After pumps have been completely installed and started-up under the direction of the Manufacturer, conduct field tests to demonstrate that pump operation conforms to these Specifications.

B. If the pump performance does not comply with Specifications, take corrective measures or remove and replace pumps with pumps which satisfy the conditions specified, at no additional cost.

C. The Contractor shall provide all necessary test equipment, including temporary flow meters, pressure gauges, piping plugs or caps, or temporary bulkheads, and current meters.

D. Contractor shall ensure there is sufficient volume of water available to conduct test and that all downstream components are capable of receiving pumped liquid. If there is no available water, the Contractor shall provide water for testing purposes. If downstream components are not in place, Contractor shall make provisions for recycling pumped water and disposal.

E. Contractor shall verify that all structures, pipes, and equipment are installed correctly and make any adjustments required before start-up of pump. Any component parts which are damaged as a result of this testing or which fail to meet the requirements of these specifications shall be replaced, reinstalled, and re-tested at the Contractor's expense.

F. No form of energy shall be turned on to any part of the system prior to approval of Manufacturer's service representative.

G. Field tests shall consist of operating the pumps under normal and abnormal conditions.

H. Flow, pressure, vibration, and current shall be measured and documented for at least three operating points on each pump.

I. Pumps shall be checked for proper alignment to avoid imbalance and excessive vibration. Any misalignment of greater than ¼-inch shall be remedied prior to demonstration period.

J. Provide a testing acceptance letter from the Manufacturer on his letterhead that states the pump was installed in accordance with the manufacturer's instructions, has met all performance requirements, and has been accepted by the Manufacturer.

L. Should the tests indicate any malfunction, CONTRACTOR shall make any necessary repairs and adjustments, and then re-test the equipment. Such tests and adjustments shall be repeated until, in the opinion of the ENGINEER, the installation is complete and the equipment is functioning properly and accurately, and is ready for permanent operation.

M. Manufacturer will be back charged by the Owner for an unsuccessful field testing demonstration.

3.5 DEMONSTRATION PERIOD

A. Satisfactory operation of pumps, under the Owner's control, for the specified Demonstration Period shall commence a minimum of 48 hours after successful field testing. If malfunctions of other operational problems halt the Demonstration Period, the Contractor shall make appropriate corrections and restart the Demonstration Period.

B. Substantial Completion will not occur until after the Demonstration Period has been accepted by the Engineer.

3.6 SERVICES BY MANUFACTURER

A. A factory trained representative of the Manufacturer shall provide services for installation supervision, start-up and test services and operation and maintenance personnel training services.

B. The Manufacturer's Representative shall make a minimum of 2 visits, minimum 4 hours on-site for each visit, to the Site. The first visit shall be for assistance in the installation of equipment. Subsequent visits shall be for checking the completed installation, start-up, testing, and training on the system.

C. Manufacturer's Representative shall provide a written report certifying that the installation has been checked, is adequate for the intended purpose, all power connections have been checked, all controls are functional, and that the equipment is ready to be placed into service.

D. Manufacturer's Representative shall start-up and operate the system in the presence of the Engineer, and conduct the field performance test to verify that the equipment meets or exceeds the specified requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory. The Manufacturer's Representative shall provide a written report documenting the results of the field testing.

E. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the Owner.

3.7 FINAL ACCEPTANCE

A. Final acceptance use will not occur until after the following activities have been performed and accepted by the Engineer.
   1. Training the Owner's operating and maintenance personnel by the Manufacturer's Representative.
   2. Satisfactory completion of the Demonstrative Period under the Owner's control.

END OF SECTION

SECTION 15600
PLANT PIPING

1.0 GENERAL

1.1 SCOPE

This section provides for plant piping at water plants. The work includes furnishing all labor, equipment and materials and performing all operations required for proper fabrication and installation of all pipe, fittings and accessories required to complete the work as shown on the drawings and specified herein. The drawings show flange and push-on joint systems.

1.2 RELATED WORK

a. Division 2 - Excavation, Trenching and Backfilling for Utilities

b. Division 9 - Coating

c. Division 15 - Valves

1.3 MISCELLANEOUS ITEMS

Include all supplementary parts necessary to complete each item even though such work may not be definitely shown or specified.

1.4 STANDARD MANUFACTURED PRODUCTS

Details and specifications, for which standard manufactured products are available, are representative guides for requirements of these items. Standard manufactured products conforming to these general requirements will be acceptable if details of construction and installation are approved by Engineer.

1.5 MEASUREMENTS

Make measurements of previously installed construction before fabrication of connecting work, so that all work will fit properly.

1.6 PROJECT RECORD DOCUMENTS

Upon completion of all work, furnish prints and tracings showing location and principal details and modifications of piping systems “as-built.”

1.7 SHOP DRAWINGS

Submit shop drawings, product data, and samples as specified in Division 1, General Requirements. The shop drawings shall include detailed dimensional drawings of piping, elevations and equipment layouts.

2.0 PRODUCTS

2.1 DUCTILE IRON PIPE

Provide ductile iron pipe thickness Class 52 manufactured in accordance with the latest revisions of ANSI A21.51, A21.15,

A21.50/AWWA C-151, AWWA C-115. Both pipe and joints shall be rated for a working pressure of 150 psi plus a surge pressure of 100 psi. Flanged pipe shall be thickness class 53.

a. Joints.

(1) All above ground piping shall have flanged joints with cadmium plated steel bolts. In addition, the first horizontal underground fitting shall have flanged joints with stainless steel bolts and isolation kits as manufactured by National Gasket or approved equal. All vertical underground fittings shall have flanged joints. All flanged joints shall conform to ANSI A-21.15/AWWA C-115.

(2) All below ground piping underneath structures shall have restrained push-on joints such as Field Lok and TR Flex by U.S. Pipe; Flex-Ring or Lok-Ring by American Pipe; Super-Lock by Clow, or mechanical joints if approved by the Engineer on a case by case basis. Mechanical joints and restrained push-on joints shall conform to ANSI A-21.11/AWWA C-111. Underground mechanical joints shall have stainless steel bolts.

(3) All other below ground piping shall have push-on joints unless otherwise specified. Push-on joints shall conform to ANSI A-21.11/AWWA C-111.

b. Interior Lining. The interior of all ductile iron pipe shall be cement mortar lined in accordance with ANSI A-21.4/AWWA C-104.

c. Exterior Coating.

(1) All ductile iron pipe below ground shall be coated with an asphaltic base bituminous material in accordance with ANSI A21.10, A21.15, or A21.51.

(2) All ductile iron pipe above ground shall be coated in accordance with Section 09920 of these specifications.

(3) All below ground ductile iron pipe shall be encased in two complete wraps of 8-mil virgin polyethylene film in accordance with ANSI A-21.5/AWWA C-105.

2.2 POLYVINYL CHLORIDE (PVC) PIPE

Provide PVC pipe as manufactured by Certainteed, Johns-Manville, Clow, Gifford-Hill, Robintech, or approved equal. The pipe material shall conform to ASTM D-1784 and National Sanitation Foundation Standard No. 14 for a design stress of 2,000 psi. The pipe must also conform to quality control tests as described in ASTM 1599, ASTM 1598, ASTM 2152 and ASTM 2241.

a. For two-inch (2") and smaller, provide Schedule 80 PVC with solvent welded joints or pipe conforming to ASTM D-` 2241, SDR 21, Class 200 for a working pressure up to 200 psi.

b. For three-inch (3"), use Schedule 40 PVC with solvent welded joints.

c. For four-inch (4") through 12-inch (12"), provide DR-18, Class 150 PVC pipe fittings and joints, provide Fluid-Tite by Certainteed, Ring-Tite by Johns-Manville, or approved equal. The fittings shall conform to ASTM D-2467 and the joints shall conform to ASTM D-3139. The pipe material shall conform to ASTM D-1784 and National Sanitation Foundation Standard No. 14 for a design stress of 2,000 psi. The gasket material shall conform to ASTM F-477.

2.3 STEEL PIPE

a. Provide all steel pipe, sizes six-inches (6") through 24-inches (24"), conforming with ASTM specifications and the latest revision of AWWA C-200. Provide four-inch (4") and smaller pipe in accordance with this specification.

b. Minimum wall thickness for carrier pipe must meet the following criteria:

Nominal Pipe Size (Inches)	Outside Diameter (Inches)	Minimum Wall Thickness (Inches)	Pounds per Linear Foot (Uncoated)
4	4.500	0.237	10.79
6	6.625	0.280	18.97
8	8.625	0.322	28.55
12	12.750	0.375	49.56
16	16.000	0.375	62.58
20	20.000	0.375	78.60
24	24.000	0.375	94.62

c. Furnish either flanged joint pipe or welded joint pipe as shown on the plans. Welded joint pipe shall have beveled ends for field butt welding.

d. Protective Coatings

(1) For buried pipe, wrap the exterior surfaces of the pipe with cold-applied plastic tape coating in accordance with AWWA C-214 with a minimum thickness of 80 mils. Exterior surfaces of all pipe will be commercial blasted SSPC-SP-6, primed with Polyken 1019 primer and wrapped with Polyken innerwrap 989-20, Polyken middlewrap 955-30 and Polyken outerwrap 956-30 or approved equal. Field welds or disturbed areas shall be touch-up coated with cold-applied tape in accordance with AWWA C-209.

(2) For above ground pipe, coat the interior surface with coal tar epoxy and coat the exterior in accordance with Section 09920 unless otherwise specified on the plans.

e. Furnish new and unused pipe manufactured in compliance with Underwriters' Laboratories, Inc. (UL), Specifications, “Steel Pipelines for Underground Water Service.” Potable water piping must be acceptable, without penalty, to the Texas Fire Insurance Commission (TFIC) for use in potable water supply systems.

2.4 STAINLESS STEEL

a. Tube - Stainless steel tube 3" and larger shall conform to the requirements of ASTM A-778- 80 and shall be of the grade and wall thickness specified in table below. Tubing less than 3" shall conform to ASTM A-269 specification.

For service pressures to 150 psi with operating temperatures to 200 ºF the following wall thickness shall be specified as a minimum:

Tube O.D.	Wall Thickness
1 1/2" thru 10"	16 Ga.
12"	14 Ga.
14"	12 Ga.
16"	11 Ga.

18" & 20"	10 Ga.
24"	8 Ga.

For low-pressure air service (0-25 psig) the following wall thicknesses shall be specified as a minimum:

Diameter	Wall Thickness
10" O.D. & Less	16 Ga.
12" O.D.	14 Ga.
14" O.D.	12 Ga.
16" O. D.	12 Ga.
18" O.D.	12 Ga.
20" O.D.	11 Ga.
24" O.D.	10 Ga.

Note: These wall thicknesses are equal to or greater than are required for 150 psi service by a margin of safety of 4 to 1 as applied to theoretical bursting pressures to which has also been applied a weld joint efficiency of 70%. The total safety factor is approximately 5 to 1 considering worst-case wall thickness variation of 12 ½ % below nominal gauge or schedule thickness.

Wall thicknesses for pipe over 24" diameter are to be calculated using a factor of safety of 5 to 1 applied to Barlow's formula:

$$t \text{ (wall thickness)} = PD/2S$$

b. Fittings - Stainless steel tube size fittings 3" and larger shall conform to the requirements of ASTM A-774-80 and shall be of the grade and schedule (wall thickness) specified in table above. Elbows shall be die-formed, long (1½ x d.) radius through 18" size. Five-segment mitered elbows may be supplied above 18".

c. Joints - Stainless steel tube fabricated into spool pieces shall have shop welded circumferential butt weld joints, or Van Stone joints using angle face rings with backing flanges drilled to ANSI B16.1 Class 125 standards. Backing flange thicknesses to be ½" for 3" thru 8" diameter lines, 5/8" for 10" through 18" diameter lines, ¾" for 20" diameter lines, 1" for 24" thru 30" lines and 1 ¼" for 36" diameter lines. Backing flanges to be prime painted steel plate flanges except in the case of submerged joints in which case they are to be stainless steel plate flanges. (Galvanized back-up flanges are to be furnished where deemed necessary by the engineer.)

d. Gaskets - Flanged joints in air lines shall be provided with rubber or neoprene gaskets suitable for use at temperatures to 250º F.

e. Hangers and Supports – Hanger and support components in contact with tube or pipe lines shall be of stainless steel or fiberglass materials. See tables below for spacing.

Distance Between Supports or
Hangers for Air Line Service (Empty)

Tube Size	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24" Up
"D"	12.7	14.8	18.3	21.2	23.8	26.1	28.2	30.2	32.0	33.8	37

"D" = Max. distance between supports in feet.

Distance Between Supports or
Hangers for Lines Full of Water

Tube Size	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24" Up
"D"	9.8	10.3	11.0	11.3	11.6	12.8	15.0	16.1	17.0	17.2	19.0

f. General - Materials used in tube and fitting manufacture shall conform to ASTM A-240 furnished in the cold rolled sheet finish through ¼" thicknesses and in the #1 plate finish over ¼" thickness. Chemical and physical material certificates to be available upon request. All tubular products to be immersion pickled subsequent to manufacturing and fabrication operations and prior to shipping to point of installation. Only extra low carbon (ELC) materials with .03% max. carbon shall be used for pipe and fitting manufacture.

g. Tolerances - Diameter tolerances and wall thickness tolerances of tubular products are to conform to ASTM A-530.

h. Workmanship on spool fabrication shall be of the highest quality and appearance. Fabricators shall have had a minimum of five years experience supplying stainless steel fabrication.

(1) Only weld procedures that have been qualified under ASME Section IX and only welders who have successfully completed performance qualification tests per ASME Section IX on is these qualified procedures shall be utilized in pipe spool fabrication.

(2) Only inert gas shielded welding processes, namely, GTAW (TIG), GMAW (MIG), PAW (plasma arc welding) shall be used in spool fabrication.

(3) Inert gas shielding shall be utilized on the back as well as the torch side of a weld joint to prevent atmospheric contamination of the molten and adjacent metal.

(4) Filler metal shall be added to all welds to provide a cross section of weld metal equal to or greater than parent metal.

(5) Butt welds shall have 100% penetration to the interior or back side of the weld joint.

(6) Weld joints shall be accurately fitted and cleaned of all foreign material prior to welding.

(7) Weld reinforcement on both sides of the weld shall be smooth, uniform and no more than 1/16" in height.

(8) Weld concavity and undercut shall not be acceptable on either side of the weld.

(9) Only extra low carbon (ELC) filler metals shall be used.

(10) Each spool piece shall be marked with identification relatable to the spool drawing and or system line to facilitate job site assembly.

(11) Spools shall be fabricated to the "Pipe Fabrication Institute" fabricating tolerances ES-3 (1981).

(12) All spool pieces shall be immersion pickled after fabrication and prior to shipping in a pickling solution of 6-10% nitric acid and 3-4% hydrofluoric acid. Temperature and exact concentrations to be such that only a modest etch is produced but that all oxidation and ferrous contamination is removed from the metal surface. All residues of the pickling solution are to be neutralized after pickling.

(13) Backing flanges shall be secured to pipe ends for shipping protection and pipes pools shall be loaded and blocked and lagged as necessary to ensure protection from damage during shipping.

2.5 STAINLESS STEEL DUCT

a. Manufacturer - Stainless steel duct shall be manufactured by Viron Internation Corporation.

b. Wall thickness

Nominal Pipe Size (Inches)	Duct Thickness (Gage)
4	22
6	22
8	22
10	20
12	20
14	20
16	20

c. Material - Stainless steel duct shall be constructed of 316L stainless steel.

d. Corrosion Resistance - All ducting shall be corrosion resistant and coated with VI-LAR brand ECTFE to a thickness of 12MILS.

e. Jointing:

(1) Flanged Joints – Flanged connections shall utilize Van Stone Flanged ends.

d. Fittings – Fittings shall be manufactured by Viron International Corporation and shall coated with Vi-LAR brand ECTFE to a thickness of 12MILS.

e. Gaskets - Flanged joints in air lines shall be provided with rubber or neoprene gaskets suitable for use at temperatures to 250º F.

f. Hangers and Supports – Hanger and support components in contact with tube or pipe lines shall be of stainless steel or fiberglass materials.

2.6 CONCRETE PIPE

Provide reinforced concrete pipe conforming to ASTM C-76, Class III.

2.7 COPPER TUBING

Unless otherwise specified, all fire protection piping shall be copper tube conforming to ASTM B75, ASTM B88, and ASTM B251.

2.8 HIGH DENSITY POLYETHYLENE TUBING

Unless directed otherwise by the Engineer, provide and install one-quarter-inch (1/4") poly flow continuous tubing inside one-inch (1") diameter, Schedule 40 PVC conduit for control lines. All tubing shall continuous without couplings from the source of pressure to the control device.

2.9 FLEXIBLE HDPE

a. Unless directed otherwise by the Engineer, provide and install black flexible HDPE pipe with a maximum rated pressure of 200 psi, installed underground in a PVC conduit carrier pipe and aboveground with supports. Pipe shall conform to ANSI/AWWA 901, ASTM D2239.

2.10 FITTINGS

Use fittings of same size as pipe they serve. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Reduction in piping size will be made by reducing fittings. Use galvanized fittings for galvanized pipe. Dissimilar metals shall require isolation kits on all bolts.

a. Ductile Iron Pipe.

(1) Flanged Fittings. Provide flanged fittings of high quality ductile iron castings accurately machined and finished. Dimensions must conform to ANSI A21.10, AB16.1/AWWA C-110/AWWA C-115. Flanges shall be Class 125, pressure rated at 250 psig, and conforming to ANSI B16.1.

(2) Mechanical Joint Fittings. Provide Type III ductile iron fittings conforming to ANSI A-21.10/AWWA C-110/C-111. Compact DIP joints shall conform to the latest edition of AWWA C-153 and shall be rated for 350 psi. Install in accordance with the manufacturer's recommendations, ASTM C-443 and the latest revision of AWWA C-600. Use only with pipe and fittings designed for compression gaskets. Provide thrust blocking.

b. PVC Pipe. Provide fittings with a wall thickness equal to or greater than the wall thickness of the pipe to which the fitting is to be attached to.

(1) For two-inch (2") and smaller, provide Schedule 80 PVC solvent weld fittings and couplings conforming to ASTM 2467.

(2) For three-inch (3"), provide Schedule 40 PVC solvent weld fittings and couplings conforming to ASTM D2466.

(3) For four-inch (4") and larger, provide DR-18 couplings conforming to AWWA C900 & C905. All buried DIP fittings shall be lined, coated, and wrapped as described in this specification.

c. Steel Pipe.

(1) Welded. Provide welded fittings conforming to physical and chemical requirements of ASTM specifications and dimensional standards of AWWA C-207/C-208. Provide standard weight, forged steel, long radius pattern, butt welding type fittings with full thickness of metal sustained at all points. Use welding tees when pipes are of same size. Use weld-o-lets to tee a smaller pipe into a larger.

(2) Threaded. Provide 150 pound screwed fittings with American Standard taper pipe threads. For

compressed air service use 300 pound fittings.

(3) Flanged. Provide Class B flanges.

d. Copper Tubing. Use solder-type, wrought copper fittings meeting the same requirements as pipe material. Furnish high melting point solder of tin and lead, containing not less than 85 percent (85%) tin.

2.11 COUPLINGS

a. Dresser Couplings. Use Style 128, unless otherwise specified.

b. Victaulic Couplings. Provide Victaulic Style 31 or Nappco Series 300 with radius groove.

2.12 GASKETS

All gaskets on flanged piping shall be full-faced. Air piping gaskets (flanged or push-on piping) shall be rated for temperatures of 250 degrees Fahrenheit.

3.0 EXECUTION

3.1 EXCAVATION, TRENCHING, AND BACKFILLING

Conform to applicable provisions of the section on excavation, trenching and backfilling for utilities in Division 2, Site Work.

3.2 CONCRETE

Provide concrete in accordance with applicable provisions of sections in Division 3, Concrete.

3.3 JOINTING

a. Flanged Joints. When bolting, take care to insure that there is no restraint on the opposite end of the pipe or the fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. Leave one (1) flange free to move in any direction while flange bolts are being tightened. Tighten bolts gradually and at a uniform rate, in such manner that gasket compression is uniform over the entire area of gasket.

(1) Take special care when attaching suction and discharge piping flanges to pumping equipment. Insure that no stresses are transmitted to or imposed on the pump suction and discharge flanges by connected piping. Install and permanently support piping to provide accurate matching of bolt holes and uniform contact over the entire flange. In addition, leave pump connection piping free to move parallel to its longitudinal center line while the bolts in pump connection flanges are tightened.

(2) Provide maximum flexibility and ease of alignment correction by taking advantage of the slack between the flange bolts and bolt holes for slight angular rotation of connecting flanges. Assemble pump connecting piping with gaskets in place, with only a portion of the flange bolts (no fewer than four (4) per joint) installed. After final alignment and before final bolting, test pump connections for applied piping stresses by loosening flange bolts which, if piping is properly installed, should result in no movement of piping relative to the pump, or opening of the pump connection joints.

b. Mechanical Joints. Carefully assemble mechanical joints in accordance with the manufacturer's recommendations. If seal is defective, disassemble the joint, thoroughly clean it, and reassemble the joint. Do not over tighten bolts

to compensate for poor installation practice.

c. Push-On Joints. Remove lumps, blisters, and excess coating from the exterior spigot and interior bell surfaces. Wire brush such surfaces and wipe them clean and dry (free from oil and grease) before placing the gasket and spigot in the bell. Keep joint contact surfaces clean until jointing is completed. Take every precaution to prevent foreign material from entering the pipe during installation. Do not place debris, tools, clothing, or other materials in the pipe. Observe and follow instructions of the manufacturer, relative to gasket installation and other jointing operations. Lubricate joint surfaces with heavy vegetable soap solution immediately before joint is completed. Suitably level each spigot end to facilitate assembly.

d. Restrained Push-on Joints. Follow the same instructions as for push-on joints.

e. Threaded Joints. Make threaded joints using suitable joint compound applied to male threads only. Thoroughly ream field cuts. Make connections carefully so that thread engagement will be secured. Machine cut threads to American National taper pipe thread sizes. After installation of galvanized piping, all exposed threads shall be wire brushed, degreased to remove cutting oil, and coated with a cold galvanizing compound.

f. Welded Joints. Make welded joints as recommended by standards of the American Welding Society. Insure complete penetration of deposited metal with base metal. The filler metal must be suitable for use with the base metal. The inside of fittings must be free from globules of weld metal which would restrict the flow or become loose. Do not use mitered joints. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld.

g. Soldered Joints. Prior to making solder joints, cut the pipe square and ream the pipe to full diameter. Thoroughly clean the exterior of the pipe and the socket of the fitting. Polish to bright metal, free from oxidized metal. Apply a thin coat of suitable fluxing compound to both pipe and socket. Fit the parts together immediately. Heat the assembled joint only as required to cause solder to flow. Run joint full with a slight bead on the outside. Wipe to remove excess solder.

h. Solvent Welded Joints. All PVC solvent welded joints are to be solvent welded using Type 80 P solvent cement and primer as manufactured by Celanese Corporation, or approved equal. Other coupling or jointing systems will be noted on plans.

(1) When pipe is cut make sure all cuts are perpendicular to the centerline of the pipe. Remove all burrs, chips, and fillings.

(2) Make sure pipe surface is clean and dry prior to priming.

(3) Do not make solvent welds when the ambient air temperature is less than 40°F or greater than 90°F or when the relative humidity is such as to cause a condition of misting or raining.

3.4 HANDLING

Handle pipe, fittings, and accessories to insure their installation in a sound, undamaged condition. Use equipment, tools and methods to prevent damage in unloading, reloading, hauling, and laying pipe and fittings. When using hooks in pipe ends, be sure that the contact surfaces are broad and well padded.

3.5 CUTTING

Cut pipe in a neat manner, without damage to the pipe. Make cuts smooth, straight, and at right angles to the pipe axis.

Use mechanical pipe cutters of an approved type, except in locations where the use of mechanical cutters would be difficult or impracticable. In such locations, cut the pipe with diamond point chisels, saws, or other tools which will cut pipe without damaging impact or shock. Field cut push-on joint pipe shall have the cut end beveled to a 30° angle before joining. Remove any burrs from beveling prior to joining.

3.6 CLEANING

Thoroughly clean the interior of the pipe and fittings of foreign matter before installation. Keep the interior clean until the work has been accepted.

3.7 INSPECTION

During installation, while the pipe is suspended and hanging free, inspect each pipe and fitting for defects. Tap the pipe with a light hammer to detect cracks. Reject defective, damaged, or unsound pipe and fittings and remove them from the site.

3.8 LAYING PIPE

a. Protect the pipe from lateral displacement by means of pipe embedment material installed as specified in Division 2, Site Work, and as shown.

b. Under no circumstances should pipe be laid in water. Do not lay pipe under unsuitable weather or trench conditions.

c. Lay pipe with bell ends facing in the direction of the laying except when making closures.

d. The Contractor is responsible for staking the plant piping, valves, and fittings unless directed otherwise by the Engineer.

e. Place pipe so that the full length of each section rests solidly upon the pipe bed, with recesses excavated to accommodate bells and joints. Take up and relay pipe when the grade or joint is disturbed after laying.

3.9 PIPE BEDDING AND BACKFILL

a. Regardless of the type of pipe being laid, provide six-inches (6") of sand bedding in the bottom of the trench, the trench having previously been cut six-inches (6") below grade. Provide sand bedding prior to laying the pipe and making up the joints. After making up and inspecting joints, place sand backfill around the pipe, extending the full width of the trench and to a minimum compacted depth of twelve-inches (12") over the top of the pipe to provide a compacted encasement surrounding the pipe. Take care that no dirt, clods or trench sides are allowed to fall on or to rest against the pipe prior to completion of the sand encasement.

b. Backfill remainder of the trench as described under Excavation, Trenching, and Backfilling for Utilities, except under pavement sections. Under existing or proposed paving sections, backfill trench with sand, compacted in 12-inch (12") layers, to within one-foot (1') of finished pavement surface.

c. <u>Placing and Laying.</u>

(1) Bury lines 12-inches and smaller and leads to a minimum depth of four-feet (4'). Bury lines 16 inches and larger to a minimum depth of five-feet (5').

(2) Do not exceed pipe manufacturer's recommendations for deflections from straight line or grade as required by vertical curves, horizontal curves, or offsets. If alignment requires deflections in excess of these limitations, furnish special bends or sufficient number of shorter lengths of pipe to provide angular deflections within the limits set or approved.

(3) After a length of pipe is placed in the trench, hold packing material for the joint around the bottom of the spigot so that packing will enter the bell as the pipe is pushed into position, or a rubber gasket may be inserted in the bell before pushing the pipe into place. Center the spigot on the bell and push the spigot into required alignment and position. Except where necessary in making connections with other lines, lay pipe with bells facing the direction at least two (2) lengths of pipe ahead of each joint, with packing of pipe laying. Lay installed and earth fill tamped alongside pipe, before joint is poured.

3.91 REACTION ANCHORAGE AND BLOCKING

a. Install suitable reaction blocking, struts, anchors, clamps, joint harness or other adequate means for preventing movement of pipe caused by unbalanced internal liquid pressure. Pressure can be expected at unplugged tees, Y-branches, and bends deflecting 22½ degrees or more which are installed in piping subjected to internal hydrostatic heads in excess of 15-feet (15') in exposed, or 30-feet (30') in buried piping.

(1) In trenches, fittings must be provided with concrete thrust blocking between the fitting and solid, undisturbed ground in each case, except where solid ground blocking support is not available. At tops of slopes, anchor vertical angle bends with concrete of sufficient weight to resist hydraulic thrust to which pipe will be subjected at maximum pressures. Install the concrete block and anchors so that joints between the pipe and the fittings are accessible for repair. The bearing area of the concrete reaction block against the ground or the trench bank shall be as shown or as directed by Engineer in each case. In the event that adequate support against undisturbed ground cannot be obtained, install metal harness anchorages consisting of steel rods or bolts across the joint and securely anchored to the pipe and fitting or other adequate anchorage facilities to provide necessary support. Should the trench lack a solid vertical excavation face due to careless or otherwise improper trench excavation, no additional payment will be made for furnishing and installing metal harness anchorage in excess of contract value of concrete blocking replaced by such anchorages.

(2) For fittings in locations other than trenches and as shown, provide reaction blocking, struts, anchorages, or other supports. This includes but is not limited to fittings installed in fills or other unstable ground.

(3) Adequately protect from corrosion all steel, clamps, rods, bolts, and other metal accessories used in reaction anchorage or joint harness where subject to submergence or contact with earth or other fill material and not encased in concrete. Apply not less than two (2) heavy coats of coal tar coating material to clean, dry metal surfaces. Allow the first coat to become dry and hard before the second coat is applied. Paint the metal surfaces exposed above grade or within structures in accordance with Division 9, Finishes.

b. Substitution. In lieu of reaction anchorages and blocking for underground pipe and fittings, use push-on, locking type joints. For ductile iron pipe use TR Flex and Field LOK manufactured by United States Pipe and Foundry Company; Flex-Ring or Lok-Ring manufactured by American Pipe; or Super-Lock by Clow Corporation. . Equip all joints with gaskets. One Bolt fittings by One Bolt, Inc. may be used on ductile iron and PVC pipe. Some installations may require a combination of restrained fittings, and restrained joints both upstream and downstream of the fitting. Anytime a substitution is requested, the Engineer shall evaluate the number of restrained fittings and joints to be installed.

4.0 DISINFECTION

Disinfect each unit of completed potable water distribution systems with liquid sodium hypochlorite or calcium hypochlorite in accordance with the latest revision of AWWA C-651-05. Flush lines thoroughly before introducing chlorinating materials. Chlorine concentration must be at least 50 mg/l at the beginning of the contact period. Open and close valves and hydrants in lines several times during the contact period. After 24 hours, the minimum chlorine residual must be 25 mg/l. After contact period, flush system with clean water until chlorine residual is 1.0 mg/l or less.

Tablet Method

a. Placing of Calcium Hypochlorite Granules. During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500 feet intervals. The quantity of granules shall be as follows:

Pipe Diameter (Inches)	Calcium Hypochlorite Granules (oz)
4	1.7
6	3.8
8	6.7
10	10.5
12	15.1
14 & larger	D^2 X 15.1

Where D is the inside pipe diameter in feet.

b. Placing of Calcium Hypochlorite Tablets. During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe and also one (1) such tablet shall be placed in each hydrant, hydrant branch, and other appurtenances. The number of 5-g tablets required for each pipe section shall be $0.0012d^2L$, where d is the inside diameter in inches, and L is the length of section in feet. (See following table). Attach all tablets inside and at top of the main.

Pipe Diameter (Inches)	Length of Section (Feet)				
	13	18	20	30	40
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

c. Filling and Contact. When installation is completed, the main shall be filled. Precautions shall be taken to eliminate air pockets. Water shall remain in the pipe for at least 24 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service.

4.1 TESTING

a. Pressure Test. Conduct hydrostatic tests in the presence of the Engineer, and in an approved manner. Apply test pressure of 125 psi (or 1.5 times the design pressure, whichever is greater) for small diameter water lines and stabilize the line pressure for at least 15 minutes. For large diameter water lines, apply 150 psi (or 1.5 times the

design pressure, whichever is greater) and stabilize for a minimum of 15 minutes. After the line is stabilized, maintain the appropriate test pressure for a minimum of two (2) hours *when joints are exposed and a minimum of eight (8) hours when the pipe has been backfilled*. Do not permit line losses during the test to exceed the limits set forth in the table titled "Maximum Allowable Leakage" provided herein and as allowed in the following formula and table:

$$L = (S)\,(D)\,(P^{0.5}) / 133{,}200$$

Where: L = Leak in gallons per hour.
S = Length of pipe in feet.
D = Inside diameter of pipe in inches.
P = Pressure in pounds per square inch.

Duration of Test	Acceptable Loss as % of Maximum Allowable
2 hr. (Min.)	25%
4 hr.	50%
6 hr.	75%

MAXIMUM ALLOWABLE LEAKAGE
Gallons Per Hour Per 1,000 Ft. of Main
Type of Pipe and Joint

Pipe Size (Inches)	C.I. or D.I.	PVC
	Test Pressure – 125 psi	
2	0.34	0.05
4	0.68	0.10
6	1.01	0.15
8	1.35	0.20
12	2.02	0.30
	Test Pressure – 150 psi	
16	2.69	0.40
18	3.02	0.45
20	3.36	0.50
24	4.03	0.60
30	5.40	0.75

Where practicable, pipe lines shall be tested in lengths between line-valves or plugs of 4,000 feet or less.
Regardless of the rate of line loss, repair observed leaks. Replace faulty or defective materials at no charge in the contract sum. Provide all pumps, gages, meters, and other equipment necessary for performance of the tests.

b. Bacteriological Tests. After disinfecting and flushing potable water mains, obtain the service of an approved laboratory to gather representative samples and conduct bacteriological tests. Take two (2) consecutive sets of samples, taken at least 24 hours apart, at each dead end line (blow-off) and for each 1,200 linear feet of distribution main. Test results must have less than 500 colony-forming units (cfu) per mL and no detectable coliforms. Make all necessary corrections, repeat disinfection and flushing procedures, and retest affected lines, if test results are not acceptable. Repeat this procedure until satisfactory results are obtained.

END OF SECTION

SECTION 16502
LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide a complete lightning protection system for the following buildings:
   1. Ground Storage Tank
   2. SCADA Tower
   3. Electrical and Control Building

   The system shall be UL labeled and shall be designed and installed in compliance with provisions of UL-96A and NFPA-780 and SAWS standard requirements.

B. Employ the services of a licensed lightning protection systems engineering company to design and install the lightning protection system and prepare detailed installation drawings and material specifications. The Drawings and this Section shall be submitted for review in accordance with Section 01300.

C. The lightning protection system shall be checked by a UL field inspector upon completion of the installation. Assume full responsibility for the correctness of the installation and shall make any and all corrections and additions deemed necessary by the UL inspector. Pay for all costs of the UL inspection and any subsequent re-inspections as required.

D. The lightning protection system for the structure shall consist of a copper ground wire with air terminals which shall be grounded to the building structural steel or ground grid at regular intervals. The Contractor has the option of submitting alternate methods of lightning protection for consideration in his/her proposal, provided they offer an equal or greater degree of protection than those specified.

E. The grounding systems for the building shall be provided under Section 16060.

1.2 REFERENCE STANDARDS

A. Underwriters Laboratories (UL)

   UL 96A - UL Standard for Safety Installation Requirements for Lightning Protection System.

B. National Fire Protection Association (NFPA)

   NFPA 780 - Lightning Protection Code

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be new and shall comply in weight, size, and composition with the requirements of UL and NFPA.

B. Grounding materials and methods shall be equal to those specified under Section 16660.

C. The following is a brief description of the various items of material:
1. Air Terminals
a. Air terminals shall be 1/2-in by 18-in minimum solid copper and shall extend at least 10-feet above the object to be protected. All air terminal bases shall be cast bronze with stainless steel bolt pressure cable connectors. The air terminals should be spaced so as not to exceed 20-ft apart around the outside perimeter of the roof or the ridge and not over 50-ft apart through the center of flat roof areas. The air terminals in the center roof area shall be 1/2-in by 48-in solid copper with a proper brace. All air terminal bases for flat roof areas shall be of the adhesive type.
2. Conductors
a. Conductors shall consist of UL 96A listed 28 strands copper wire braid or weave installed in accordance with the UL Code. Ground connections shall be made to the main down conductor at a maximum of 60-ft-0-in on centers.
b. Class I- main conductors: Stranded copper conductors shall be at least 57,400 circular mils at 187 lbs per 1000 ft. Secondary or bonding conductors the minimum size shall be 26,240 cir. Mils.
c. Class II- main conductors: Shall be not less than 115,000 cir. mils for copper conductor at 375 lbs per 1000 ft. Secondary or bonding conductors the minimum size shall be 26,240 cir. Mils.
3. Fasteners
a. Conductor fasteners shall be an approved type of non-corrosive metal, have ample strength to support conductors and shall be spaced not to exceed 8-ft-0-in centers. Concrete type cable fasteners spaced every 8-ft-0-in on concrete. Adhesive type cable fasteners spaced every 8-ft-0-in on flat roofs.
4. Cable Connectors
a. All cable connectors shall be cast bronze with screw-pressure type stainless steel bolts and nuts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials shall be installed by experienced workmen that specialize in this type of work. The lightning protection system shall be installed per approved shop drawings and UL and NFPA recommended practices.

B. The lightning protection system engineering company shall provide job site assistance and supervision of the installation as required and shall be present during the UL inspection.

C. All concealed conductors shall be installed in Schedule 40 PVC conduit.

D. All metal bodies within 6-ft of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connections.

END OF SECTION