



Standards and Design Guidelines  
for  
Wastewater Treatment Plants  
and  
Lift Stations

(Updated March 09, 2018)

The following standards are for the design of interim wastewater treatment systems, permanent wastewater treatment systems, and lift stations to be dedicated to GBRA and/or operated by GBRA. Please review the following guidelines carefully and contact GBRA for a consultation meeting to address any related variances or other construction related matters.

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# **INTERIM WASTEWATER TREATMENT PLANTS**

## **Minimum Standards for Interim Wastewater Treatment Plants (5 Years Maximum and up to 100,000 GPD AADF)**

Interim wastewater treatment systems will be allowed with the stipulation that they shall be replaced by permanent wastewater treatment systems within five (5) years, as measured from interim startup to permanent startup. The following standards are for the design of interim conventional extended air process wastewater treatment systems to be dedicated to GBRA and/or operated by GBRA. Please review the following guidelines carefully and contact GBRA for a consultation meeting to address any related variances or other construction related matters.

These guidelines are for facilities with an annual average daily design flow up to 100,000 GPD. Larger facilities may have additional requirements, and the design of these facilities should be coordinated, in advance, with GBRA staff.

### **Design and Documents**

1. If construction has not commenced within one (1) year of GBRA design approval, that approval is no longer valid.
2. GBRA design approval is reliant upon the adequacy of the work of the engineer of record. All responsibility for the adequacy of the design remains with the engineer of record.
3. Provide complete design submittals for GBRA review and approval prior to bidding. Include master plan, plats, easements, design calculations, process flow diagrams, drawings, and specifications. Provide six (6) printed and bound half size copies and two (2) CD/PDF electronic copies. Allow 30 calendar days for review.
4. All piping shown on drawings shall be labeled as to the size, type, class, process fluid contained, and flow direction.
5. Submit easements and preliminary and final plats for GBRA review and approval.
  - a. Provide dedicated easements in the name of GBRA. Easements shall not overlap or be within residential lots.
  - b. Where outside of public right-of-way, provide dedicated easements with a minimum width equal to pipe outside diameter, rounded up to the nearest foot, plus 10 feet minimum on each side. For easements with multiple pipes, provide 10 feet minimum horizontal clearance between pipes. Provide additional width for easements that are not located adjacent to public right-of-way.
  - c. Other utilities, structures, grading, drainage, detention/retention ponds, landscaping, trees, roads, parking lots, fences, walls, construction of any type, or any other improvements or obstructions, are not allowed within GBRA easements.
  - d. Designs for any proposed alterations or crossings of GBRA easements must be approved in writing by GBRA and the installation of such must be inspected and approved by GBRA.
  - e. Maintenance of easements is the responsibility of the property owner.
  - f. The property owner must install 16 foot gates in any fences that cross GBRA easements; gates must be centered across GBRA utilities.
  - g. Customer water and wastewater services shall not be installed within fenced areas.

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6. Copies of each construction submittal (shop drawings, product data, etc.) shall be provided for GBRA review and approval prior to fabrication. Use clouds, boxes, arrows, etc., to clearly mark all proposed options and part numbers. List any proposed deviations on the submittal cover sheet. Allow 21 calendar days for review.
7. Provide the following materials prior to acceptance of facility by GBRA. Provide one (1) hard copy and one (1) CD/PDF copy unless noted otherwise:
  - a. Engineer's certification of completion in accordance with approved plans, specifications, and permits.
  - b. Engineer to provide TCEQ 217.16 plant operation and maintenance manual.
  - c. Copies of all close-out submittals required by regulatory agencies (city, county, TCEQ, etc.).
  - d. Spare Parts: Provide a spare for each single point of failure item. Provide one change of lubricants and filters for each piece of equipment.
  - e. Provide CD backup copies of programming for PLCs, pump controllers, HMI and control room(s).
  - f. O&M Manuals: Provide three (3) hard copies and three (3) CD/PDF searchable electronic copies of each O&M manual. Hard copies shall be printed duplex 8.5"x11" in color on 24# bond paper with reinforced holes and bound in D-ring binders (maximum 4" binders per volume) with sheet lifters front and back, table of contents, and tabbed sections. Drawings and schematics shall be 11"x17" and z-folded. Include test reports and calibration certificates. O&M description, project name, contractor name, and specification section shall be printed on the spine and cover of each binder. All copies shall be manufacturer original quality. Scanned and/or photocopies are not acceptable. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies. Submit at least two (2) weeks prior to operator training.
  - g. Waiver of lien by contractor (and subcontractors, as appropriate).
  - h. Warranty certificates, both from contractor and from manufacturer(s), valid for one (1) year from date of project final acceptance. Warranty shall include parts and labor for removal, repair, and replacement.
  - i. Executed operating contract or bill of sale transferring facility to GBRA.
  - j. As-Built and Record Drawings: Provide complete project drawing sets including all sheets and all trades. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies.
    - i. Contractor shall provide one (1) printed and bound full size copy of red lined as-built drawings and one (1) CD/PDF electronic copy, each sheet stamped "as-built drawing".
    - ii. Engineer shall prepare corrected CAD drawings, each sheet stamped "record drawing", and submit to GBRA five (5) printed and bound half size copies and five (5) CD/PDF searchable electronic copies of the corrected CAD drawings. Scanned and/or photocopies are not acceptable.
  - k. Recorded plats and easements.
  - l. Title Company review for release of all liens.

# INTERIM WASTEWATER TREATMENT PLANTS

## General Requirements

1. Design and installation shall be in accordance with TCEQ rules and AWWA standards, and in accordance with GBRA standards as further described in this document (see attachments). Any items or components that are intended to be permanent shall be furnished and installed in accordance with GBRA standards for permanent facilities.
2. The designs of wastewater systems shall be based on minimum 300 GPD/EDU average daily flow, 4.0 peak factor, and 300 GPD/acre inflow and infiltration.
3. Noise and odor impacts shall be considered in design.
4. Piping friction losses shall be calculated with a Hazen-Williams coefficient no greater than 120 for plastic pipe, and no greater than 100 for concrete or metal pipe.
5. All equipment shall be designed to automatically reset after power outages.
6. All equipment shall have elapsed time meters.
7. All pumps shall be equipped with mechanical seals.
8. All exposed piping 4" and smaller conveying liquids shall be heat traced, insulated, and covered with an aluminum insulation jacket cover. Pipes with continuous flow are exempt from this requirement.
9. Cleanouts shall have cast iron frames and covers with concrete collars in accordance with GBRA standard details.
10. All equipment, piping, and valves shall be labeled for identification purposes (e.g. pipe labels, color coding, banding, flow arrows, equipment numbers, valve tags, etc.).
11. Provide color coded tracing wire (copper clad steel, 12 gauge, 30 mil HDPE jacket) for all buried piping.
12. Valve boxes, equipment, exposed piping and valves, and appurtenances shall be painted. Provide colors in accordance with TCEQ rules. Do not paint hot dip galvanized (except if immersed), stainless steel, brass, or aluminum items.
13. All exposed ferrous metals shall be painted with a minimum 3-coat system consisting of zinc-rich primer, white color high-build epoxy second coat, and polyurethane top coat. Immersed ferrous metals shall be coated with minimum two (2) coats of coal tar epoxy. Immersed hot dip galvanized items shall be coated with minimum two (2) coats of coal tar epoxy for a minimum of 12" above and below the normal water level. Install in accordance with manufacturer recommendations.
14. All submerged steel shall have a minimum thickness of 1/4".
15. Provide adequate workspace and walkways to access all in-plant equipment. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24" maximum outside handrail.
16. All walkways shall be a minimum of 36" wide. Provide a minimum of 24" workspace on all sides of clarifier drive. Walkways shall be designed for a maximum deflection under 100 PSF live load of  $L/360$ .

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17. All steps, stair treads, and ladders shall have abrasive nosings. The maximum allowable slope for steps and stairs is 32.5 degrees. Provide 7" risers and 11" treads.
18. Provide access ladders from clarifier bridge into effluent launder trough for cleaning and maintenance purposes.
19. All submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length lifting chains.
20. Air lift pumps shall be 3" minimum with expansion box, air release vent pipe, top entry 316SS interior stinger air pipe thru 4" minimum flanged top cleanout with union, lever operated full port ball valve, and 316SS lifting chains. Centerline of cleanout shall be 24" maximum outside handrail.
21. The each basin and clarifier shall have drain piping with a hose connection. Hose connections shall be aluminum 3" female camlock with plug.
22. Each basin and clarifier shall have gates or valves to allow it to be hydraulically isolated.
23. Gate valves are not allowed for wastewater use. Valves shall be round port plug valves, horizontal shaft, closing downward, by Crispin, GA, Milliken, or Pratt.
24. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.
25. PVC male adapters are not allowed.
26. Flange coupling adapters shall be Smith Blair Model 911. Flange adapters are not allowed within hydraulic structures.
27. Non-potable water (NPW) shall be used for all in-plant uses. Suction for NPW pumps shall be from the chlorine contact basin 24" above floor. Provide freeze protection, basket strainers, flow meter, and minimum 250 gallon pressure tank. NPW system shall be designed to maintain 80 PSI minimum working pressure. Provide a 1" hose station in each process area for wash down purposes; each with 50ft heavy duty rubber hose, brass adjustable spray nozzle, and McMaster-Carr 53325K33 hose rack. At ground level, provide 1" Woodford Y1 non-freeze yard hydrants. In elevated locations, provide insulated 1" hose bibbs. Clearly label as non-potable.
28. For potable water service, provide Watts 009 RPZ backflow preventer with brass pipe/fittings/valves, insulated and heated aluminum enclosure, and cast-in-place reinforced concrete pad. Install pipe unions inside enclosure on each side of RPZ. Assembly minimum clearances inside the enclosure shall be 12" below, 3" above, and 6" sides. Provide licensed field testing certification for RPZ.
29. Provide open channel effluent flow metering with staff gauge, primary and secondary measuring devices, for both the chlorine contact basin and for plant discharge after the final treatment unit. Provide a 10" diameter, seven (7) day chart recorder for each flow meter. Install flow meter displays and chart recorders inside the Operations Building. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths. Flow meters shall be HydroRanger 200 or Greyline SLT 5.0 flow monitor.
30. All exposed vertical and horizontal concrete edges shall be formed with 3/4" chamfer strips.
31. Hydraulic structures must pass leakage testing prior to application of any coatings or linings. Fill with clean water to overflow level. Allow minimum 24-hour saturation period. Test

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duration is 1-hour. No allowable leakage. Test each basin or chamber separately. Any areas of visible moisture shall be repaired and retested.

32. All testing shall be performed by the contractor and witnessed by GBRA.
33. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.
34. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.
35. Explosives and blasting are not allowed.
36. Reference "GBRA Design Guidelines for Developer Utilities" for inspection requirements, survey staking, piping, manholes, testing requirements, etc. All work shall be in accordance with GBRA standards as published at the following website:  
<http://www.gbra.org/public/waterwastewaterservices.aspx>

### **Headworks**

1. Provide manual bar screens with maximum ½" openings and drying decks. Size screens and decks to be removable by one person. Minimum thickness shall be 3/16". For gravity fed facilities, provide mechanical screens with backup manual bypass bar screens.

### **Anaerobic/Anoxic Zones**

1. For systems utilizing an internal recycle of MLSS, provide ability to control recycle rate proportional to plant influent flow.
2. If submersible mixers or pumps are utilized for mixing or internal recycle, all submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length 316SS lifting chains.
3. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

### **Aeration Zone**

1. Guaranteed oxygen transfer efficiency shall be 9% minimum at the design diffuser submergence at design air flow rate. Oxygen transfer efficiency shall be guaranteed and substantiated by submission of test data compiled by a nationally recognized independent testing laboratory.
2. Each diffuser assembly shall be easily removable from tank manually by one person.

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3. PVC is not acceptable for aeration drops. Each diffuser drop pipe assembly shall consist of a union to allow for ease of removal, a lever operated ball valve accessible from the walkway for the purpose of shut off and regulation of air supply, and the necessary pipe and fittings. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24" maximum outside handrail.
4. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

### **Aeration Blowers**

1. Aeration blowers shall be one of the following:
  - a. Positive displacement blowers, operating at a speed less than 1780 rpm; by Aerzen, Gardner Denver, or Kaeser.
  - b. High speed turbo blowers by Hoffman or HSI.
  - c. Multi-stage centrifugal blowers by Gardner Denver, Hoffman, or HSI.
2. Provide the following items for each blower:
  - a. Isolation valves.
  - b. Check valves.
  - c. Adjustable pressure relief valves.
  - d. Inlet and discharge silencers and separate inlet filter. Combined inlet filter/silencers are not acceptable. Provide inlet air filter monitor gauges.
  - e. Secure blowers to equipment pad with vibration isolators and anchor bolts.
3. Maximum allowable sound level shall be 75 dBA at 10 feet. Provide insulated housings if necessary to meet this requirement.
4. Provide a pressure gauge and transmitter assembly on the common discharge header, in accordance with GBRA standards, for monitoring and to provide low pressure alarm to auto dialer.
5. PVC piping is not allowed for aeration piping.

### **Clarifiers**

1. Clarifiers, including piping, inlet, feedwell, and sludge scrapers, shall be in accordance with recommendations of WEF MOP-8.
2. Minimum sidewater depth in clarifier shall be 10'-0", with a minimum floor slope of 1:12.
3. Provide dual scum skimmers and a rotating pipe scum collection trough that extends the full radius of the clarifier, from the scum baffle at the outside, to the torque tube on the inside, thereby eliminating any possibility of scum escaping the system. Scum piping shall be provided to allow discharge to either the digester or the aeration basin.
4. Provide scum spray system with brass nozzles and an isolation valve at each nozzle and a master valve to isolate the entire system. Use Sch. 80 PVC pipe, valves, and fittings.
5. Weirs and scum baffle fasteners shall allow for adjustment.



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6. RAS/WAS pumping
  - a. Air-lift pumps are acceptable for RAS and WAS pumping, but shall be provided with sludge measurement box and weir. RAS piping shall be minimum 6" diameter with maximum 45 degree bends. Reference "General" above for additional requirements.
  - b. If mechanical pumps are utilized, they shall be positive displacement type by Gorman-Rupp, Hayward-Gordon, or Wemco; and shall be capable of passing 2" solids. Provide belt drive or VFD (adjustable sheaves are not allowed).

### **Aerobic Digesters, Sludge Dewatering and Disposal**

1. Provide telescoping valve, air lift, or other means of decanting digester and returning supernatant to plant headworks.
2. Provide a staff gauge in each digester extending from floor to top of wall. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths.

### **Filtration** (if required)

1. Filters shall be required for any facilities with permit limitations requiring phosphorus removal, for facilities with effluent TSS limits less than or equal to 5 mg/L, or where required by TCEQ.
2. Design overflow piping to accommodate peak flow.
3. Provide chlorine injection upstream of filters.
4. Provide hoist and access platform. Access platform shall be of sufficient size to lay a filter element flat on the platform with 18" minimum clearance on all sides to facilitate replacement of cloth media.

### **UV Disinfection** (if utilized)

1. Provide minimum of two (2) channels of UV equipment.
2. Flow-pace UV system to reduce energy consumption.

### **Chlorination** (if utilized)

1. All equipment and hardware in chlorination rooms shall be PVC, FRP, or other materials resistant to chlorine gas.
2. Chlorination equipment shall be gas type by Hydro Instruments or Superior. Provide automatic flow pacing, cylinder scales, automatic switchover, brass wye strainer, and manual bypass piping and valves around solenoid valve.
3. Provide chlorine leak detection system with audible and visual alarms. A leak detection sensor shall be installed inside each chlorine room. Detection meter shall be mounted on building exterior adjacent to entry door(s). Alarm beacon shall be LED and red color, mounted 12" minimum above roof peak.
4. Provide an intake fan and exhaust louver. The intake fan shall automatically shutdown when a chlorine leak is detected.

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5. Provide sidewalk and ramp at entrance to chlorination rooms.
6. Provide standard PM kits for each chlorinator, injector, and vacuum regulator.
7. Provide a Chlorine Institute Emergency Kit.
8. Provide Scott SCBA with fully charged carbon fiber tank and Scott AV-2000 face mask. Install storage cabinet in a non-chemical area/location.
9. Provide non-freeze combination eyewash showers.
10. Provide a potable water hose bibb in the chlorination room for backup supply during NPW maintenance and repair. Provide a hose connection point and isolation valve on the NPW supply piping in the chlorination room.
11. For fiberglass chemical buildings, reference GBRA Standard Specification 13124.

### **Chemical Feed** (if required)

1. Provide automatic flow pacing for each chemical feed system.
2. Provide redundancy for each chemical feed system.
3. Each chemical storage tank shall be equipped with an ultrasonic level indicator with local display.
4. All equipment and hardware in chemical buildings shall be PVC, FRP, or other chemical resistant materials.
5. For facilities with effluent phosphorus limitations, provide chemical feed system for phosphate precipitation, sized for ultimate peak flow. Provide two (2) peristaltic metering pumps, each rated for ultimate peak flow.
6. The use of methanol as a supplemental carbon source is not acceptable. Micro-C or other non-hazardous supplemental carbon sources shall be utilized, if required.
7. Provide concrete curb containment and floors with broom finish. Slope floors to recessed sump pits.
8. Provide interior and exterior ramp at entrance to each chemical room.
9. Provide non-freeze combination eyewash showers.
10. For fiberglass chemical buildings, reference GBRA Standard Specification 13124.

### **Operations Building**

1. Provide an insulated 12'x12' portable building with the following items:
  - a. Plywood interior.
  - b. Sink with potable water.
  - c. Window above sink.
  - d. 12' countertop and base cabinets.
  - e. Window A/C unit.

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- f. Portable floor heater.
- g. Lights.
- h. Receptacles.
- i. Door hardware with Best brand key system, construction cores, and control keys.

### **Site Improvements**

- 1. Roads shall be 16ft wide.
- 2. Fencing shall be designed to minimize noise impacts if necessary. Comply with TCEQ requirements. If chain link fencing is used, follow GBRA standard details.

### **Electrical, Instrumentation, and Controls**

- 1. Electrical work shall be installed in accordance with NEC.
- 2. Include site plan, load calculations, one-line diagrams, schematics, panel layouts, etc. Include types, sizes, quantities, and routing of all raceways and conductors. Detail each duct bank section; IMC conduit on top of ground would be acceptable (not buried). Provide interior and exterior layout details, schematics, and one-line diagrams for all control panels and MCCs.
- 3. Engineer to design grounding system for panels, generator, and metal structures. Resistance to ground for site grounding shall be 5 Ohms or less.
- 4. All equipment shall be designed to automatically reset after power outages.
- 5. Main electrical service shall be provided with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.
- 6. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
- 7. Provide a cellular auto dialer with email capability to monitor all equipment. Backup power supply shall be a 24V battery system with trickle charger. The battery system shall have sufficient capacity to power the auto dialer for a minimum of four (4) hours duration.
- 8. All floats shall have one NO and one NC set of contacts.
- 9. All full voltage starters shall be NEMA sized, minimum size of 1. Half sized starters and IEC starters are not allowed. Provide these starters with solid state overload relays.
- 10. Allowable manufacturers for SSRV's and VFD's are ABB, Eaton/Cutler Hammer, GE, and Schneider/SQD. Substitutions are not allowed.
- 11. Equipment control panels shall be tested in accordance with NFPA 70.
- 12. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
- 13. All control panel and MCC control wiring shall be color coded as follows:
  - a. AC controls                      Red
  - b. DC controls                      Blue
  - c. DC (+) power                      Red
  - d. DC (-) power                      Black

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- e. AC hot                      Black
- f. AC neutral                White

14. Phase colored tape is required for all conductors.
15. All 4-20mA signal wire shall be 20 AWG twisted shielded.
16. A separate neutral conductor is required for every 120VAC circuit.
17. A separate grounding conductor is required for every raceway, including electrical and I&C. Minimum size is 12 AWG.
18. Label wiring with Ideal pre-printed wire markers.
19. Enclosures in chemical areas shall be NEMA 4X FRP or PVC. In climate controlled areas, provide NEMA 1A gasketed or NEMA 12 enclosures for starters, disconnects, enclosed circuit breakers, control panels, MCCs, and RTU cabinets. All other enclosures shall be NEMA 4. All enclosures shall be provided with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
20. Provide type written panel directories and laminated as-built schematics and diagrams in all electrical panels.
21. Electrical panels shall have aluminum bus.
22. All electrical enclosures shall have black phenolic labels with white 3/8" block lettering, attach with aluminum rivets. All instruments shall have round shaped black phenolic tags with white 1/4" block lettering, attach with cable. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.
23. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
24. Exposed/above ground conduit may be Sch 40 PVC (3/4" minimum). Duct banks may be IMC conduit on top of ground, not buried (1" minimum).
25. For flexible conduit, use Type LFNC flexible seal tight conduit for 3/4" minimum to 2" sizes (1/2" LFNC flex will be allowed for instruments with 1/2" threaded hub entries, all other flex shall be 3/4" or larger). Use aluminum core liquid tight flexible metal conduit for sizes 2 1/2" and larger. Maximum length of flex conduit shall be 18". All connectors shall be aluminum. All conduit shall be mounted on strut.
26. Use FRP hardware, strut, straps, and anchors in chemical areas. All electrical enclosures, devices, and light fixtures shall be mounted on strut.
27. Use grounding type Myers hubs with insulated throats for all enclosure entries.
28. Use aluminum seal-off fittings where required by NEC, seal with 3M-2123 re-enterable sealing compound.
29. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.
30. Megger test load and line conductors of all power circuits and submit test reports.
31. Resistance to ground for site grounding shall be 5 Ohms or less. Contractor shall perform Fall-of-Potential three point ground megger testing.

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32. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.
33. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.
34. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.

### **Emergency Generator**

1. Provide a permanent emergency generator at each treatment plant.
2. Generator shall be as manufactured by Caterpillar, Cummins, Generac, Kohler, MTU, Stewart & Stevenson, or Taylor; substitutions are not allowed. Size generator to operate the facility at 100% capacity with 20% maximum voltage drop.
3. For generators less than 105 kW, inclusive, provide natural gas or propane powered generator. Generators larger than 105 kW may be diesel. Fuel capacity shall be 24 hours minimum at 100% generator load rating. Maximum storage for fuel calculations shall be 90% of tank capacity.
4. Maximum noise level shall be 78 dbA at 7 meters.
5. Generator shall have a battery charger and dry contacts for all alarms. Generator and ATS alarms shall be monitored via auto dialer.
6. Provide automatic transfer switch (ATS) with programmable exerciser (with and without load), NEMA 4X enclosure mounted on vertical strut, external mounting lugs, and lockable 3-point latch system. Substitutions are not allowed.
7. Generator shall be mounted on a cast-in-place reinforced concrete pad with perimeter beam.
8. Perform onsite load bank testing as follows:
  - a. Perform cold start block test at 100% load.
  - b. Perform 4-hour load bank testing, 2-hours of which shall be at 100% load.
  - c. Refill fuel tank to 90% capacity upon completion of testing.
9. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.
10. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.

# **PERMANENT WASTEWATER TREATMENT PLANTS**

## **Minimum Standards for Permanent Wastewater Treatment Plants**

The following standards are for the design of permanent conventional extended air process wastewater treatment systems to be dedicated to GBRA and/or operated by GBRA. Please review the following guidelines carefully and contact GBRA for a consultation meeting to address any related variances or other construction related matters.

### **Design and Documents**

1. If construction has not commenced within one (1) year of GBRA design approval, that approval is no longer valid.
2. GBRA design approval is reliant upon the adequacy of the work of the engineer of record. All responsibility for the adequacy of the design remains with the engineer of record.
3. Provide complete design submittals for GBRA review and approval prior to bidding. Include master plan, plats, easements, design calculations, process flow diagrams, drawings, and specifications. Provide six (6) printed and bound half size copies and two (2) CD/PDF electronic copies. Allow 30 calendar days for review.
4. All piping shown on drawings shall be labeled as to the size, type, class, process fluid contained, and flow direction.
5. Submit easements and preliminary and final plats for GBRA review and approval.
  - a. Provide dedicated easements in the name of GBRA. Easements shall not overlap or be within residential lots.
  - b. Where outside of public right-of-way, provide dedicated easements with a minimum width equal to pipe outside diameter, rounded up to the nearest foot, plus 10 feet minimum on each side. For easements with multiple pipes, provide 10 feet minimum horizontal clearance between pipes. Provide additional width for easements that are not located adjacent to public right-of-way.
  - c. Other utilities, structures, grading, drainage, detention/retention ponds, landscaping, trees, roads, parking lots, fences, walls, construction of any type, or any other improvements or obstructions, are not allowed within GBRA easements.
  - d. Designs for any proposed alterations or crossings of GBRA easements must be approved in writing by GBRA and the installation of such must be inspected and approved by GBRA.
  - e. Maintenance of easements is the responsibility of the property owner.
  - f. The property owner must install 16 foot gates in any fences that cross GBRA easements; gates must be centered across GBRA utilities.
  - g. Customer water and wastewater services shall not be installed within fenced areas.
6. Copies of each construction submittal (shop drawings, product data, etc.) shall be provided for GBRA review and approval prior to fabrication. Use clouds, boxes, arrows, etc., to clearly mark all proposed options and part numbers. List any proposed deviations on the submittal cover sheet. Allow 21 calendar days for review.
7. Provide the following materials prior to acceptance of facility by GBRA. Provide one (1) hard copy and one (1) CD/PDF copy unless noted otherwise:

## PERMANENT WASTEWATER TREATMENT PLANTS

- a. Engineer's certification of completion in accordance with approved plans, specifications, and permits.
- b. Engineer to provide TCEQ 217.16 plant operation and maintenance manual.
- c. Copies of all close-out submittals required by regulatory agencies (city, county, TCEQ, etc.).
- d. Spare Parts: Provide a spare for each single point of failure item. Provide one change of lubricants and filters for each piece of equipment.
- e. Provide CD backup copies of programming for PLCs, pump controllers, HMI and control room(s).
- f. O&M Manuals: Provide three (3) hard copies and three (3) CD/PDF searchable electronic copies of each O&M manual. Hard copies shall be printed duplex 8.5"x11" in color on 24# bond paper with reinforced holes and bound in D-ring binders (maximum 4" binders per volume) with sheet lifters front and back, table of contents, and tabbed sections. Drawings and schematics shall be 11"x17" and z-folded. Include test reports and calibration certificates. O&M description, project name, contractor name, and specification section shall be printed on the spine and cover of each binder. All copies shall be manufacturer original quality. Scanned and/or photocopies are not acceptable. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies. Submit at least two (2) weeks prior to operator training.
- g. Waiver of lien by contractor (and subcontractors, as appropriate).
- h. Warranty certificates, both from contractor and from manufacturer(s), valid for one (1) year from date of project final acceptance. Warranty shall include parts and labor for removal, repair, and replacement.
- i. Executed operating contract or bill of sale transferring facility to GBRA.
- j. As-Built and Record Drawings: Provide complete project drawing sets including all sheets and all trades. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies.
  - i. Contractor shall provide one (1) printed and bound full size copy of red lined as-built drawings and one (1) CD/PDF electronic copy, each sheet stamped "as-built drawing".
  - ii. Engineer shall prepare corrected CAD drawings, each sheet stamped "record drawing", and submit to GBRA five (5) printed and bound half size copies and five (5) CD/PDF searchable electronic copies of the corrected CAD drawings. Scanned and/or photocopies are not acceptable.
- k. Recorded plats and easements.
- l. Title Company review for release of all liens.

### General Requirements

1. Design and installation shall be in accordance with TCEQ rules and AWWA standards, and in accordance with GBRA standards as further described in this document (see attachments).
2. The designs of wastewater systems shall be based on minimum 300 GPD/EDU average daily flow, 4.0 peak factor, and 300 GPD/acre inflow and infiltration.
3. Noise and odor impacts shall be considered in design.
4. Piping friction losses shall be calculated with a Hazen-Williams coefficient no greater than 120 for plastic pipe, and no greater than 100 for concrete or metal pipe.

## PERMANENT WASTEWATER TREATMENT PLANTS

5. All hydraulic structures and basins shall be of reinforced concrete construction.
6. Provide 1" minimum thickness calcium aluminate chemical resistant lining for lift station wet well, headworks, and primary treatment structures. Calcium aluminate material shall be SewperCoat, Refratta HAC 100, or approved equal. Proposed substitutes must be equal in composition and manufacturer warranty. Product must be installed by a manufacturer certified applicator. Prepare surface by sand blasting. Provide smooth trowel finish. Apply spray curing compound.
7. All equipment shall be designed to automatically reset after power outages.
8. All equipment shall have elapsed time meters.
9. All pumps shall be equipped with mechanical seals.
10. All motors shall be Premium Efficiency, totally enclosed, with minimum 1.15 service factor. All motors driven by variable frequency drives shall be inverter-duty rated.
11. Supports and hardware for equipment and piping shall be Type 316 stainless steel (i.e. clamps, brackets, stanchions, etc.).
12. All fasteners shall be Type 316 stainless steel (e.g. hardware, screws, anchor bolts, rods, bolts, nuts, etc. for piping, valves, pumps, motors, equipment, etc.) including those for factory assembly of components. All bolts and nuts shall be heavy hex. Anchor bolts installed within hydraulic structures shall be epoxy type. Field apply nickel anti-seize compound to threads prior to assembly. Stainless steel items shall not be painted.
13. All exposed piping 4" and smaller conveying liquids shall be heat traced, insulated, and covered with an aluminum insulation jacket cover. Pipes with continuous flow are exempt from this requirement.
14. Cleanouts shall have cast iron frames and covers with concrete collars in accordance with GBRA standard details.
15. All equipment, piping, and valves shall be labeled for identification purposes (e.g. pipe labels, color coding, banding, flow arrows, equipment numbers, valve tags, etc.).
16. Provide color coded tracing wire (copper clad steel, 12 gauge, 30 mil HDPE jacket) for all buried piping.
17. Valve boxes, equipment, exposed piping and valves, and appurtenances shall be painted. Provide colors in accordance with TCEQ rules. Do not paint hot dip galvanized (except if immersed), stainless steel, brass, or aluminum items.
18. All exposed ferrous metals shall be painted with a minimum 3-coat system consisting of zinc-rich primer, white color high-build epoxy second coat, and polyurethane top coat. Immersed ferrous metals shall be coated with minimum two (2) coats of coal tar epoxy. Immersed hot dip galvanized items shall be coated with minimum two (2) coats of coal tar epoxy for a minimum of 12" above and below the normal water level. Install in accordance with manufacturer recommendations.
19. All submerged steel shall have a minimum thickness of ¼".
20. Clarifier equipment, bridge support beams, and stairs shall be hot dip galvanized.



## PERMANENT WASTEWATER TREATMENT PLANTS

21. Provide adequate workspace and walkways to access all in-plant equipment. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24" maximum outside handrail.
22. All walkways shall be a minimum of 36" wide. Provide a minimum of 24" workspace on all sides of clarifier drive. Walkways shall be designed for a maximum deflection under 100 PSF live load of  $L/360$ .
23. All handrails shall be aluminum or stainless. All grating shall be aluminum. Galvanized and checker plate are not acceptable.
24. All steps, stair treads, and ladders shall have abrasive nosings. The maximum allowable slope for steps and stairs is 32.5 degrees. Provide 7" risers and 11" treads.
25. Provide aluminum access ladders from clarifier bridge into effluent launder trough for cleaning and maintenance purposes.
26. All submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length lifting chains (all these items shall be 316SS).
27. Air lift pumps shall be 3" minimum and hot dip galvanized with expansion box, air release vent pipe, top entry 316SS interior stinger air pipe thru 4" minimum flanged top cleanout with union, 316SS lever operated full port ball valve, and 316SS lifting chains. Centerline of cleanout shall be 24" maximum outside handrail.
28. The floor each in basin and clarifier shall be sloped to drain piping that penetrates the floor. Drain piping and valves shall be 4" minimum. Hose connections shall be aluminum 3" female camlock with plug.
29. Each basin and clarifier shall have gates or valves to allow it to be hydraulically isolated.
30. Gate valves are not allowed for wastewater use. Valves shall be round port plug valves, horizontal shaft, closing downward, with 316SS external bolts, nuts, and hardware by Crispin, GA, Milliken, or Pratt.
31. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.
32. PVC male adapters are not allowed.
33. Flange coupling adapters shall be Smith Blair Model 911. Flange adapters are not allowed within hydraulic structures.
34. Ductile iron pipe and fittings shall be epoxy lined.
35. Non-potable water (NPW) shall be used for all in-plant uses. Suction for NPW pumps shall be from the chlorine contact basin 24" above floor. Install pumping systems within buildings designed for human occupancy, reference "Equipment Buildings" below for additional requirements. Provide basket strainers, flanged mag meter, and minimum 250 gallon pressure tank. NPW system shall be designed to maintain 80 PSI minimum working pressure. Reference "Reuse" below for pump types, manufacturers, and additional requirements. Provide a 1" hose station in each process area for wash down purposes; each with 50ft heavy duty rubber hose, brass adjustable spray nozzle, and McMaster-Carr 53325K33 hose rack. At ground level, provide 1" Woodford Y1 non-freeze yard hydrants. In elevated locations, provide insulated 316SS 1" hose bibbs. Clearly label as non-potable.

## PERMANENT WASTEWATER TREATMENT PLANTS

36. For potable water service, provide Watts 009 RPZ backflow preventer with brass pipe/fittings/valves, insulated and heated aluminum enclosure, and cast-in-place reinforced concrete pad. Install pipe unions inside enclosure on each side of RPZ. Assembly minimum clearances inside the enclosure shall be 12" below, 3" above, and 6" sides. Provide licensed field testing certification for RPZ.
37. Provide open channel effluent flow metering with staff gauge, primary and secondary measuring devices, for both the chlorine contact basin and for plant discharge after the final treatment unit. Provide a 10" diameter, seven (7) day chart recorder for each flow meter. Install flow meter displays and chart recorders inside the Operations Building. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths. Flow meters shall be HydroRanger 200 or Greyline SLT 5.0 flow monitor. All flow meter data shall be logged via the SCADA system.
38. Pressure gauge assemblies shall include the following items:
  - a. Stainless steel full port isolation ball valve.
  - b. Pressure diaphragm seal and plain end bibb sampling valve, both stainless steel.
  - c. 4" Pressure gauge, complying with ASME B40.1, Grade 1A, with 1% full scale accuracy, stainless case and stainless steel wetted parts, glycerin filled.
  - d. Gauges shall read in both ftH<sub>2</sub>O and PSI. Select range for normal working pressure to be mid-range.
  - e. The entire assembly shall be Type 316 stainless steel.
39. All exposed vertical and horizontal concrete edges shall be formed with 3/4" chamfer strips.
40. Hydraulic structures must pass leakage testing prior to application of any coatings or linings. Fill with clean water to overflow level. Allow minimum 24-hour saturation period. Test duration is 1-hour. No allowable leakage. Test each basin or chamber separately. Any areas of visible moisture shall be repaired and retested.
41. All testing shall be performed by the contractor and witnessed by GBRA.
42. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.
43. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.
44. Explosives and blasting are not allowed.
45. Reference "GBRA Design Guidelines for Developer Utilities" for inspection requirements, survey staking, piping, manholes, testing requirements, etc. All work shall be in accordance with GBRA standards as published at the following website:  
<http://www.gbraz.org/public/waterwastewaterservices.aspx>

# **PERMANENT WASTEWATER TREATMENT PLANTS**

## **Headworks**

1. Provide mechanical screens with backup manual bypass bar screens. The screening area shall be fabricated of 316SS or aluminum. Hot dip galvanized or painted steel are not acceptable. Mechanical screens shall be Lakeside Equipment Raptor Micro Strainer or Huber Technology Rotamat Micro Strainer Ro9. Manual and mechanical screens shall have maximum ½” openings. Manual bar screens shall have drying decks. Size screens and decks to be removable by one person. Minimum thickness shall be 3/16”.

## **Anaerobic/Anoxic Zones**

1. For systems utilizing an internal recycle of MLSS, provide ability to control recycle rate proportional to plant influent flow.
2. If submersible mixers or pumps are utilized for mixing or internal recycle, all submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length lifting chains (all these items to be 316SS).
3. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

## **Aeration Zone**

1. All diffusers shall be 316SS wide band diffusers (e.g. Sanitaire D-24, or of equivalent quality). Guaranteed oxygen transfer efficiency shall be 9% minimum at the design diffuser submergence at design air flow rate. Oxygen transfer efficiency shall be guaranteed and substantiated by submission of test data compiled by a nationally recognized independent testing laboratory.
2. Each diffuser assembly shall be easily removable from tank manually by one person.
3. All aeration drop pipes shall be aluminum or light-wall 316SS pipe. PVC is not acceptable for aeration drops. Each diffuser drop pipe assembly shall consist of a union to allow for ease of removal, a lever operated 316SS ball valve accessible from the walkway for the purpose of shut off and regulation of air supply, and the necessary pipe and fittings. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24” maximum outside handrail.
4. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

## **Aeration Blowers**

1. Provide a hot dip galvanized roof structure over blowers. Provide wall(s) as necessary to reduce noise.
2. Maximum allowable sound level shall be 75 dBA at 10 feet. Provide insulated housings if necessary to meet this requirement.

## PERMANENT WASTEWATER TREATMENT PLANTS

3. Aeration blowers shall be one of the following:
  - a. Positive displacement blowers, operating at a speed less than 1780 rpm; by Aerzen, Gardner Denver, or Kaeser.
  - b. High speed turbo blowers by Hoffman or HIS.
  - c. Multi-stage centrifugal blowers by Gardner Denver, Hoffman, or HIS.
4. Provide the following items for each blower:
  - a. Isolation valves.
  - b. Check valves.
  - c. Adjustable pressure relief valves.
  - d. Inlet and discharge silencers and separate inlet filter. Combined inlet filter/silencers are not acceptable. Provide inlet air filter monitor gauges.
  - e. Secure blowers to equipment pad with vibration isolators and 316SS anchor bolts.
5. Provide a pressure gauge and transmitter assembly on the common discharge header, in accordance with GBRA standards, for monitoring and to provide low pressure alarm via SCADA.
6. PVC piping is not allowed for aeration piping.

### Clarifiers

1. Clarifiers shall be circular design.
2. Clarifiers, including piping, inlet, feedwell, and sludge scrapers, shall be in accordance with recommendations of WEF MOP-8.
3. Minimum sidewater depth in clarifier shall be 10'-0", with a minimum floor slope of 1:12.
4. Clarifier drives shall utilize SEW Eurodrive gearmotors.
5. Provide dual scum skimmers and a rotating pipe scum collection trough that extends the full radius of the clarifier, from the scum baffle at the outside, to the torque tube on the inside, thereby eliminating any possibility of scum escaping the system. Scum piping shall be provided to allow discharge to either the digester or the aeration basin.
6. Provide scum spray system with brass nozzles and an isolation valve at each nozzle and a master valve to isolate the entire system. Use Sch. 80 PVC pipe, valves, and fittings.
7. Weirs and scum baffle shall be 316SS or aluminum, with 316SS fasteners for adjustment.
8. RAS/WAS pumping
  - a. Air-lift pumps are acceptable for RAS and WAS pumping, but shall be provided with sludge measurement box and weir. RAS piping shall be minimum 6" diameter with maximum 45 degree bends. Reference "General" above for additional requirements.
  - b. If mechanical pumps are utilized, they shall be positive displacement type by Gorman-Rupp, Hayward-Gordon, or Wemco; and shall be capable of passing 2" solids. Provide belt drive or VFD (adjustable sheaves are not allowed). Provide a magnetic flow meter monitored by SCADA (insertion type is not acceptable).

# PERMANENT WASTEWATER TREATMENT PLANTS

## Aerobic Digesters, Sludge Dewatering and Disposal

1. Provide telescoping valve, air lift, or other means of decanting digester and returning supernatant to plant headworks.
2. Provide a staff gauge in each digester extending from floor to top of wall. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths with minimum 4" tall numbering at every foot increment.
3. Provide a high level float alarm for digesters.
4. Liquid sludge disposal is not allowed. Provide equipment for sludge dewatering and disposal as follows:
  - a. For facilities up to 200,000 GPD AADF, provide two (2) sludge dewatering boxes.
  - b. For facilities up to 300,000 GPD AADF, provide three (3) sludge dewatering boxes.
  - c. For facilities greater than 300,000 GPD AADF, provide belt presses.
5. For sludge dewatering boxes, provide the following:
  - a. Equipment building/room for pumps.
  - b. Two (2) rotary lobe VFD pumps, each capable of 80 to 150 GPM.
  - c. Sludge suction piping shall be minimum 6" diameter with maximum 45 degree bends.
  - d. Flanged magnetic flow meter.
  - e. Polymer injection system with two (2) peristaltic metering pumps, each capable of 0.1 to 5.0 GPH.
  - f. Sludge dewatering boxes installed on a sloped concrete drainage pad, with perimeter curb walls, trench drain, and embed tracks for wheels. Provide 3 feet minimum clearance around boxes. Provide gravity drains or two (2) sump pumps, each capable of 60 GPM minimum.
6. For belt presses, provide the following:
  - a. Comply with TCEQ redundancy requirements.
  - b. Roof structure over all equipment.
  - c. Belt presses by Alfa Laval Ashbrook Simon-Hartley.
  - d. Polyurethane coated sludge disposal boxes installed on a sloped concrete drainage pad, with perimeter curb walls, trench drain, embed tracks for wheels, and electric winch to slide boxes. Provide 3 feet minimum clearance around boxes. Provide gravity drains or two (2) sump pumps, each capable of 60 GPM minimum.

## Filtration (if required)

1. Filters shall be required for any facilities with permit limitations requiring phosphorus removal, for facilities with effluent TSS limits less than or equal to 5 mg/L, or where required by TCEQ.
2. Filters shall be Fluidyne FFP, or GBRA approved equal with no submerged moving parts.
3. Provide two (2) independent filter basins, each with independent controls, and each rated for ultimate peak flow with one (1) element out of service.
4. Metal components shall be aluminum or 316SS.
5. Design overflow piping to accommodate ultimate peak flow.
6. Algae covers shall be aluminum or 316SS and removable by one person.

## **PERMANENT WASTEWATER TREATMENT PLANTS**

7. Provide chlorine injection upstream of filters.
8. Provide hoist and access platform. Access platform shall be of sufficient size to lay a filter element flat on the platform with 18" minimum clearance on all sides to facilitate replacement of cloth media.

### **UV Disinfection** (if utilized)

1. Provide minimum of two (2) channels of UV equipment, each with independent controls, and each rated for ultimate peak flow with the largest bank out of service.
2. Flow-pace UV system to reduce energy consumption.

### **Chlorination** (if utilized)

1. All equipment and hardware in chlorination rooms shall be PVC, FRP, or other materials resistant to chlorine gas.
2. Chlorination equipment shall be gas type by Hydro Instruments or Superior. Provide automatic flow pacing, cylinder scales, automatic switchover, brass wye strainer, and manual bypass piping and valves around solenoid valve.
3. Provide chlorine leak detection system with audible and visual alarms. A leak detection sensor shall be installed inside each chlorine room. Detection meter shall be mounted on building exterior adjacent to entry door(s). Alarm beacon shall be LED and red color, mounted 12" minimum above roof peak.
4. Provide an intake fan and exhaust louver. The intake fan shall automatically shutdown when a chlorine leak is detected.
5. Provide concrete floors with smooth trowel finish and concrete sealer. Install cast iron floor drains with brass strainers and slope floors to drains.
6. Provide sidewalk and ramp at entrance to chlorination rooms.
7. Provide standard PM kits for each chlorinator, injector, and vacuum regulator.
8. Provide a Chlorine Institute Emergency Kit.
9. Provide Scott SCBA with fully charged carbon fiber tank and Scott AV-2000 face mask. Install storage cabinet in a non-chemical area/location.
10. Provide non-freeze combination eyewash showers.
11. Provide a potable water hose bibb in the chlorination room for backup supply during NPW maintenance and repair. Provide a hose connection point and isolation valve on the NPW supply piping in the chlorination room.
12. For fiberglass chemical buildings, reference GBRA Standard Specification 13124.

### **Chemical Feed** (if required)

1. Provide automatic flow pacing for each chemical feed system.
2. Provide redundancy for each chemical feed system.

## **PERMANENT WASTEWATER TREATMENT PLANTS**

3. Each chemical storage tank shall be equipped with an ultrasonic level indicator with local display.
4. All equipment and hardware in chemical buildings shall be PVC, FRP, or other chemical resistant materials.
5. For facilities with effluent phosphorus limitations, provide chemical feed system for phosphate precipitation, sized for ultimate peak flow. Provide two (2) peristaltic metering pumps, each rated for ultimate peak flow.
6. The use of methanol as a supplemental carbon source is not acceptable. Micro-C or other non-hazardous supplemental carbon sources shall be utilized, if required.
7. Provide concrete curb containment and floors with broom finish and concrete sealer. Slope floors to recessed sump pits.
8. Provide sidewalk and interior and exterior ramp at entrance to each chemical room.
9. Provide non-freeze combination eyewash showers.
10. For fiberglass chemical buildings, reference GBRA Standard Specification 13124.

### **Operations Building and Equipment Buildings**

1. Split-face CMU construction, precast concrete, or pre-engineered metal building. Provide for CMU cleaning, sealer, and water repellent. Wooden materials are not allowed.
2. Roof shall be monolithic single panel precast concrete (i.e. no joints) or metal framing with metal roofing and trim. Roof shall be sloped. Flat roofs, wooden materials, and shingles are not allowed.
3. Buildings shall be insulated, including minimum R-30 insulation in ceiling.
4. Provide concrete floors with smooth trowel finish and concrete sealer. Install cast iron floor drains with brass strainers and slope floors to drains.
5. Doors shall be seamless and shall be hot dip galvanized, aluminum, or FRP. Door hinges shall be stainless steel. Exterior door hinges shall be NRP type. All other hardware and accessories shall be aluminum and/or stainless steel. All fasteners for all items shall be stainless steel, including those for factory assembly of components. Hardware shall be mortised. Provide drip caps, 12" tall kick plates, 4 ½" butt hinges, Best brand key system, construction cores, control keys, panic hardware with keyed external lever, hold open arm hydraulic closers, door stops with latches, rubber gaskets, single flap insert type neoprene sweeps, silencers, 4 ½" black vinyl thresholds, and 18" wide x 12" tall wire safety glass in each door. Size doors to accommodate removal of equipment. Minimum door size 3'-0" wide, 7'-0" high, 1 ¾" thick. Doors shall open to exterior. Embed 2"x2"x1/4" hot dip galvanized angles in edge of slab across door openings. Install "Danger" signs indicating any type of chemicals or hazards present.
6. Provide aluminum windows with Low-E break resistant glass.
7. Caulking sealants shall be matching color Sikaflex, Sonneborn NP-1, or approved equal. Use self-leveling sealant for flatwork.
8. Interior light fixtures shall be 48" strip LED, vapor tight, 4000K and 4,000 lumens.

## **PERMANENT WASTEWATER TREATMENT PLANTS**

9. Exterior light fixtures shall be weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W min., bronze finish, wall/surface mount above doors. Provide one centered above each door frame.
10. Pre-wire for Ethernet.
11. Buildings shall have appropriately sized HVAC system capable of maintaining an appropriate working environment within the building.
12. Bathroom shall be provided with hot water, sink, countertop, rolled paper towel dispenser, cabinets, mirror, toilet, toilet paper dispenser, walk-in shower, towel bars, towel hooks, heater, and exhaust fan. Bathroom shall be handicapped accessible.
13. Laboratory facilities shall be provided. The following minimum capacities shall apply: 150 SF floor area, 60 CF base cabinets, 30 CF wall cabinets, 12 LF and 24 SF countertops.
14. Countertops and sinks shall be 1" thick black epoxy resin with sinks 10" deep.
15. Base and wall cabinets shall be ¾" thick plywood with red oak veneer.
16. Buildings shall be ADA compliant.
17. Provide signs and/or labels for all buildings and rooms.

### **Effluent Storage and Reuse (if required)**

1. Provide a minimum of two (2) storage tanks. Total storage capacity shall be designed to provide 24-hours minimum storage. Any volume below pump minimum suction requirements shall not be used in calculations.
2. Effluent storage tanks shall be welded steel or prestressed concrete and shall comply with applicable AWWA standards.
3. Tank foundations shall be cast-in-place reinforced concrete.
4. Provide floor drain, interior ladder, sample ports, pressure level transmitter, and exterior inlet pipe with air gap. Level transmitter shall be located on exterior tank wall and shall be monitored by SCADA.
5. Overflow piping shall be connected to plant discharge piping and meter.
6. Provide buried bypass piping to allow for tank maintenance and repair and water quality issues.
7. Provide open channel effluent flow metering, chart recorders, and appurtenances for common inlet and common outlet at tanks in accordance with "General" above. Metering for inlet shall occur after the final treatment unit. Metering for outlet shall occur prior to plant discharge.
8. Tank pump suction pipe shall be 24" above floor of tank with anti-vortex protection.
9. Install pumping systems within buildings designed for human occupancy. Buildings shall have appropriately sized HVAC system capable of maintaining an appropriate working environment within the building. Reference "Equipment Buildings" above for additional requirements.
10. Provide hoisting provisions for pumps and motors.
11. Pumping systems shall be certified for municipal service for 20-years minimum service life. Agricultural grade systems are not allowed.



## **PERMANENT WASTEWATER TREATMENT PLANTS**

12. Provide basket strainers for pumping systems.
13. Suction and discharge air release valves shall be 2" A.R.I. Model D-040-L.
14. All pumps shall be equipped with mechanical seals and elapsed time meters.
15. All motors shall be Premium Efficiency, totally enclosed, with minimum 1.15 service factor. All motors driven by variable frequency drives shall be inverter-duty rated.
16. Impellers shall be low-zinc bronze, stainless steel, or nickel-aluminum-bronze. Zinc content shall be less than 5%.
17. Provide lead/lag/standby pump operation and first on/first off alternation.
18. Provide a flanged mag meter to measure pump discharge in accordance with GBRA Standard Specification 13442.
19. Packaged skid-mounted pumping systems shall be manufactured by Fairbanks-Morse, Flowserve, or Goulds.
20. Vertical turbine pumps shall be manufactured by Fairbanks-Morse, Flowserve, Peerless, or Sulzer.
21. Horizontal split-case pumps shall be manufactured by Fairbanks-Morse, Flowserve, or Peerless.
22. Pumping systems shall include hydropneumatic tanks equipped with B&W probe controls installed inside a sight glass. For freeze protection, install controls end of tank inside the pump building (i.e. tank penetrating building wall). Provide 24" minimum diameter tank access manway. At a minimum air compressors shall be 60 GAL, 5 HP, 150 PSI, with automatic drain valve; engineer to evaluate additional capacity requirements.
23. Exposed gate valves shall be rising stem American Flow Control Series 2500, or GBRA approved equal.
24. Reuse water distribution systems shall be designed to provide 55 PSI minimum at customer meters.

## **Site Improvements**

1. Access road and parking areas shall be asphalt or concrete. Roads shall be 16ft wide.
2. Provide at least one handicap-accessible parking space.
3. All unpaved areas of site within fenced boundaries shall be covered with weed barrier and a 6" layer of TXDOT Grade 1 crushed stone coarse aggregate.
4. Fencing shall be designed to minimize noise impacts if necessary. Comply with TCEQ requirements. If chain link fencing is used, follow GBRA standard details.
5. Provide signs in accordance with TCEQ rules and as further described herein. Signs shall be 0.080" thick aluminum with painted background and painted block lettering. Attach with aluminum rivets and/or 316SS hardware, flat washers, and lock nuts.

# PERMANENT WASTEWATER TREATMENT PLANTS

## Electrical, Instrumentation, and Controls

1. Electrical work shall be installed in accordance with GBRA standard details (see attachments).
2. Engineer to provide complete design drawings and specifications. Include site plan, load calculations, one-line diagrams, schematics, panel layouts, etc. Include types, sizes, quantities, and routing of all raceways and conductors. Detail each duct bank section. Provide interior and exterior layout details, schematics, and one-line diagrams for all control panels and MCCs.
3. Engineer to design site grounding system to include fencing, tanks, buildings, structures, generator, RTU, antenna, etc. Resistance to ground for site grounding shall be 5 Ohms or less.
4. All equipment shall be designed to automatically reset after power outages.
5. Main electrical service shall be provided with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.
6. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
7. Provide a Power Quality Meter (PQM) on load side of service or on load side of main disconnect. The PQM shall be Shark Model 200 with outputs as required to provide ampacities, voltages, and KWH to the applicable control room(s) via SCADA.
8. Provide a centralized climate controlled environment for electrical panels and control system. Any panels installed in outdoor locations shall be equipped with a roof and single wall shelter. Orientation of shelter shall be such that panels face east or north with wall on west or south side.
9. Interior light fixtures shall be 48" strip LED, vapor tight, 4000K and 4,000 lumens.
10. Exterior light fixtures shall be weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W min., bronze finish, wall/surface mount above doors. Provide one centered above each door frame.
11. Provide manually-controlled full cutoff LED site lighting in each process area: 15,000 lumens and 4,000K. Provide intermediate hinged aluminum poles in bronze color; anchors, hardware, and winch shall be stainless steel. Provide switches, photocells, and receptacles at all lighting poles.
12. All treatment facilities shall have a SCADA system, appropriate for the applicable service area. All equipment shall be monitored via SCADA; including instruments, flow meters, and HOA switches.
13. All PLCs shall be of the same communication type; each with 10% minimum spare I/O, all mapped to the top end. This applies to the entire site and all equipment.
14. Plant main RTU shall be SCADA Pack 32 PLC or Banner Engineering DX80DR9M-H1C. Depending on service area, provide MDS iNet-900 or Banner Engineering DX80DR9M-H1C radio for communication to applicable control room(s). Coordinate with GBRA staff to determine service area, site specific requirements, and appropriate radio and controller. SCADA system shall be designed and installed in accordance with GBRA standards. Reference GBRA Standard Specification 13428 for additional requirements.

## PERMANENT WASTEWATER TREATMENT PLANTS

15. RTU backup power supply shall be a 24V battery system with trickle charger. The battery system shall have sufficient capacity to power the RTU for a minimum of four (4) hours duration.
16. Provide a 15" minimum master OIT local touch screen for the site, mounted on the exterior face of the SCADA panel. Display all statuses and all process values for the entire project. Process setpoints shall be operator adjustable on the OIT. Display main PQM ampacities, voltages, and KWH.
17. Provide hinged UV protective covers for all OITs that are installed outdoors. Provide Shade Aide, or GBRA approved equal.
18. All floats shall have one NO and one NC set of contacts.
19. All full voltage starters shall be NEMA sized, minimum size of 1. Half sized starters and IEC starters are not allowed. Provide these starters with solid state overload relays.
20. Solid State Reduced-Voltage (SSRV) soft starters shall be used for motors larger than 25 HP or as required by the site electrical service size.
21. Allowable manufacturers for SSRV's and VFD's are ABB, Eaton/Cutler Hammer, GE, and Schneider/SQD. Substitutions are not allowed.
22. Equipment control panels shall have an aluminum dead-front inner door. Panels shall be provided by equipment manufacturer, and shall be tested in accordance with NFPA 70.
23. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
24. Indicator lights shall be LED push-to-test type (red/run/open, green/stop/closed, amber/fault, white/power).
25. Alarm beacons shall be LED and red color. Do not penetrate tops of panels.
26. Provide LED strip lighting with door switch inside control panels if the enclosure size is greater than or equal to 30" wide and greater than or equal to 12" deep.
27. All control panel and MCC control wiring shall be flexible 41 strand tinned copper, size 14 AWG minimum, 600V insulation, Type SIS for control panels, Type MTW for MCCs, and color coded as follows:
  - a. AC controls Red
  - b. DC controls Blue
  - c. DC (+) power Red
  - d. DC (-) power Black
  - e. AC hot Black
  - f. AC neutral White
28. All other conductors shall be stranded copper XHHW-2.
29. Phase colored insulation is required for all conductors.
30. All 4-20mA signal wire shall be 20 AWG twisted shielded.
31. A separate neutral conductor is required for every 120VAC circuit.
32. A separate grounding conductor is required for every raceway, including electrical and I&C. Minimum size is 12 AWG.

## PERMANENT WASTEWATER TREATMENT PLANTS

33. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.
34. Enclosures in chemical areas shall be NEMA 4X FRP or PVC. In climate controlled areas, provide NEMA 1A gasketed or NEMA 12 enclosures for starters, disconnects, enclosed circuit breakers, control panels, MCCs, and RTU cabinets. All other enclosures shall be NEMA 4X 316SS. All enclosures shall be provided with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
35. Provide type written panel directories and laminated as-built schematics and diagrams in all electrical panels.
36. Electrical panels shall have tinned copper bus and bolt-on type circuit breakers.
37. All electrical enclosures shall have black phenolic labels with white 3/8" block lettering, attach with aluminum rivets. All instruments shall have round shaped black phenolic tags with white 1/4" block lettering, attach with 316SS cable. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.
38. All surface mounted device boxes shall be FD type sand cast aluminum with 316SS cover screws.
39. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
40. Exposed/above ground conduit shall be aluminum rigid (3/4" minimum). Underground conduit shall be Sch 40 PVC (1" minimum) and shall be installed in reinforced concrete duct banks. Stub-ups from underground to 6" above grade including the 90-degree bends shall be ETL-PVC-001 certified PVC coated GRS conduit, submit installer certification.
41. Duct banks shall be steel reinforced red-dyed concrete in accordance with GBRA standard details.
42. Route circuits inside building slabs and walls (not on the surface of walls). Sch. 40 PVC may be used for these feeds where they are enclosed in walls.
43. For flexible conduit, use Type LFNC flexible seal tight conduit for 3/4" minimum to 2" sizes (1/2" LFNC flex will be allowed for instruments with 1/2" threaded hub entries, all other flex shall be 3/4" or larger). Use aluminum core liquid tight flexible metal conduit for sizes 2 1/2" and larger. Maximum length of flex conduit shall be 18". All connectors shall be aluminum. All conduit shall be mounted on strut.
44. Use FRP hardware, strut, straps, and anchors in chemical areas. All other locations shall be 316SS. All electrical enclosures, devices, and light fixtures shall be mounted on strut.
45. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and 316SS screws. Snap-on covers are not permitted.
46. Use aluminum grounding type Myers hubs with insulated throats for all enclosure entries.
47. Use UNY and UNF aluminum unions. Galvanized unions are not permitted.
48. Use aluminum seal-off fittings where required by NEC, seal with 3M-2123 re-enterable sealing compound.
49. Use Noalox or other comparable anti-oxidizing agent on all conduit threads.

## **PERMANENT WASTEWATER TREATMENT PLANTS**

50. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.
51. Megger test load and line conductors of all power circuits and submit test reports.
52. Resistance to ground for site grounding shall be 5 Ohms or less. Contractor shall perform Fall-of-Potential three point ground megger testing.
53. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.
54. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.
55. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.

### **Emergency Generator**

1. Provide a permanent emergency generator at each treatment plant.
2. Generator shall be as manufactured by Caterpillar, Cummins, Generac, Kohler, MTU, Stewart & Stevenson, or Taylor; substitutions are not allowed. Size generator to operate the facility at 100% capacity with 20% maximum voltage drop at ultimate build-out of facility.
3. For generators less than 105 kW, inclusive, provide natural gas or propane powered generator. Generators larger than 105 kW may be diesel. Fuel capacity shall be 24 hours minimum at 100% generator load rating. Maximum storage for fuel calculations shall be 90% of tank capacity.
4. Maximum noise level shall be 78 dbA at 7 meters.
5. Generator shall have a battery charger and dry contacts for all alarms. Generator and ATS alarms shall be monitored via SCADA.
6. Provide ASCO or Russelectric automatic transfer switch (ATS) with programmable exerciser (with and without load), NEMA 4X 316SS enclosure mounted on vertical strut, external mounting lugs, and lockable 3-point latch system. Substitutions are not allowed.
7. Generator shall be mounted on a cast-in-place reinforced concrete pad with perimeter beam.
8. Perform onsite load bank testing as follows:
  - a. Perform cold start block test at 100% load.
  - b. Perform 4-hour load bank testing, 2-hours of which shall be at 100% load.
  - c. Refill fuel tank to 90% capacity upon completion of testing.
9. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.

## **PERMANENT WASTEWATER TREATMENT PLANTS**

10. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.

# **LIFT STATIONS**

## **Minimum Standards for Lift Stations**

The following standards are for the design of lift stations to be dedicated to GBRA and/or operated by GBRA. Please review the following guidelines carefully and contact GBRA for a consultation meeting to address any related variances or other construction related matters.

### **Design and Documents**

1. If construction has not commenced within one (1) year of GBRA design approval, that approval is no longer valid.
2. GBRA design approval is reliant upon the adequacy of the work of the engineer of record. All responsibility for the adequacy of the design remains with the engineer of record.
3. Provide complete design submittals for GBRA review and approval prior to bidding. Include master plan, plats, easements, design calculations, process flow diagrams, drawings, and specifications. Provide six (6) half-size hard copies and two (2) CD/PDF format copies. Allow 30 calendar days for review.
4. All piping shown on drawings shall be labeled as to the size, type, class, process fluid contained, and flow direction.
5. Submit easements and preliminary and final plats for GBRA review and approval.
  - a. Provide dedicated easements in the name of GBRA. Easements shall not overlap or be within residential lots.
  - b. Where outside of public right-of-way, provide dedicated easements with a minimum width equal to pipe outside diameter, rounded up to the nearest foot, plus 10 feet minimum on each side. For easements with multiple pipes, provide 10 feet minimum horizontal clearance between pipes. Provide additional width for easements that are not located adjacent to public right-of-way.
  - c. Other utilities, structures, grading, drainage, detention/retention ponds, landscaping, trees, roads, parking lots, fences, walls, construction of any type, or any other improvements or obstructions, are not allowed within GBRA easements.
  - d. Designs for any proposed alterations or crossings of GBRA easements must be approved in writing by GBRA and the installation of such must be inspected and approved by GBRA.
  - e. Maintenance of easements is the responsibility of the property owner.
  - f. The property owner must install 16 foot gates in any fences that cross GBRA easements; gates must be centered across GBRA utilities.
  - g. Customer water and wastewater services shall not be installed within fenced areas.
6. Copies of each construction submittal (shop drawings, product data, etc.) shall be provided for GBRA review and approval prior to fabrication. Use clouds, boxes, arrows, etc., to clearly mark all proposed options and part numbers. List any proposed deviations on the submittal cover sheet. Allow 21 calendar days for review.
7. Provide the following materials prior to acceptance of facility by GBRA. Provide one (1) hard copy and one (1) CD/PDF copy unless noted otherwise:
  - a. Engineer's certification of completion in accordance with approved plans, specifications, and permits.

## LIFT STATIONS

- b. Copies of all close-out submittals required by regulatory agencies (city, county, TCEQ, etc.).
- c. Spare Parts: Provide a spare for each single point of failure item. Provide one change of lubricants and filters for each piece of equipment.
- d. Provide CD backup copies of programming for PLCs, pump controllers, HMI and control room(s).
- e. O&M Manuals: Provide three (3) hard copies and three (3) CD/PDF searchable electronic copies of each O&M manual. Hard copies shall be printed duplex 8.5"x11" in color on 24# bond paper with reinforced holes and bound in D-ring binders (maximum 4" binders per volume) with sheet lifters front and back, table of contents, and tabbed sections. Drawings and schematics shall be 11"x17" and z-folded. Include test reports and calibration certificates. O&M description, project name, contractor name, and specification section shall be printed on the spine and cover of each binder. All copies shall be manufacturer original quality. Scanned and/or photocopies are not acceptable. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies. Submit at least two (2) weeks prior to operator training.
- f. Waiver of lien by contractor (and subcontractors, as appropriate).
- g. Warranty certificates, both from contractor and from manufacturer(s), valid for one (1) year from date of project final acceptance. Warranty shall include parts and labor for removal, repair, and replacement.
- h. Executed operating contract or bill of sale transferring facility to GBRA.
- i. As-Built and Record Drawings: Provide complete project drawings sets including all sheets and all trades. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies.
  - i. Contractor shall provide one (1) printed and bound full size copy of red lined as-built drawings and one (1) CD/PDF electronic copy, each sheet stamped "as-built drawing".
  - ii. Engineer shall prepare corrected CAD drawings, each sheet stamped "record drawing", and submit to GBRA five (5) printed and bound half size copies and five (5) CD/PDF searchable electronic copies of the corrected CAD drawings. Scanned and/or photocopies are not acceptable.
- j. Recorded plats and easements.
- k. Title Company review for release of all liens.

## General Requirements

1. Design and installation shall be in accordance with TCEQ rules and AWWA standards, and in accordance with GBRA standards as further described in this document (see attachments).
2. The designs of wastewater systems shall be based on minimum 300 GPD/EDU average daily flow, 4.0 peak factor, and 300 GPD/acre inflow and infiltration.
3. Noise and odor impacts shall be considered in design.
4. Piping friction losses shall be calculated with a Hazen-Williams coefficient no greater than 120 for plastic pipe, and no greater than 100 for concrete or metal pipe.
5. Surge control shall be considered in design. Evaluate loss of power while all pumps are running.



## LIFT STATIONS

6. Pumps and control panels shall be ABS, Flygt, or KSB; substitutions are not allowed. Grinder pumps are not allowed. Each pump shall be equipped with a mix/flush valve or equivalent mixing device. Provide full length 316SS lifting chains and chain grip eye. Pumps shall have minimum 4" diameter suction and discharge openings. Provide non-clogging impellers. Lift station design and pump selection shall incorporate the future ability to increase impeller one size without changing pump bases, motors, electrical, or controls. Pumping systems shall be selected based on maximum wire-to-water efficiency. Field draw down testing is required to demonstrate the specified flow rate for each pump.
7. Guide rails with intermediate brackets, hoists, and hatches are required for stand-alone mixers. Materials of construction, components, and accessories shall be the same as for pumps.
8. All guide rails, brackets, anchors, and supports shall be 316SS.
9. All motors shall be Premium Efficiency with minimum 1.15 service factor. All motors driven by variable frequency drives shall be inverter-duty rated.
10. All equipment shall be designed to automatically reset after power outages.
11. All equipment shall have elapsed time meters.
12. Every lift station shall be equipped with a permanent mounted electric hoist. All components shall be corrosion resistant.
13. Wet wells and manholes shall be precast concrete. The interior of the structures shall be lined with SewperCoat, Refratta HAC 100, or approved equal calcium aluminate material. Proposed substitutes must be equal in composition and manufacturer warranty. Product must be installed by a manufacturer certified applicator. Prepare surface by sand blasting. Provide smooth trowel finish. Apply spray curing compound. Minimum thickness for manholes shall be ½". Minimum thickness for wet wells shall be 1".
14. The first riser and floor of the wet well shall be pre-cast integrally. Where this is not feasible, Adeka P-201 waterstop shall be used to seal the walls to a cast-in-place floor slab. Provide rubber O-ring gaskets at all riser joints.
15. All exposed vertical and horizontal concrete edges shall be formed with ¾" chamfer strips.
16. All equipment, piping, and valves shall be labeled for identification purposes (e.g. pipe labels, color coding, banding, flow arrows, equipment numbers, valve tags, etc.).
17. Provide color coded tracing wire (copper clad steel, 12 gauge, 30 mil HDPE jacket) for all buried piping.
18. Valve boxes, equipment, exposed piping and valves, and appurtenances shall be painted. Provide colors in accordance with TCEQ rules. Do not paint stainless steel, hot dip galvanized, brass, or aluminum items.
19. Lift station wet well and valve pad piping shall be epoxy lined flanged ductile iron. Wet well piping shall be coated with minimum two (2) coats of coal tar epoxy. Paint for valve pad piping and valves shall be white color high-build epoxy with topcoat of polyurethane in Grey Pantone #431-U color. Do not paint stainless steel, hot dip galvanized, brass, or aluminum items. Install in accordance with manufacturer recommendations.
20. Gate valves are not allowed for wastewater use. Isolation valves shall be round port plug valves with horizontal shaft closing downward by Crispin, GA, Milliken, or Pratt. Plug valves

## LIFT STATIONS

and check valves shall have 316SS external bolts, nuts, fasteners, and hardware. Valve assembly shall be installed above ground on concrete slab/pad.

21. Flange coupling adapters shall be Smith Blair Model 911. Flange adapters are not allowed within hydraulic structures.
22. Provide an emergency bypass pumping port at lift station valve pad with check valve, plug valve, and aluminum female camlock with plug. Size to match pump discharge flange.
23. All influent lines penetrating the wet well walls shall be shown in both plan view and sections. Seal wall penetrations with PSX direct drive boots, or GBRA approved equal, and non-shrink grout.
24. Wet wells shall have 4" minimum cast-in-place 316SS gooseneck vents with welded waterstop rings on pipe at penetrations. Provide flanged 316SS screens located 24" above top of roof slab.
25. Wet well hatch assemblies shall be aluminum with frames, safety grates, and covers rated for 300 PSF live load. Covers shall be equipped with padlock staples. Hardware, fasteners, and hinges shall be 316SS. Hatch assemblies shall be EJ Safe Hatch, or GBRA approved equal. Provide 2ea hatch keys.
26. All fasteners shall be Type 316 stainless steel (e.g. hardware, screws, anchor bolts, rods, bolts, nuts, etc. for piping, valves, pumps, motors, equipment, etc.) including those for factory assembly of components. All bolts and nuts shall be heavy hex. Anchor bolts installed within hydraulic structures shall be epoxy type. Field apply nickel anti-seize compound to threads prior to assembly. Stainless steel items shall not be painted.
27. All exposed piping 4" and smaller conveying liquids shall be heat traced, insulated, and covered with an aluminum insulation jacket cover. Pipes with continuous flow are exempt from this requirement.
28. Pipe bells shall be installed in upstream direction.
29. Air release valves shall be A.R.I. Model D-025. ARV vent piping to be Schedule 80 PVC with 316 stainless steel anchors and strut supports. Install a PVC ball valve below air release valve. Install union in vent piping adjacent to ARV.
30. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.
31. PVC male adapters are not allowed.
32. Pressure gauge assemblies shall include the following items:
  - a. Stainless steel full port isolation ball valve.
  - b. Pressure diaphragm seal and plain end bibb sampling valve, both stainless steel.
  - c. 4" Pressure gauge, complying with ASME B40.1, Grade 1A, with 1% full scale accuracy, stainless case and stainless steel wetted parts, glycerin filled.
  - d. Gauges shall read in both ftH<sub>2</sub>O and PSI. Select range for normal working pressure to be mid-range.
  - e. The entire assembly shall be Type 316 stainless steel.
33. Provide 1" Woodford Y1 non-freeze yard hydrant with 50ft heavy duty rubber hose, brass adjustable spray nozzle, and McMaster-Carr 53325K33 hose rack. Provide Watts 009 RPZ backflow preventer with brass pipe/fittings/valves, insulated and heated aluminum enclosure,

## **LIFT STATIONS**

and cast-in-place reinforced concrete pad. Install pipe unions inside enclosure on each side of RPZ. Assembly minimum clearances inside the enclosure shall be 12" below, 3" above, and 6" sides. Provide licensed field testing certification for RPZ.

34. Hydraulic structures must pass leakage testing prior to application of any coatings or linings. Fill with clean water to overflow level. Allow minimum 24-hour saturation period. Test duration is 1-hour. No allowable leakage. Test each basin or chamber separately. Any areas of visible moisture shall be repaired and retested.
35. All testing shall be performed by the contractor and witnessed by GBRA.
36. Contractor shall perform operational demonstration testing (see attached procedure). Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.
37. The contractor shall maintain service to existing wastewater systems at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other interruption of flow must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.
38. Explosives and blasting are not allowed.
39. Reference "GBRA Design Guidelines for Developer Utilities" for inspection requirements, survey staking, piping, manholes, testing requirements, etc. All work shall be in accordance with GBRA standards as published at the following website:  
<http://www.gbraz.org/public/waterwastewaterservices.aspx>

## **Site Improvements**

1. Access road and parking areas shall be asphalt or concrete. Roads shall be 16ft wide.
2. All unpaved areas of site within fenced boundaries shall be covered with weed barrier and a 6" layer of TXDOT Grade 1 crushed stone coarse aggregate.
3. Fencing shall be designed to minimize noise impacts if necessary. Comply with TCEQ requirements. If chain link fencing is used, follow GBRA standard details.

## **Electrical, Instrumentation, and Controls**

1. Electrical work shall be installed in accordance with GBRA standard details (see attachments).
2. Engineer to provide complete design drawings and specifications. Include site plan, load calculations, one-line diagrams, schematics, panel layouts, etc. Include types, sizes, quantities, and routing of all raceways and conductors. Detail each duct bank section. Provide interior and exterior layout details, schematics, and one-line diagrams for all control panels and MCCs.
3. Engineer to design site grounding system to include fencing, electrical rack, generator, RTU, antenna, etc. Resistance to ground for site grounding shall be 5 Ohms or less.

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4. All equipment shall be designed to automatically reset after power outages.
5. Main electrical service shall be provided with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.
6. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
7. Provide a Power Quality Meter (PQM) in its own separate enclosure on load side of service or on load side of main disconnect. The PQM shall be Shark Model 200 with outputs as required to provide amperage readings of all three phases to the applicable control room(s) via SCADA.
8. Provide roof and single wall shelter for control panels installed outdoors. Orientation of shelter shall be such that panels face east or north with wall on west or south side.
9. Provide two, external receptacles at lift station for temporary loads, power tools, etc.
10. Provide manually-controlled full cutoff LED site lighting in each process area: 15,000 lumens and 4,000K. Provide intermediate hinged aluminum poles in bronze color; anchors, hardware, and winch shall be stainless steel. Provide switches, photocells, and receptacles at all lighting poles.
11. All lift stations shall have a SCADA system, appropriate for the applicable service area.
12. Equipment control panels shall have an aluminum dead-front inner door. Panels shall be tested in accordance with NFPA 70.
13. Lift station pump controllers and pump control panels shall be provided by the pump manufacturer. Provide an OIT touch screen for local system monitoring and adjustment of setpoints. Mount the OIT on the exterior door of the pump control panel with a hinged UV protective cover by Shade Aide, or GBRA approved equal. Furnish a spare pump controller, backup programming CD, and one spare I/O module of each type.
14. For lift stations located at a plant site, pump controllers shall be connected to the plant main RTU via serial MODBUS connection. For remote lift stations, depending on service area, provide MDS iNet-900 or Banner Engineering DX80DR9M-H1C radio for communication to applicable control room(s). Coordinate with GBRA staff to determine service area, site specific requirements, and appropriate radio. SCADA system shall be designed and installed in accordance with GBRA standards. All SCADA points inside the pump control panel shall be landed on terminal strips mounted on the backplane. Reference GBRA Standard Specification 13428 for additional requirements.
15. All PLCs shall be of the same communication type; each with 10% minimum spare I/O, all mapped to the top end. This applies to the entire site and all equipment.
16. The primary level control shall be a Dwyer Model PBLTX (0-15psi) submersible level transmitter. Provide stilling well for transmitter. Provide staggered lead/lag/standby pump operation and first on/first off alternation. Backup level control shall be two floats. Provide one high level float and one low level float. Both floats, when either is activated, shall disengage primary transmitter control and provide alarms to SCADA and provide local horn and beacon alarms. High float shall provide alarms and turn all pumps on. Low float shall provide alarms and turn all pumps off, regardless of HOA position. Pumps shall remain in backup control until manually reset locally. System in backup alarm shall latch in until manually reset locally; including horn, beacon, and SCADA.

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17. All floats shall have one NO and one NC set of contacts.
18. Provide start delay relay timers for each pump to stagger starts in hand and auto, primary and backup control modes, regardless of power source whether normal or emergency.
19. At a minimum, the following points shall be monitored in the control room(s):
  - a. Pump run status for each pump.
  - b. Pump auto status for each pump.
  - c. Common pump fault for each pump (seal fail, over temp, fail to start, motor overload).
  - d. Generator run.
  - e. Generator fault.
  - f. Power fail.
  - g. ATS in emergency.
  - h. High float.
  - i. Low float.
  - j. System in backup.
  - k. PQM ampacities.
  - l. Daily pump run time hour meters (display on control room screens, reset daily at noon).
  - m. Intrusion alarms (pump control panel and RTU).
  - n. Submersible transmitter level.
  - o. Communications fail.
20. RTU backup power supply shall be a 24V battery system with trickle charger. The battery system shall have sufficient capacity to power the RTU for a minimum of four (4) hours duration.
21. All full voltage starters shall be NEMA sized, minimum size of 1. Half sized starters and IEC starters are not allowed. Provide these starters with solid state overload relays.
22. Solid State Reduced-Voltage (SSRV) soft starters shall be used for motors larger than 25 HP or as required by the site electrical service size.
23. Allowable manufacturers for SSRV's and VFD's are ABB, Eaton/Cutler Hammer, GE, and Schneider/SQD. Substitutions are not allowed.
24. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
25. Indicator lights shall be LED push-to-test type (red/run/open, green/stop/closed, amber/fault, white/power).
26. Alarm beacons shall be LED and red color. Do not penetrate tops of panels.
27. Provide LED strip lighting with door switch inside control panels if the enclosure size is greater than or equal to 30" wide and greater than or equal to 12" deep.
28. All control panel and MCC control wiring shall be flexible 41 strand tinned copper, size 14 AWG minimum, 600V insulation, Type SIS for control panels, Type MTW for MCCs, and color coded as follows:
  - a. AC controls                      Red
  - b. DC controls                      Blue
  - c. DC (+) power                      Red
  - d. DC (-) power                      Black

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- e. AC hot                      Black
- f. AC neutral                White

29. All other conductors shall be stranded copper XHHW-2.
30. Phase colored insulation is required for all conductors.
31. All 4-20mA signal wire shall be 20 AWG twisted shielded.
32. A separate neutral conductor is required for every 120VAC circuit.
33. A separate grounding conductor is required for every raceway, including electrical and I&C. Minimum size is 12 AWG.
34. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.
35. Wet well junction box shall be NEMA 4X 316SS with external mounting lugs, 24"x30"x12" minimum, with backplane, terminal strips, piano hinge, and ¼-turn latches. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
36. All other enclosures shall be NEMA 4X 316SS with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
37. Provide type written panel directories and laminated as-built schematics and diagrams in all electrical panels.
38. Electrical panels shall have tinned copper bus and bolt-on type circuit breakers.
39. All electrical enclosures shall have black phenolic labels with white 3/8" block lettering, attach with aluminum rivets. All instruments shall have round shaped black phenolic tags with white 1/4" block lettering, attach with 316SS cable. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.
40. All surface mounted device boxes shall be FD type sand cast aluminum with 316SS cover screws.
41. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
42. Exposed/above ground conduit shall be aluminum rigid (¾" minimum). Underground conduit shall be Sch 40 PVC (1" minimum) and shall be installed in reinforced concrete duct banks. Stub-ups from underground to 6" above grade including the 90-degree bends shall be ETL-PVC-001 certified PVC coated GRS conduit, submit installer certification.
43. Duct banks shall be steel reinforced red-dyed concrete in accordance with GBRA standard details.
44. For flexible conduit, use Type LFNC flexible seal tight conduit for ¾" minimum to 2" sizes (½" LFNC flex will be allowed for instruments with ½" threaded hub entries, all other flex shall be ¾" or larger). Use aluminum core liquid tight flexible metal conduit for sizes 2 ½" and larger. Maximum length of flex conduit shall be 18". All connectors shall be aluminum. All conduit shall be mounted on strut.
45. Use 316SS hardware, strut, straps, and anchors. All electrical enclosures, devices, and light fixtures shall be mounted on strut.

## **LIFT STATIONS**

46. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and 316SS screws. Snap-on covers are not permitted.
47. Use aluminum grounding type Myers hubs with insulated throats for all enclosure entries.
48. Use UNY and UNF aluminum unions. Galvanized unions are not permitted.
49. Use aluminum seal-off fittings where required by NEC, seal with 3M-2123 re-enterable sealing compound.
50. Use Noalox or other comparable anti-oxidizing agent on all conduit threads.
51. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.
52. Megger test load and line conductors of all power circuits and submit test reports.
53. Resistance to ground for site grounding shall be 5 Ohms or less. Contractor shall perform Fall-of-Potential three point ground megger testing.
54. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.
55. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.
56. The contractor shall maintain service to existing wastewater systems at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other interruption of flow must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.

## **Emergency Generator**

1. Provide a permanent emergency generator at each lift station.
2. Generator shall be as manufactured by Caterpillar, Cummins, Generac, Kohler, MTU, Stewart & Stevenson, or Taylor; substitutions are not allowed. Size generator to operate the facility at 100% capacity with 20% maximum voltage drop at ultimate build-out of facility with all pumps starting simultaneously.
3. For generators less than 105 kW, inclusive, provide natural gas or propane powered generator. Generators larger than 105 kW may be diesel. Fuel capacity shall be 24 hours minimum at 100% generator load rating. Maximum storage for fuel calculations shall be 90% of tank capacity.
4. Maximum noise level shall be 78 dbA at 7 meters.
5. Generator shall have a battery charger and dry contacts for all alarms. Generator and ATS alarms shall be monitored via SCADA.

## **LIFT STATIONS**

6. Provide ASCO or Russelectric automatic transfer switch (ATS) with programmable exerciser (with and without load), NEMA 4X 316SS enclosure mounted on vertical strut, external mounting lugs, and lockable 3-point latch system. Substitutions are not allowed.
7. Generator shall be mounted on a cast-in-place reinforced concrete pad with perimeter beam.
8. Perform onsite load bank testing as follows:
  - a. Perform cold start block test at 100% load.
  - b. Perform 4-hour load bank testing, 2-hours of which shall be at 100% load.
  - c. Refill fuel tank to 90% capacity upon completion of testing.
9. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.
10. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.



## GENERIC SCADA POINTS LIST

(Additional SCADA points requirements will be evaluated by GBRA during design review based on the equipment proposed.)

<b>OIT - ONSITE AT WWTP</b>
DISPLAY ALL STATUSES AND ALL PROCESS VALUES FOR ENTIRE PROJECT.
PROCESS SETPOINTS SHOULD BE OPERATOR ADJUSTABLE ON THE OIT.
DISPLAY MAIN PQM (AMPACITIES, VOLTAGES, KWH).
DISPLAY EACH LIFT STATION PQM (AMPACITIES ONLY).

<b>TOP END - OFFSITE AT CONTROL ROOM</b>
DISPLAY EACH LIFT STATION WET WELL LEVEL.
DISPLAY RUN STATUS FOR EACH LIFT STATION PUMP.
DISPLAY RUN STATUS FOR EACH BLOWER.
DISPLAY INSTANTANEOUS FLOW RATE FOR EACH CONTACT BASIN METER.
DISPLAY INSTANTANEOUS FLOW RATE EACH FOR EFFLUENT DISCHARGE METER.

ALARMS	WWTP OIT	TOP END
WWTP COM FAIL ALARM		*
PLANT POWER FAIL		*
MCC MAIN POWER FAULT		*
GENERATOR RUNNING		*
GENERATOR GENERAL FAULT ALARM	*	*
ATS IN EMERGENCY POSITION	*	*
OPS BUILDING AC UNIT ALARM	*	*
OPS BUILDING SMOKE DETECTOR	*	*
INFLUENT LIFT STATION PUMP FAIL (EACH SEPARATELY)	*	*
INFLUENT LIFT STATION LOW LEVEL	*	*
INFLUENT LIFT STATION HIGH LEVEL	*	*
INFLUENT LIFT STATION IN BACKUP FLOAT CONTROL	*	*
HEADWORKS GENERAL ALARM	*	*
HEADWORKS HIGH LEVEL ALARM	*	*
CHEM PUMP GENERAL ALARM (EACH SEPARATELY)	*	*
CLARIFIER NOT RUNNING (EACH SEPARATELY)	*	*
BLOWER 1 GENERAL ALARM	*	*
BLOWER 2 GENERAL ALARM	*	*
BLOWER 3 GENERAL ALARM	*	*
BLOWER HEADER LOW PRESSURE	*	*
DIGESTER HIGH LEVEL	*	*
CL2 LEAK ALARM	*	*
FILTER SYSTEM AIR LOW PRESSURE	*	*
FILTER SYSTEM HIGH LEVEL (EACH SEPARATELY)	*	*
NPW LOW SUCTION PRESSURE	*	*
NPW LOW DISCHARGE PRESSURE	*	*
NPW HIGH DISCHARGE PRESSURE	*	*
EFFLUENT LIFT STATION PUMP FAIL (EACH SEPARATELY)	*	*
EFFLUENT LIFT STATION LOW LEVEL	*	*
EFFLUENT LIFT STATION HIGH LEVEL	*	*
EFFLUENT LIFT STATION IN BACKUP FLOAT CONTROL	*	*

## Generic Spare Parts List

Provide a spare for each single point of failure item and the following typical items as applicable. Additional spare parts requirements will be evaluated by GBRA during design review based on the equipment proposed.

- 1) Electrical, Controls & SCADA
  - a) One (1) radio of each type.
  - b) One (1) antenna of each type and size.
  - c) One (1) PLC of each type.
  - d) One (1) CD backup copy of programming for each PLC, HMI, and control room.
  - e) One (1) I/O module of each type.
  - f) One (1) communication module of each type.
  - g) One (1) circuit breaker of each type and size.
  - h) Relays (30% of each type and size).
  - i) Fuses (30% of each type and size).
  - j) Lamps for push-to-test indicator lights (30% of each type).
- 2) Lift Stations
  - a) One (1) chain grip eye for each lift station.
  - b) Two (2) hatch slam lock keys for each lift station.
  - c) One (1) float.
  - d) One (1) submersible level transmitter.
  - e) One (1) pump controller of each type.
  - f) One (1) PLC of each type.
  - g) One (1) CD backup copy of programming for each PLC and HMI.
  - h) One (1) I/O module of each type.
  - i) One (1) communication module of each type.
  - j) One (1) circuit breaker of each type and size.
  - k) Relays (30% of each type and size).
  - l) Fuses (30% of each type and size).
  - m) Lamps for push-to-test indicator lights (30% of each type).
- 3) Headworks
  - a) One (1) maintenance kit (e.g. brushes, wear plates, hardware, etc.).
  - b) One (1) float of each type and size.
  - c) One (1) PLC of each type.
  - d) One (1) CD backup copy of programming for each PLC and HMI.
  - e) One (1) I/O module of each type.
  - f) One (1) communication module of each type.
  - g) One (1) circuit breaker of each type and size.
  - h) Relays (30% of each type and size).
  - i) Fuses (30% of each type and size).
  - j) Lamps for push-to-test indicator lights (30% of each type).
- 4) Blowers
  - a) Two (2) sets of belts and/or couplings.
  - b) Oil and/or grease for one (1) change for each blower.
  - c) One (1) air inlet filter for each blower.
  - d) One (1) circuit breaker of each type and size.
  - e) Relays (30% of each type and size).
  - f) Fuses (30% of each type and size).
  - g) Lamps for push-to-test indicator lights (30% of each type).

- 5) Clarifier
  - a) One (1) complete set of inside and outside scum rake rubber.
  - b) One (1) shear pin.
  - c) One (1) oil change for drive unit.
  - d) One (1) circuit breaker of each type and size.
  - e) Relays (30% of each type and size).
  - f) Fuses (30% of each type and size).
  - g) Lamps for push-to-test indicator lights (30% of each type).
- 6) Peristaltic Pumps
  - a) One (1) pump head or five (5) pump tubes, whichever is applicable.
- 7) Digesters
  - a) One (1) float.
- 8) Chlorine
  - a) One (1) Chlorine Institute Emergency Kit.
  - b) One (1) standard PM kit for each component chlorinator, injector, and vacuum regulator.
- 9) Filter System
  - a) Complete filter media replacement (i.e. every element).
  - b) One (1) float of each type and size.
  - c) Oil and/or grease for one (1) change for each pump.
  - d) One (1) PLC of each type.
  - e) One (1) CD backup copy of programming for each PLC and HMI.
  - f) One (1) I/O module of each type.
  - g) One (1) communication module of each type.
  - h) One (1) circuit breaker of each type and size.
  - i) Relays (30% of each type and size).
  - j) Fuses (30% of each type and size).
  - k) Lamps for push-to-test indicator lights (30% of each type).
- 10) Air Compressor
  - a) One (1) belt.
  - b) One (1) change of oil.
  - c) One (1) filter.
  - d) One (1) circuit breaker of each type and size.
  - e) Relays (30% of each type and size).
  - f) Fuses (30% of each type and size).
  - g) Lamps for push-to-test indicator lights (30% of each type).
- 11) NPW
  - a) Oil and/or grease for one (1) change for each pump.
  - b) One (1) pump controller.
  - c) One (1) pressure transmitter of each type and size.
  - d) One (1) PLC of each type.
  - e) One (1) CD backup copy of programming for each PLC and HMI.
  - f) One (1) I/O module of each type.
  - g) One (1) communication module of each type.
  - h) One (1) circuit breaker of each type and size.
  - i) Relays (30% of each type and size).
  - j) Fuses (30% of each type and size).
  - k) Lamps for push-to-test indicator lights (30% of each type).

**GBRA Lift Station Demonstration Testing Procedure**  
**Updated 01/30/2018**

Pull Pumps

- 1) Pull each pump. Verify make, model, mix/flush valves, guiderails, supports, hoist, and rotation.

Level Setpoints

- 2) Verify transducer model, range, installation height, cord grip, hook, controller parameters.
- 3) Verify high float installation height, cord grip, hook.
- 4) Verify low float installation height, cord grip, hook.

Transducer Normal Operation

- 5) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 6) Adjust setpoints to conserve test water if necessary.
- 7) Acknowledge/clear all panel, controller, and SCADA alarms.
- 8) Fill wet well above pumps off setpoint, but below lead on setpoint.
- 9) Turn all HOA switches to auto, verify run status and HOA status via SCADA.
- 10) Fill wet well to lead on setpoint, verify lead pump starts (first pump), verify run status and HOA status via SCADA, verify pumps off setpoint.
- 11) Fill wet well to lead on setpoint, verify lead pump alternation (second pump), verify pump starts, verify run status and HOA status via SCADA, verify pumps off setpoint.
- 12) Fill wet well to lead on setpoint, verify lead pump alternation (back to first pump), verify pump starts, verify run status and HOA status via SCADA, verify pumps off setpoint.
- 13) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 14) Fill wet well above lag on setpoint, but below high float.
- 15) Turn all HOA switches to auto, verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA, verify pumps off setpoint.

Low Float First

- 16) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 17) Fill wet well above lag on setpoint, but below high float.
- 18) Turn all HOA switches to auto, verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA.
- 19) Drop low float, verify both pumps stop, verify switch to backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 20) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 21) Lift high float, verify both pumps start, verify staggered starts, verify backup controls latched in, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 22) Drop high float, verify both pumps still running, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 23) Drop low float, verify both pumps stop, verify backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 24) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 25) Reset to transducer control, both pumps should start to complete previous transducer auto cycle, verify staggered starts, verify backup control cleared local and SCADA, verify high/low/system in backup alarms cleared horn and beacon and SCADA, verify run status and HOA status via SCADA, verify pumps off setpoint.

### High Float First

- 26) Fill wet well above pumps off setpoint, but below lead on setpoint.
- 27) Lift high float, verify both pumps start, verify staggered starts, verify switch to backup controls latched in, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 28) Drop high float, verify both pumps still running, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 29) Drop low float, verify both pumps stop, verify backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 30) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 31) Reset to transducer control, verify pumps do not start, verify backup control cleared local and SCADA, verify high/low/system in backup alarms cleared horn and beacon and SCADA, verify run status and HOA status via SCADA.

### High Float Stuck Raised

- 32) Fill wet well above pumps off setpoint, but below lead on setpoint.
- 33) Lift high float, verify both pumps start, verify staggered starts, verify switch to backup controls latched in, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 34) With high float still lifted drop low float, verify both pumps stop, verify backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 35) Lower high float.
- 36) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 37) Reset to transducer control, verify pumps do not start, verify backup control cleared local and SCADA, verify high/low/system in backup alarms cleared horn and beacon and SCADA, verify run status and HOA status via SCADA.

### Hand Operation

- 38) Verify each pump starts and stops in hand mode.

### Draw Down Testing

- 39) Perform wet well draw down testing for each pump separately. Start and stop within normal operating range shown on construction drawings. Record static and dynamic discharge pressures for each pump. Record vertical distance from pump discharge flanges to pressure gauge. Verify specified TDH and flow rates for each pump.
- 40) Verify size, make, model, flow direction, and function of plug valves, check valves, and air release valves.

### Power Loss

- 41) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 42) Fill wet well above lag on setpoint, but below high float.
- 43) Turn all HOA switches to auto, verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA.
- 44) While the wet well level is still above lag on setpoint, simulate a loss of normal power by opening the service main disconnect switch. Verify loss of normal power and emergency power supply via SCADA. Verify that the station automatically returns to primary transducer level control mode. Verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA.
- 45) Restore normal power. Verify that the station automatically returns to primary transducer level control mode.

### Other

- 46) Verify intrusion alarms via SCADA (pump control panel and RTU).
- 47) Verify PQM ampacities via SCADA.
- 48) Turn generator HOA to off position. Open the service main disconnect switch. Verify SCADA backup power. Verify power fail alarm via SCADA.

## **SECTION 13124**

### **PREFABRICATED FIBERGLASS BUILDINGS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Prefabricated fiberglass buildings to house various equipment including chemical feed systems, air release valves, pressure transmitters, flow control valves, electrical, SCADA, and/or flow meters.
- B. Related Sections include but are not necessarily limited to:
  - 1. GBRA Standards and Design Guidelines.
  - 2. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
  - 3. Division 1 - General Requirements.
  - 4. Division 3 - Concrete.
  - 5. Division 7 - Thermal and Moisture Protection.
  - 6. Division 8 - Doors and Windows.
  - 7. Division 10 - Specialties.
  - 8. Division 11 - Equipment
  - 9. Division 13 - Special Construction.
  - 10. Division 15 - Mechanical.
  - 11. Division 16 - Electrical.

##### **1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. C518, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
    - b. D256, Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
    - c. D638, Standard Test Method for Tensile Properties of Plastics.
    - d. D732, Standard Test Method for Shear Strength of Plastics by Punch Tool.
    - e. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
    - f. 792, Standard Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
    - g. D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
    - h. D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
    - i. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Qualifications:
  - 1. Manufacturer's qualifications:
    - a. Manufacturer must have minimum of five years experience designing and fabricating structures of the type specified.

##### **1.3 SYSTEM DESCRIPTION**

- A. Enclosure shall be one-piece insulated fiberglass shell-type enclosure complete with sloped roof, lighting, heating, and ventilation systems.

##### **1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. Product technical data including:
    - a. Manufacturer's installation instructions.

- b. Drawings showing layout, dimensions, anchorages, and accessories.
  - 2. Fabrication drawings:
    - a. Details of anchor bolts, base plates, and all other components fastened to the foundation.
    - b. Details of wall panels, roof panels, finishes, lights, heater, louvers, trim, caulking, and all other miscellaneous components.
  - 3. Submit electrical components in accordance with Division 16.
- B. Operation and Maintenance Manuals.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
- 1. Prefabricated fiberglass enclosure:
    - a. Jacobs Manufacturing Co.
    - b. Warminster Fiberglass Co.
    - c. Or approved equal.
- B. Submit requests for substitution in accordance with Division 0.

### **2.2 DESIGN REQUIREMENTS**

- A. Design enclosure to withstand 125 mile per hour wind load and 30 PSF snow load.
- B. Minimum inside dimensions:
- 1. Length 12'-0", Width 8'-0", Wall Height 8'-0".
  - 2. Electrical and SCADA conduit, devices, and enclosures shall be field installed inside the fiberglass building by the contractor. The building size shall be as required to achieve NEC required clearances for all electrical and SCADA components and enclosures. All enclosures shall be NEMA 4X PVC or FRP.
- C. Comply with TCEQ Rules.
- D. All materials shall be chemical and corrosion resistant.

### **2.3 MATERIALS**

- A. Molded composite: Exterior and interior resin-fiberglass laminate with foam core.
- 1. Laminate: Polyester resin and chopped strand fiberglass; minimum glass content of 25%.
    - a. Provide gel coat with UV inhibitors.
    - b. Exterior surface: Beige color gel coat with low luster finish, smooth and free from fiber pattern, roughness, or other irregularities.
    - c. Exterior laminate: 1/8" thick minimum; chemically bonded to gel coat.
    - d. Interior laminate: Beige color; 1/8" thick minimum; encapsulate core in place.
    - e. Laminate properties:
      - 1) Tensile strength (ASTM D638): 11,000 PSI.
      - 2) Flexural strength (ASTM D790): 18,000 PSI.
      - 3) Shear strength (ASTM D732): 12,000 PSI.
      - 4) Barcol hardness (ASTM D2583): 40.
      - 5) Impact (ASTM D256): 12 ft lbs/inch.
      - 6) Density/specific gravity (ASTM D792): 93.6 PCF/1.5.
      - 7) Surface burning characteristics (ASTM E84): Flame spread, less than 150; smoke density, less than 1000.
  - 2. Core:
    - a. Rigid closed cell, self extinguishing, polyisocyanurate foam with a density of 2.0 pounds per cubic foot.
    - b. 1" thick with a minimum insulating value of R-7.
    - c. Core properties:
      - 1) Thermal conductivity (ASTM C518): 0.13 BTU inch / Hr. SF F.

- 2) Density/specific gravity (ASTM D 1622): 2.0 PCF/.03.
- 3) Surface burning characteristics (ASTM E84): Flame spread, 35; smoke density, 240.
3. Coupons prepared in accordance with ASTM D 618 test method.
- B. The manufacturer shall maintain a continuous quality control program and upon request shall furnish to the engineer certified test results of the physical properties.

## 2.4 FABRICATION

- A. Assembly:
  1. Construct buildings using prefabricated molded composite wall and roof panels. Single-piece construction may be employed with the approval of the Engineer.
  2. Provide factory assembled buildings if panel construction is employed.
- B. Encapsulated stainless steel extrusion 3" wide by 1 1/2" high by 0.125" thick with a 1" wide side flange shall be encapsulated into each corner of end panels (full height) and around the entire roof perimeter to maintain flatness, straightness, and structural integrity. Integral internal flanges on mating panels shall be provided for bolting the sides, ends, and roof to the encapsulated extrusions.
  1. Stainless Steel: Incorporate threaded inserts on 12-inch centers for internal bolting to mating panel flange during assembly.
  2. Assembly bolts shall not penetrate the exterior wall of the structure.
  3. Assemble panels with 3/8" diameter stainless steel bolts on 12" centers and a 1/4" thick by 3" wide urethane foam gasket for a weather tight seal at all joints.
  4. Structurally reinforce wall and roof panels with stainless steel or carbon graphite extrusions to meet loading conditions.
    - a. Stainless steel mounting channel reinforcement: 0.078" thick by 13/16" high by 1 5/8" wide. Mechanically attach to the interior surface with Hastelloy-C or titanium pop rivets on 12-inch centers.
    - b. Provide reinforcement panels at equipment mounting locations.
  5. Reinforcement: 1/4" thick by 1 1/2" wide structural angle.
  6. Stainless Steel Reinforcement: Extruded channel sections 3" wide by 1 1/2" high by 0.125" thick with a 1" wide side flange as required.
  7. Encapsulate stainless steel or carbon graphite reinforcements to form a continuous, one-piece molded composite wall or roof panel.
  8. Provide wall panels with an integral 4" wide internal mounting flange pre-drilled on 12" centers with 5/8" diameter holes for attaching to foundation.
- C. Furnish wall and roof panels with beige color gel-coat finish on interior and exterior.

## 2.5 ACCESSORIES

- A. Doors: One-piece, resin transfer molded (RTM) in matched metal molds to produce an industrial quality door which exhibits a smooth finished, seamless, monolithic, warp-free composite consisting of beige color gel-coat, fiberglass reinforcement, polyester resin, insulating core, and internal reinforcements with all mortises, openings, recesses, and pockets molded in place.
  1. Mount each door with three stainless steel mortise NRP butt hinges 4 1/2" long.
  2. All other hardware and accessories shall be aluminum and/or stainless steel.
  3. All fasteners for all items shall be stainless steel, including those for factory assembly of components.
  4. Door gaskets: Natural sponge rubber bulb type gasket with flexible lock to retain permanent grip.
  5. Provide panic hardware with keyed external lever and floor mounted door stops with latches. Key system shall be Best brand. Provide construction cores and control keys.
  6. Provide doors with hold open arm hydraulic closers.
  7. Provide one-piece purpose built 3" deep fiberglass drip caps above doors, extend 2" past doors on each side. Cut angle will not be acceptable.
  8. Provide two silencers for each door on head of frame, three for each door on strike jamb of frames.
  9. Provide single flap insert type neoprene sweeps.
  10. Provide 4 1/2" wide black vinyl thresholds.
  11. Provide 12" tall kick plates.



12. Provide 18" wide x 12" tall wire safety glass window in each door.
  13. Doors shall open to exterior.
  14. Install "Danger" signs indicating any type of chemicals or hazards present.
  15. Single door size: 3'0" wide, 7'0" high, 1 ¾" thick.
  16. Double door size: Pair of 2'6" wide, 7'0" high, 1 ¾" thick.
- B. Base Mounting Flange Gasket: Provide 3/8" thick by 4" wide closed cell neoprene sponge rubber gasket for a weather tight seal around the building perimeter. Caulk inside and outside perimeters with matching color Sikaflex, Sonneborn NP-1, or approved equal.
- C. Lifting Eye Bolts: Provide ¾" stainless steel eye bolts in roof.
- D. Anchor Bolts: For attaching structure to concrete pad, provide ½" diameter stainless steel threaded rod, flat washers, and nuts. Secure threaded rod in drilled opening with epoxy anchoring system.
- E. Intake Fan: Provide one (1) complete air exchange every three (3) minutes, thermostatically controlled intake fan with gravity shutter, canopy, remote power switch, and removable aluminum insect screen, wall mount in upper portion of building. All components shall be constructed of PVC, FRP, and/or aluminum. The intake fan shall be Hartzell Series 59 or approved equal. The intake fan shall automatically shutdown when a chlorine leak is detected, leak alarm shall be audible and visual, detection meter shall be mounted on building exterior adjacent to entry door(s), alarm beacon shall be LED and red color and mounted 12" minimum above roof peak.
- F. Exhaust Louver: Square, wall mount in lower portion of building, with gravity shutter and removable aluminum insect screen. All components shall be constructed of PVC, FRP, and/or aluminum.
- G. Equipment mounting boards shall be ¾" thick PVC or FRP.
- H. Interior Light Fixtures: 48" strip LED, vapor tight, 4000K and 4,000 lumens. Provide two per building.
- I. Exterior Light Fixtures: Weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W min., bronze finish, wall/surface mount above doors. Provide one centered above each door frame.
- J. Fan and Light Switches: Weatherproof, outdoor rated, mount on building exterior adjacent to entry door(s).
- K. 120/240V, 18 circuit panel board with 2P-60A minimum main breaker and branch breakers as required for loads in NEMA 4X PVC or FRP enclosure. Panelboard neutral shall not be bonded to ground inside panel and shall remain separate.
1. Fill all unused spaces with 1P-20A circuit breakers.
  2. Bus shall be tinned copper.
  3. Breakers shall be 20A minimum bolt-on type.
  4. Provide control circuits in low voltage panel for RTU cabinet.
- L. Heater: 1500 watt minimum, 120 VAC, single phase, with thermostat and tip-over switch.
1. Heater shall be portable floor type.
  2. Provide GFCI receptacle for heater.
  3. Heater shall be suitable for use in a damp (corrosive) environment.
- M. Device boxes shall be PVC with stainless steel cover screws.
- N. Three duplex receptacles, ivory color, 120V, 20A, GFCI-WR, outdoor type, aluminum in-use covers.
- O. Electrical wiring shall be in flexible conduit, use Type LFNC flexible seal tight conduit for ¾" minimum to 2" sizes (½" LFNC flex will be allowed for instruments with ½" threaded hub entries, all other flex shall be ¾" or larger). Use aluminum core liquid tight flexible metal conduit for sizes 2 ½" and larger. All connectors shall be aluminum. All conduit shall be mounted on strut. Provide for:
1. Fan and thermostat.
  2. Lights and switch.
  3. Three duplex GFCI receptacles.
  4. Heater.
  5. Any other items shown on drawings.

- P. Wiring shall meet the latest requirements of the National Electrical Code. All control panel wiring shall be flexible 41 strand #14 AWG, 600V insulation, Type SIS tinned copper, and color coded. All other conductors shall be stranded copper XHHW-2. Phase colored insulation is required for all conductors. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.
- Q. All electrical enclosures shall be NEMA 4X PVC or FRP with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
- R. Hardware, strut, and straps shall be FRP.
- S. All raceways for instrumentation, power, and wiring shall be installed by the electrical contractor.
- T. Instrumentation shall be installed, terminated, tested, and calibrated by the instrumentation and controls contractor.
- U. Label all enclosures and devices in accordance with GBRA standards.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. All work shall be in accordance with GBRA Standards and Design Guidelines.
- B. Install products in accordance with manufacturer's instructions.
- C. Building foundation/floor, perimeter curb, and entrance ramp(s) shall be cast-in-place reinforced concrete. Exposed vertical and horizontal corners shall be formed with ¾" chamfer strips.
- D. Chemical containment shall be accomplished by elevating the building on a perimeter curb with floor sloped to a sump pit for a portable pump. Provide floor with broom finish and concrete sealer.
- E. For buildings where chemical containment is not required, install a floor drain in the center of the building and slope floor to drain. Provide floor with smooth trowel finish and concrete sealer.

### **3.2 ADJUSTING AND CLEANING**

- A. Touch up any damaged factory finished surfaces or remove and replace as directed by GBRA.

**END OF SECTION**

SECTION 13428  
RADIOS AND ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL

A. Scope of Work:

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place in satisfactory operation the radio system in accordance with this section and the contract drawings.
2. In order to centralize responsibility, it is required that all equipment provided under this Section be furnished by a single system supplier specified in Article 1.2 below. The contractor shall guarantee and be the source of information on all equipment furnished regardless of the manufacturing and supply source of the equipment.
3. Electrical Work: All equipment, materials, and appurtenances, as well as all signal and power wiring and cable runs and interconnections, shall be in accordance with published GBRA standards and the requirements of Division 16 - Electrical.
4. Specific information is provided below:
  - a) Remote radio sites shall have Omni and/or Yagi antenna(s) as appropriate and shall communicate with the applicable GBRA master radio, GBRA control room(s), and/or with a GBRA remote relay radio site.
  - b) **Depending on service area, radios shall be MDS iNet-900 or Banner Engineering DX80DR9M-H1C. Reference GBRA design guidelines for appropriate RTU, radios, and communications to applicable GBRA control room(s). Coordinate with GBRA staff to determine service area, site specific requirements, and appropriate equipment.**
  - c) **Design engineer shall perform a site investigation and field radio path study with portable masts and radios; submit the radio path study and proposed system design for GBRA approval prior to bidding, including model numbers of antennas used to obtain results. Evaluate terrain and potential obstructions. Radio receive signal level must be -80dBm or better. Design shall include radios, antennas, towers, repeaters, and expansion I/O modules as necessary.**
  - d) Perform programming, development, and integration at the applicable GBRA control room(s).
5. The installation details required for the radio telemetry equipment vary from site to site. The antenna installations and wiring details on the contract drawings shall indicate the sites for which specific installation details are expected to apply. The contract drawings shall also indicate the type of antenna required (i.e. Omni or Yagi).
6. The contractor shall be responsible for all wiring for radio system.
7. The contractor shall obtain the services of a tower manufacturer to furnish all labor, materials and equipment to design, construct and erect in place the antenna towers including the foundation as indicated in the specifications and on the contract drawings. The tower manufacturer shall provide design calculations and

working drawings signed and sealed by a professional engineer registered in the State of Texas.

## 1.2 QUALIFICATIONS AND QUALITY ASSURANCE

- A. SCADA contractors and integrators must be certified by Inductive Automation for Ignition HMI Software. Contractors must be Premier Certified. Integration must be performed by employees that are Gold Level Certified, experienced, and competent in the implementation of Ignition HMI Software. Submit certifications, qualifications, and experience for GBRA review and approval.
- B. Antenna installation shall be performed by personnel with a minimum of two years experience with antenna installation.
- C. Tower Erection Criteria: Provide erector who is approved by the manufacturer, and has erected at least two antenna tower structures fabricated by manufacturer.
- D. Engineering Responsibility: The contractor shall retain the services of a professional engineer registered in the State of Texas to complete the antenna tower foundation design. Design calculations, design drawings, and shop drawings shall be prepared under the direction of this Engineer. All calculations and drawings shall bear his seal.

## 1.3 SUBMITTALS

- A. Submit all components required to provide a complete functional system.
- B. The antenna tower submittal shall also comply with the special design consideration of paragraph 1.1.A.7 above.

## 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be stored in accordance with the manufacturer's recommendations prior to installation.

## 1.5 SPARE PARTS

- A. Provide a spare for each single point of failure item.

## 1.6 RADIO NETWORK FUNCTIONAL REQUIREMENTS

- A. The topography of the radio system service area does not permit direct line of sight radio paths to all remote sites from any one location. As a result, the radio network shall provide data routing between radios to establish multiple-hop routes, overcoming local terrain. Provide relay locations as necessary. Submit a radio architecture connectivity diagram. The connectivity diagram must show the paths available for transmission of communications for each remote site.
- B. It shall be possible to interface any radio and/or any PLC in the network directly from a radio/processor interface computer, or from laptop computers anywhere within the telemetry network, directly over the radio network. All radio communication shall be encrypted. The computer interface shall be provided under this section and shall be supplied with the radio diagnostic software specified in paragraph 2.6 from the radio manufacturer.

## PART 2 - PRODUCTS

### 2.1 SPREAD SPECTRUM RADIOS

- A. The 900 MHz Spread Spectrum (SS) radios shall operate under FCC Part 15 rules for unlicensed radio operation in the 902 MHz to 928 MHz band. The radio shall utilize the frequency-hopping technique to accomplish these functions, using 240 FCC-assigned channels.
- B. The following general requirements shall be met by the spread spectrum radio:
  - 1. Frequency Hopping Range: 240 channels, 25 kHz wide, 100 kHz spacing, over 902-928 MHz spread spectrum band.
  - 2. Agency Approvals: FCC Class, Part 15.247, UL, FM
  - 3. Operating Temp. Range: -40 to +60 Degrees Celsius
  - 4. Power Supply Requirements: input 117 VAC 10% and output 12/15 VDC
  - 5. Spreading Technique: frequency hopping
  - 6. Hopping Patterns: 65,536 (unique per network) pseudo random
  - 7. Network Address: latitude/longitude coordinates
  - 8. Electro Magnetic Susceptibility: ANSI C37.90.2 Modified
  - 9. Enclosure: die cast NEMA 4X aluminum enclosure
- C. The spread spectrum radio transmitter shall meet the following requirements:
  - 1. Frequency Range: 902-928 MHz
  - 2. Output Power: +17 dBm, minimum, +20 dBm typical
  - 3. Deviation: +/-5.5 kHz  $\pm$  10%
  - 4. Frequency Stability: 2.5 parts per million @ -30 to +75 Degrees Celsius  
5.0 parts per million @ -40 to +85 Degrees Celsius
  - 5. Bandwidth Modulation: 25 kHz
  - 6. Transmitter Keying: data activated
  - 7. Spurious Radiation: -55 dBc (1 kHz bandwidth)
- D. The spread spectrum radio receiver shall meet the following requirements:
  - 1. Frequency Range: 902-928 MHz
  - 2. Dynamic Range: -104 to -20 dBm
  - 3. IF Selectivity: 6 dB down at 30 kHz
  - 4. Frequency Stability: 2.5 parts per million @ -30 to +75 Degrees Celsius
  - 5. Bit Error Rate (unfaded):  $1 \times 10^{-6}$  BER
  - 6. 45 MHz IF Rejection: less than 90 dBm
- E. The spread spectrum radio equipment shall be the following:
  - 1. MDS iNet Ethernet Radio or latest version.

### 2.2 OMNIDIRECTIONAL ANTENNAS

- A. Omnidirectional remote mount antennas and ground impulse suppressors shall be furnished for each site as shown on the contract drawings.
- B. Antenna mounting at each remote site and at the master site shall be determined by the contractor at the time of installation based on field study of the terrain.
- C. The omnidirectional antennas shall meet the following requirements:
  - 1. Frequency Range: 902-928 MHz
  - 2. Gain: 11.0 dBi or higher if indicated by RF study and/or required to offset coax losses
  - 3. Bandwidth: 26 MHz
  - 4. Power Input: 50 watts minimum

5. VSWR: Less than 1.5
6. Lightning Protection: dedicated direct ground
7. Ground: DC grounded type
8. Wind Rating: 150 mph survival without ice
9. Wind Rating: 100 mph survival with .5" radial ice
10. Connector: Type N female direct connection, no factory jumper or whip
11. Mounting Hardware: stainless steel clamps and standoff hardware as recommended by the antenna manufacturer
12. Ground Impulse Suppressor: provide with each antenna
- D. Antenna Manufacturer and Products, provide the following:
  1. Andrew Decibel Products DB810KE-SY antennas with Polyphaser Model POLISB50LNC2 ground impulse suppressors, or equal.

### 2.3 YAGI DIRECTIONAL ANTENNAS

- A. Directional remote mount antennas and ground impulse suppressors shall be furnished for each site as shown on the remote site installation details as part of the Contract Drawings.
- B. Antenna mounting at each site shall be determined by the contractor at the time of installation based on field study of the terrain.
- C. The directional antennas shall meet the following requirements:
  1. Frequency Range: 902-928 MHz
  2. Gain: 12.0 dBi or higher if indicated by RF study and/or required to offset coax losses
  3. Bandwidth: 26 MHz
  4. Vertical Beamwidth: 30 degrees
  5. Horizontal Beamwidth: 60 degrees
  6. Power Input: 50 watts minimum
  7. VSWR: less than 1.5
  8. Lightning Protection: dedicated direct ground
  9. Ground: DC grounded type
  10. Wind Rating: 150 mph survival without ice
  11. Wind Rating: 100 mph survival with .5" radial ice
  12. Connector: Type N female direct connection, no factory jumper or whip
  13. Mounting Hardware: stainless steel clamps and standoff hardware as recommended by the antenna manufacturer.
  14. Ground Impulse Suppressor: provide with each antenna.
- D. Antenna Manufacturer and Products, provide the following:
  1. Kathrein Model TY-900 antennas with Polyphaser Model POLISB50LNC2 ground impulse suppressors, or equal.

### 2.4 ANTENNA TRANSMISSION CABLE AND ACCESSORIES

- A. The transmission cable connecting the radio antenna port with the antenna shall be the low-loss foam-dielectric coaxial type. This cable shall be 1/2" inch diameter (Andrew LDF4-50A, or equal). A single continuous piece of coaxial cable shall be furnished for each radio. For coax runs exceeding 100 feet in length, furnish 7/8" diameter cable (Andrew LDF5-50A, or equal).

- B. Provide one (1) 3 foot-section of super-flexible transmission cable for coax interconnection at the radio antenna port (one for each radio). Provide standard Type N connectors at each end, which will mate with the radio and the transmission cable.
- C. Furnish two (2) N-type connectors for terminating both ends of each transmission cable.
- D. Coaxial cable grounding kit shall be furnished. Furnish Andrew, or equal. Furnish two (2) kits per radio.
- E. One (1) in-line coaxial cable surge protectors shall be furnished for each cable. Furnish Polyphaser, or equal with N-connector mating.
- F. Provide stainless steel Andrew coaxial cable hanger kits and clamping hardware. Adequate kits shall be installed to anchor the cables at 3-foot intervals on the vertical antenna mast/tower.
- G. All outdoor coaxial connectors shall be wrapped with two layers of Scotch Super 88 UV resistant tape or equal, and then coated with two layers of Scotchkote or equal.

## 2.5 ANTENNA TOWER

- A. Antenna towers shall be the self-supporting equilateral triangular type. Towers shall be knock-down type structures for site assembly. Tower structural members shall be roll-formed galvanized steel. Provide an external ladder with fall protection and anti-climb devices on all towers. Towers shall be designed for a minimum wind rating of 120 miles per hour with the external ladder assembly, the specified antenna, and all appurtenances. Design for all potential and future loads, including ice.
- B. The antenna tower foundations shall be designed and constructed to safely support all tower loads, including dead and wind loads, without exceeding the allowable stresses or specified strengths when appropriate load factors are applied. Comply with the requirements of the applicable code for minimum factors of safety for stability of antenna tower type structures. Consider the most critical combination of loads utilizing the applicable code as the basis for the load combination.
- C. Furnish and install spline balls with stainless steel mounting hardware in accordance with GBRA standard details.

## 2.6 RADIO CONFIGURATION AND DIAGNOSTICS SOFTWARE

- A. A radio configuration and diagnostics system shall be furnished with the radio system. This system shall be manufactured by the radio manufacturer. The system shall provide configuration capabilities to set up and modify, if necessary, the operating parameters of each radio, and provide diagnostic features to test system performance.
- B. Specific requirements of the configuration and diagnostics system shall include the following:
  - 1. Read all remote radio tables for: status, node, frequency interference history, and RF signal strength.
  - 2. Write any or all (user selectable) acquired data to hard disk storage for later access.
  - 3. Configure (over the air) all configurable radio parameters.
  - 4. Provide user-programming of radio diagnostic functions.
  - 5. Provide owners manual and application program on CD.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The contractor is responsible for the installation of all radio equipment.
- B. Buried antenna cable shall be installed at least two feet below grade in 2" minimum conduit in accordance with published GBRA standards and the requirements of Division 16 - Electrical.

### 3.2 CONFIGURATION/PROGRAMMING

- A. Radio system shall be configured and programmed in accordance with GBRA published standards and the contract documents.
- B. Perform programming, development, and integration at the applicable GBRA control room(s). Comply with GBRA revision management policy.
- C. A mandatory pre-construction meeting is required prior to performing any control room work. Coordinate schedule with GBRA. Provide minimum two (2) weeks advance notice.

### 3.3 FIELD TESTING AND DEMONSTRATION

- A. The contractor shall perform demonstration testing of all signals and points from field equipment and devices to the applicable GBRA control room(s). Schedule GBRA to witness the demonstration testing. Provide minimum two (2) weeks advance notice. The contractor shall verify complete functionality prior to scheduling the witnessed demonstration testing.

### 3.4 TRAINING

- A. Radio system training shall be provided. Provide minimum two (2) weeks advance notice.

+ + END OF SECTION + +



## SECTION 13442

### FLANGED MAGNETIC FLOW METERS

- A. Related Sections:
  - 1. The work described in this section shall be performed in accordance with the following related sections:
    - a. Division 1
    - b. Division 15
    - c. Division 16
- B. Magnetic Flow Meters:
  - 1. Acceptable manufacturers:
    - a. Badger.
    - b. Endress + Hauser.
    - c. Foxboro.
    - d. Krohne.
    - e. McCrometer.
    - f. Rosemount.
    - g. Substitutions are not permitted.
  - 2. Design and fabrication:
    - a. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
    - b. High input impedance pre-amplifiers.
      - 1) Minimum impedance:  $10^{10}$  ohms.
    - c. Provide flanged end connections per ASME B16.5 rated for piping system operating and test conditions. Rating shall match pipe rating.
    - d. Grounding requirements:
      - 1) Nonmetallic or lined pipe:
        - a) Inlet and outlet grounding rings of same material as electrode.
      - 2) Conductive piping:
        - a) Conductive path between the meter and the piping flanges.
    - e. Provide cable between magnetic flow meter and transmitter. Cable length shall be 10m minimum. The Contractor shall cut cable in the field to suit actual field installation. Splicing is not permitted.
    - f. The signal converter shall be remotely mounted using a remote-mount kit provided by the manufacture. The transmitter shall be FM approved. Rating shall be at least NEMA 4X with separate electronics and termination areas.
    - g. Submergence: The sensor shall be pedestal sealed against accidental submersion to 3 feet for 30 minutes standard, or permanently submerged to 30 feet when the terminal box is backfilled with a non-setting, transparent potting material.
    - h. Pulsed DC magnetic field excitation.
    - i. Automatic zero.
    - j. Adjustable low flow cutoff.
    - k. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
    - l. Inaccuracy:
      - 1) Above 10 percent of range:  $\pm 1.0$  percent of rate.
      - 2) Below 10 percent of range:  $\pm 0.1$  percent of range setting.
      - 3) Add  $\pm 0.1$  percent of range to above inaccuracies for analog outputs.
    - m. 4-20 mA DC isolated output into maximum 800 ohms.
    - n. Power supply: 120 V  $\pm 10$  percent, 60 Hz.

- o. Provide surge protection.
  - p. Provide local operator interface display with indication of flow rate and totalized flow at transmitter.
  - q. Meter operable as specified in liquids with 5.0 micro mho/cm or more conductivity.
  - r. Transmitter electronics shall use microprocessor based architecture and be configured using parameters.
  - s. Repeatability : +/- 0.1% of reading or better.
  - t. The meter shall be capable of automatically indicating zero flow under empty pipe conditions.
  - u. The magmeter performance shall be verified on a NIST traceable test facility. Contractor shall also submit factory certified calibration certificates for all magmeters.
  - v. Instruments shall be designed and manufactured under the ISO 9001 series of quality standards.
  - w. Menu or programming changes shall be capable of being performed without removing covers.
  - x. Instruments shall be capable of storing data in non-volatile memory for a minimum of 10 years.
  - y. The instrument shall have password protection to prevent unauthorized personnel from making settings and programming changes.
3. Installation:
- a. In regard to flow disturbances and installation location, provide unobstructed upstream and downstream pipe clearances as recommended by the manufacturer.

**END OF SECTION**

GUADALUPE—BLANCO RIVER AUTHORITY

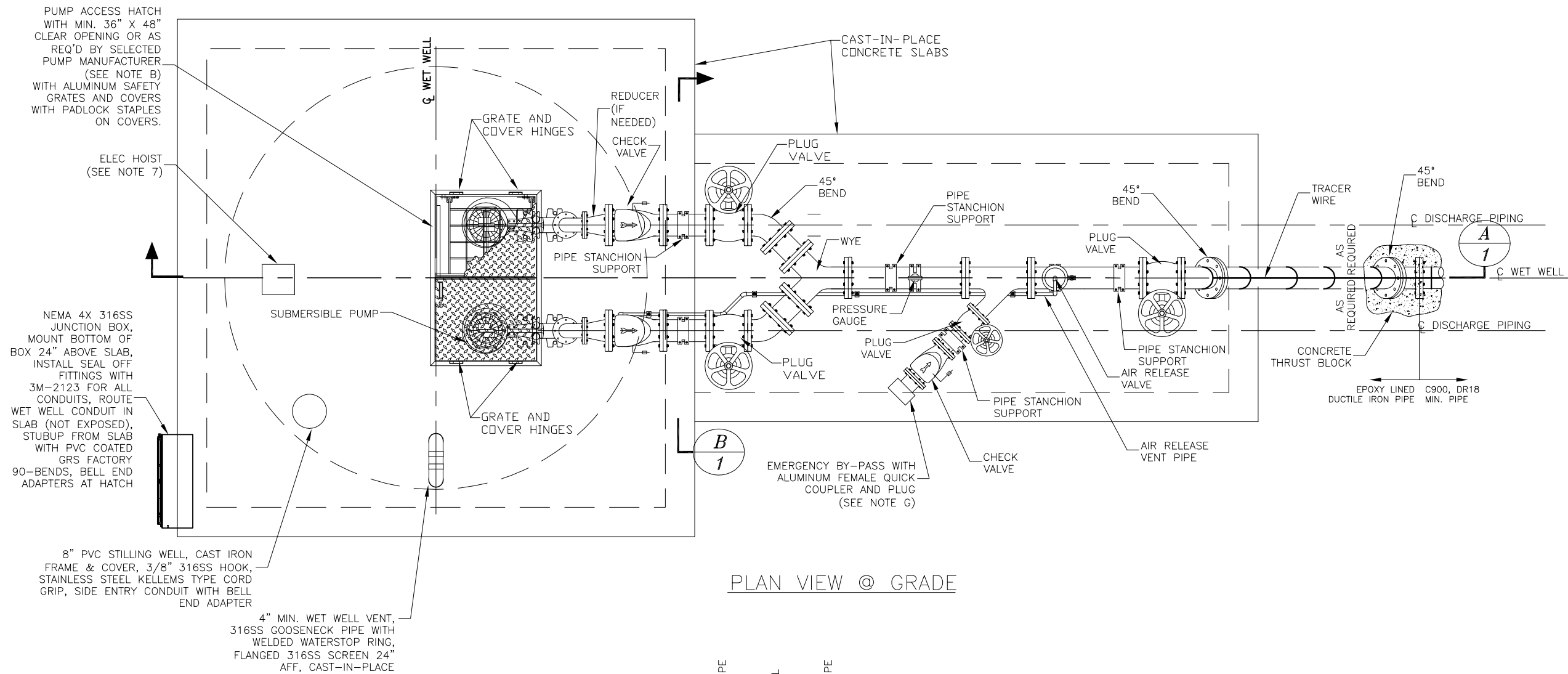


GUADALUPE—BLANCO RIVER AUTHORITY

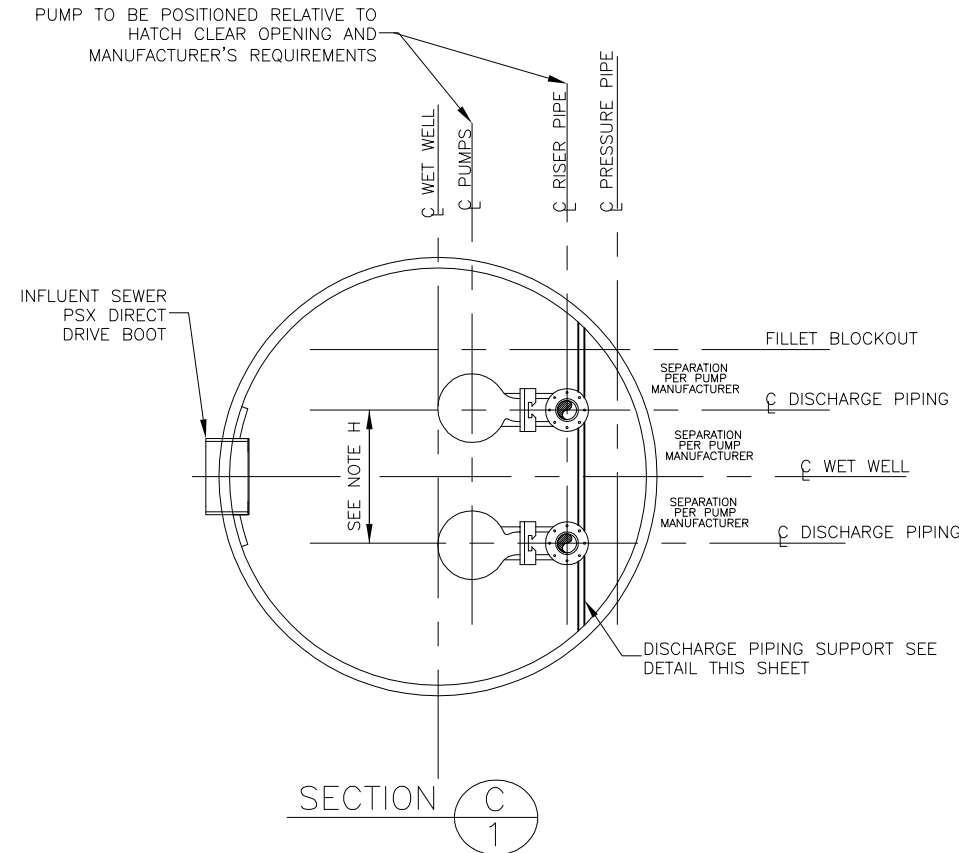
# LIFT STATION DESIGN AND CONSTRUCTION STANDARD DRAWINGS

**CAD FILES AVAILABLE UPON REQUEST  
CONTACT CHRIS LEWIS AT:  
210-825-6427 OR [CLEWIS@GBRA.ORG](mailto:CLEWIS@GBRA.ORG)**

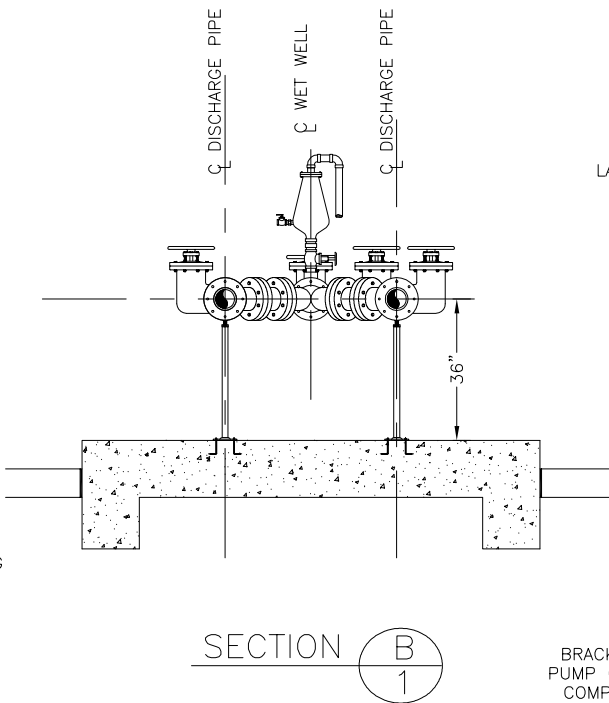
JANUARY, 2018



PLAN VIEW @ GRADE

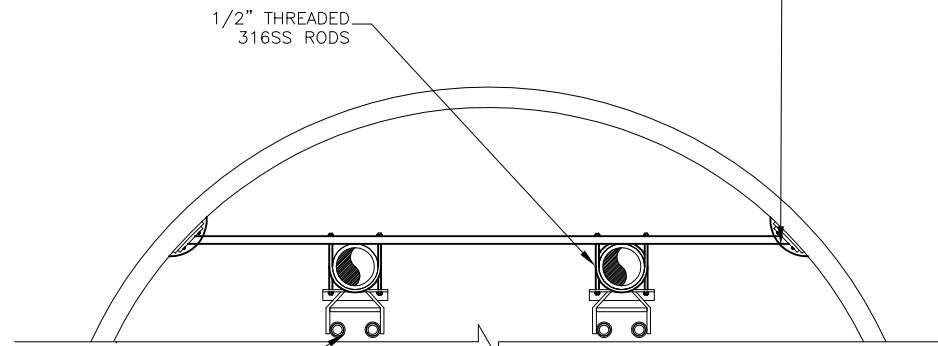


SECTION C 1



SECTION B 1

LATERAL SUPPORT C4x7.25 316SS CHANNEL WELDED TO 6" X 6" X 1/2" 316SS PLATES. BEND PLATES TO MATCH WET WELL CURVATURE. MOUNT TO WET WELL WALL USING 4 EACH 1/2" DIAMETER 316SS EPOXY ANCHOR BOLTS MINIMUM. SET 1/2" NEOPRENE GASKET ON WET WELL WALL SURFACES IN SIKI 1A (OR EQUAL) SEALANT.



BRACKET DETAIL FOR PIPE AND PUMP GUIDE RAIL SUPPORT, ALL COMPONENTS SHALL BE 316SS

NOTE: ALL MATERIAL SHALL BE 316SS, ALL NUTS SHALL BE LOCK NUTS, INSTALL FLAT WASHERS FOR ALL BOLTS AND NUTS

WET WELL PIPING SUPPORT DETAIL

NOTES TO DESIGN ENGINEER:

- THESE LIFT STATION DRAWINGS ARE CONSIDERED TO BE DESIGN GUIDELINES FOR THE CONSTRUCTION OF GUADALUPE-BLANCO RIVER AUTHORITY WASTEWATER LIFT STATIONS WITH SUBMERSIBLE PUMPS. THEIR INTENDED USE IS AS A FRAME WORK FOR THE CONTRACTED DESIGN ENGINEER IN DEVELOPING SPECIFIC LIFT STATION DESIGNS. IT IS THE RESPONSIBILITY OF THE CONTRACTED DESIGN ENGINEER TO VERIFY THE COMPLETENESS AND ACCURACY OF THE INFORMATION HEREIN CONTAINED AND TO ADJUST ACCORDING TO SPECIFIC SITE REQUIREMENTS.
- DESIGN ENGINEER TO VERIFY THE SIZE AND LOCATION OF THE WET WELL HATCHES ACCORDING TO THE SELECTED PUMP AND HATCH MANUFACTURERS' REQUIREMENTS (36"x48' MIN.).
- ELEVATIONS AND INFORMATION OMITED ARE DETERMINED BY DESIGN ENGINEER FOR SPECIFIC SITE REQUIREMENTS.
- THE DESIGN ENGINEER SHALL INCORPORATE ONLY THE NECESSARY STANDARD GUIDELINE DRAWINGS AND DETAILS INTO HIS PROJECT CONTRACT DOCUMENTATION PACKAGE, AND SHALL ADJUST PAGE NUMBERS AND CROSS REFERENCING ACCORDINGLY.
- THE DESIGN ENGINEER SHALL CONSULT THE GUADALUPE-BLANCO RIVER AUTHORITY DESIGN GUIDELINES MANUAL AND THE LATEST TCEQ RULES FOR FURTHER INSTRUCTIONS AND INFORMATION PERTINENT TO THESE STANDARD DESIGN GUIDELINE DRAWINGS.
- THE DESIGN ENGINEER SHALL REMOVE THESE NOTES, ALL REFERENCES TO THESE NOTES, AND ANY OTHER EXTRANEOUS INFORMATION FROM THE DESIGN GUIDELINE DRAWINGS. DESIGN ENGINEER SHALL PROVIDE ANY NOTES OR OTHER APPROPRIATE INFORMATION NECESSARY TO COMPLETE HIS LIFT STATION DESIGN.
- REQUIRED FOR ALL STATIONS.
- DESIGN ENGINEER MUST EVALUATE THE PUMP SEPARATION TO PROVIDE SUFFICIENT SPACE BETWEEN PUMPS, AND RELATIVE TO HATCH CLEAR OPENING.

NOTES:

- CONTRACTOR TO CONFIRM SIZE AND LOCATION OF WET WELL HATCHES PER SELECTED HATCH AND PUMP MANUFACTURERS' REQUIREMENTS (36" X 48" MIN. CLEAR OPENING)
- INSTALL FLANGED JOINT ROUND PORT PLUG VALVES WITH HORIZONTAL SHAFT, CLOSING DOWNWARD.
- INSTALL SWING TYPE CHECK VALVE WITH EXTERNAL LEVER AND WEIGHT.
- ALL PUMP DISCHARGE PIPE AND FITTINGS WITHIN WET WELL SHALL BE FLANGED AND SHALL RECEIVE AFTER INSTALLATION A COAL TAR EPOXY COATING SYSTEM IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.
- ALL PUMP DISCHARGE PIPE, VALVES AND FITTINGS OUTSIDE THE WET WELL, EXCEPT 316SS AND PVC, SHALL RECEIVE AFTER INSTALLATION A WHITE COLOR HIGH BUILD EPOXY COATING SYSTEM WITH A GREY PANTONE #431-U COLOR TOP COAT OF POLYURETHANE IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.
- ALL FASTENERS AND ANCHOR BOLTS SHALL BE 316SS WITH FIELD APPLIED ANTI-SIZE COMPOUND. ANCHOR BOLTS INSIDE WET WELL SHALL BE EPOXY TYPE. DO NOT PAINT NUTS AND BOLTS.
- ELECTRIC HOIST TO BE THERN MODEL 5124 OR EQUAL AND OF SUFFICIENT LOAD RATING CAPACITY TO LIFT PUMPS, WITH HOT DIP GALV. CRANE AND BASE, EPOXY COATED WINCH, 316SS HARDWARE AND FASTENERS, 316SS WIRE ROPE AND CHAIN GRIP EYE.



SUBMERSIBLE LIFT STATION CONFIGURATION PLAN VIEW

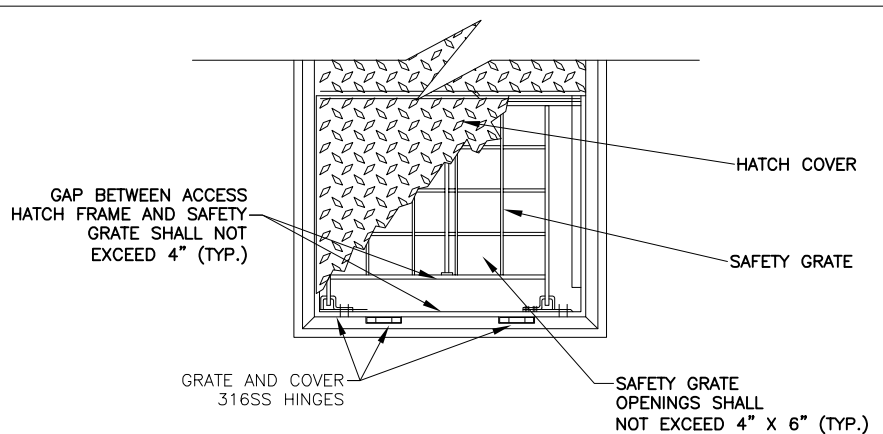
REVISION  
JAN 2018 OPERATIONS & MAINTENANCE ENGINEERING

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GUADALUPE-BLANCO RIVER AUTHORITY  
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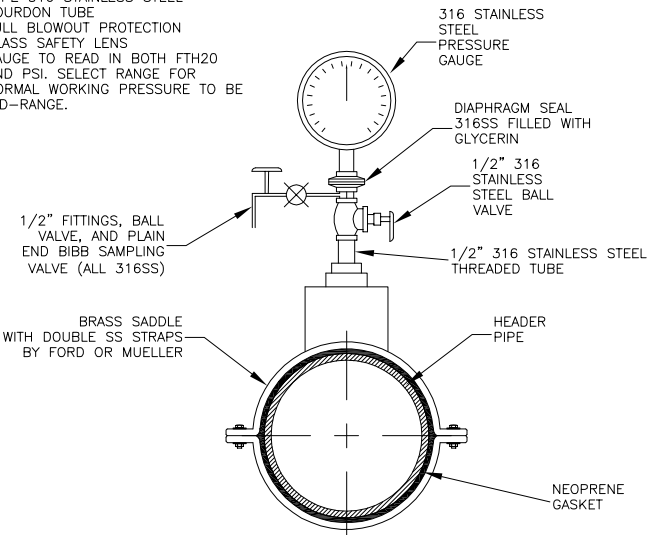


- KEY NOTES:
- TOP OF SAFETY GRATES SHALL BE 1/2" MAXIMUM BELOW TOP OF CONCRETE SLAB.
  - ACCESS HATCH COVER SHALL BE PERFECTLY LEVELED WITH TOP OF CONCRETE SLAB.
  - HATCH ASSEMBLY SHALL BE EJ SAFE HATCH OR GBRA APPROVED EQUAL WITH ALUMINUM FRAME, GRATES, COVERS AND 316SS HARDWARE, FASTENERS, AND HINGES.
  - COVERS SHALL BE EQUIPPED WITH PADLOCK STAPLES.
  - HATCH ASSEMBLY SHALL BE RATED FOR 300 PSF LIVE LOAD.
  - PROVIDE 2 EACH HATCH KEYS.

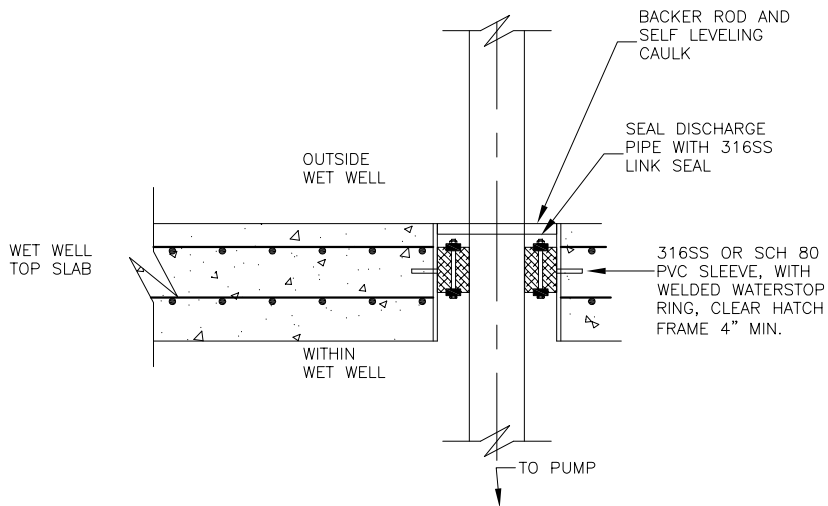
DETAIL 1:  
SAFETY GRATE DETAILS

KEY NOTES:

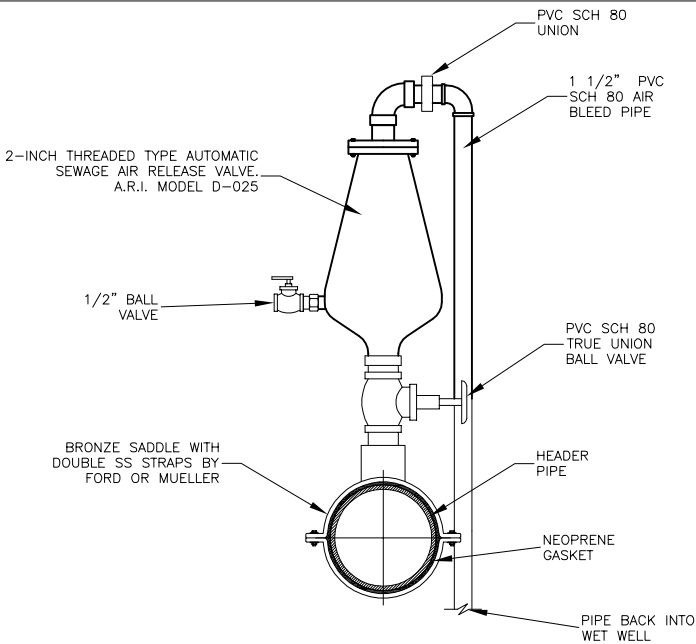
- PRESSURE GAUGE SHALL BE RATED FOR CORROSIVE SERVICE
- 4" DIAL SIZE
- GRADE 1A
- LIQUID FILLED
- TYPE 316 STAINLESS STEEL
- BOURDON TUBE
- FULL BLOWOUT PROTECTION
- GLASS SAFETY LENS
- GAUGE TO READ IN BOTH FTH20 AND PSI. SELECT RANGE FOR NORMAL WORKING PRESSURE TO BE MID-RANGE.



DETAIL 2:  
PRESSURE GAUGE INSTALLATION DETAIL



DETAIL 3:  
TYPICAL PIPE PENETRATION DETAIL



DETAIL 4:  
AIR RELEASE VALVE INSTALLATION DETAIL

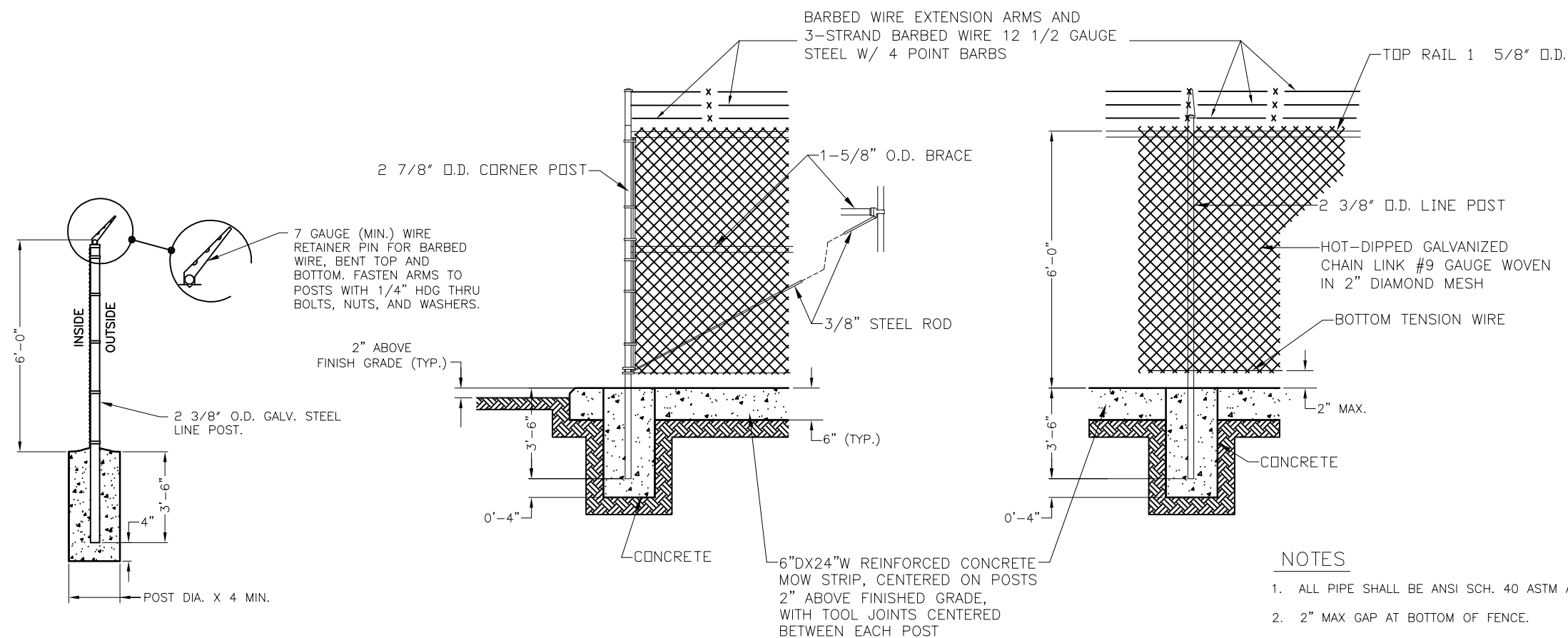
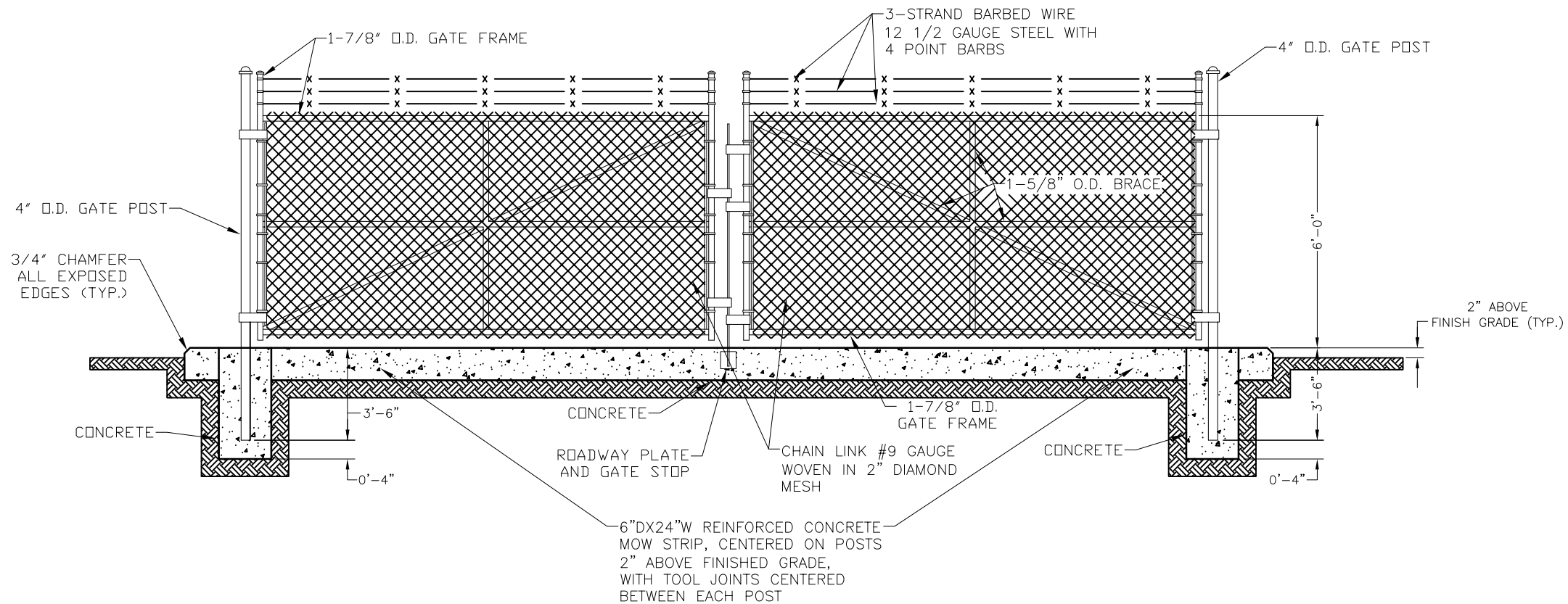


REVISION  
JAN 2018

OPERATIONS & MAINTENANCE ENGINEERING  
PROPERTY OF  
GUADALUPE-BLANCO RIVER AUTHORITY  
SEGUIN, TEXAS

WET WELL AND  
PIPING DETAILS

LS-03



#### NOTES

1. ALL PIPE SHALL BE ANSI SCH. 40 ASTM A53.
2. 2" MAX GAP AT BOTTOM OF FENCE.
3. 10' MAX. POST SPACING.
4. INSTALL GATE LEAF HOLD BACKS.
5. ALL MATERIAL TO BE HOT DIP GALV.



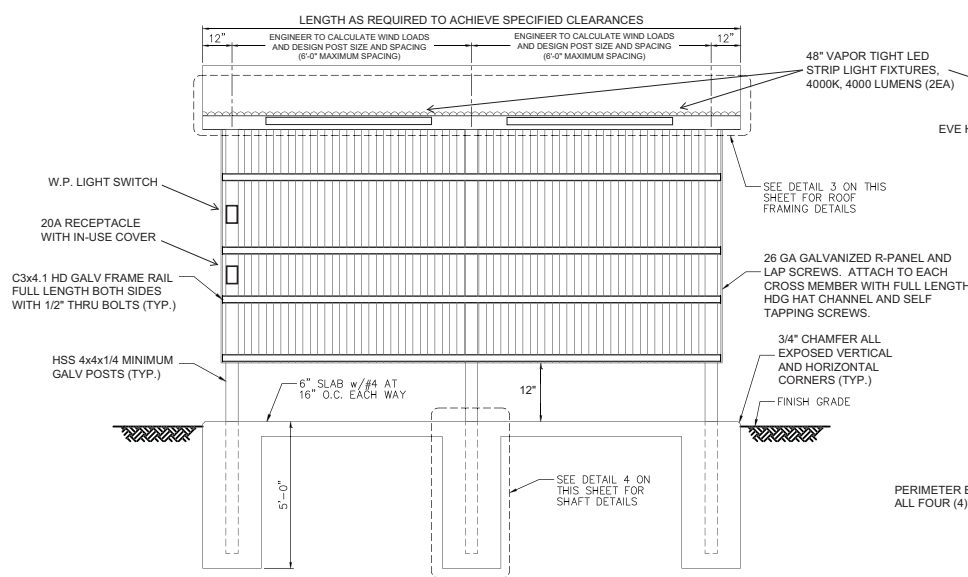
#### CHAIN LINK FENCE AND GATES DETAILS

REVISION  
JAN 2018

OPERATIONS & MAINTENANCE ENGINEERING

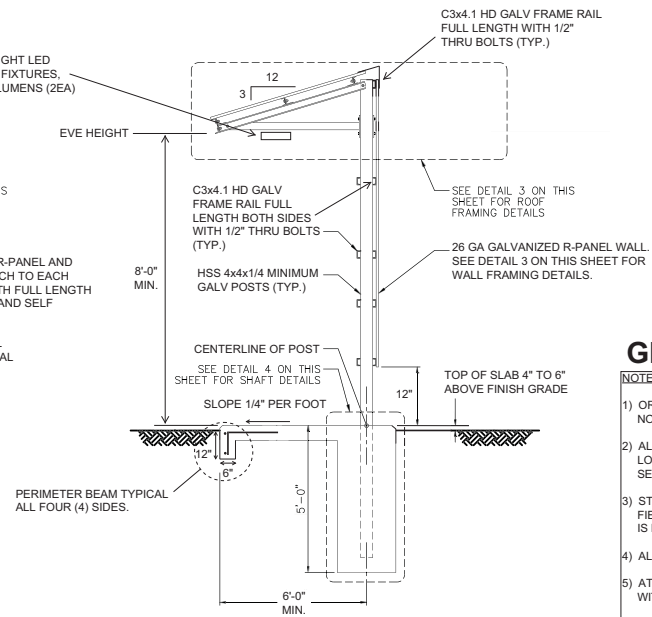
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SEGUIN, TEXAS

LS-04



① SHELTER - FRONT VIEW

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



② SHELTER - END VIEW

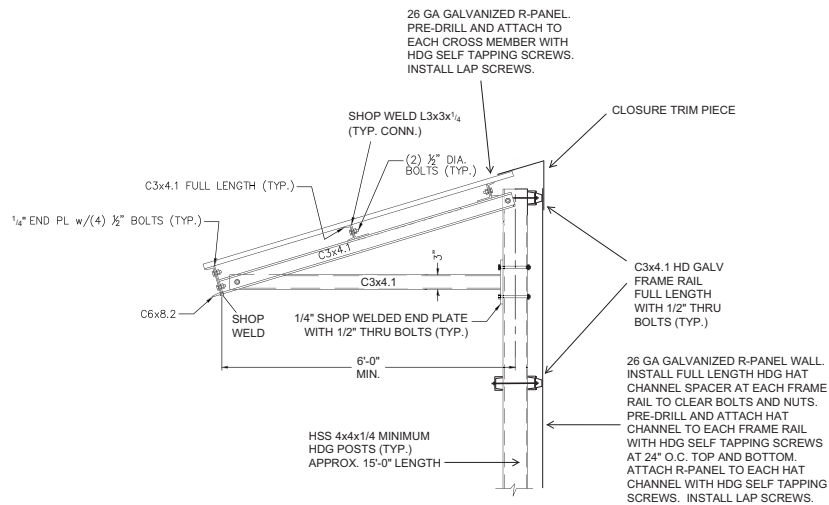
SCALE: 1/2" = 1'-0"

## GBRA ELECTRICAL SHELTER

### NOTES:

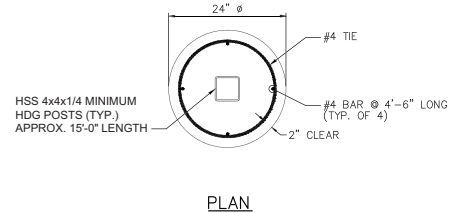
- 1) ORIENTATION OF SHELTER SHALL BE SUCH THAT PANELS FACE EAST OR NORTH WITH SHELTER WALL ON WEST OR SOUTH SIDE.
- 2) ALL BOLTS, NUTS, AND HARDWARE TO BE 316SS. FLAT WASHERS AND LOCK WASHERS ARE REQUIRED FOR ALL BOLTS AND NUTS. APPLY ANTI-SEIZE COMPOUND TO THREADS PRIOR TO INSTALLATION.
- 3) STRUCTURE TO BE HOT DIP GALVANIZED (HDG) AFTER FABRICATION. FIELD CUTTING AND WELDING IS NOT ALLOWED. SPLICING OF MATERIAL IS NOT ALLOWED.
- 4) ALL ELECTRICAL ENCLOSURES TO BE NEMA 4X 316SS.
- 5) ATTACH ALL ELECTRICAL ENCLOSURES AND DEVICES TO STRUCTURE WITH VERTICAL 316SS STRUT. CLAMPS AND HARDWARE TO BE 316SS.
- 6) VERTICAL STACKING OF ENCLOSURES IS NOT ALLOWED. PROVIDE 6" MINIMUM CLEARANCE BETWEEN ENCLOSURES. PROVIDE 12" MINIMUM CLEARANCE FROM CENTER OF END POSTS TO ENCLOSURES. CONTRACTOR SHALL SUBMIT A DIMENSIONED ELECTRICAL LAYOUT DRAWING DEMONSTRATING THE REQUIRED CLEARANCES PRIOR TO FABRICATION OF SHELTER.
- 7) ALARM BEACON TO BE MOUNTED 12" ABOVE TOP OF ROOF AT END OF STRUCTURE. DO NOT PENETRATE ROOF OR WALL.

Guadalupe-Blanco River Authority, 01/28/2018

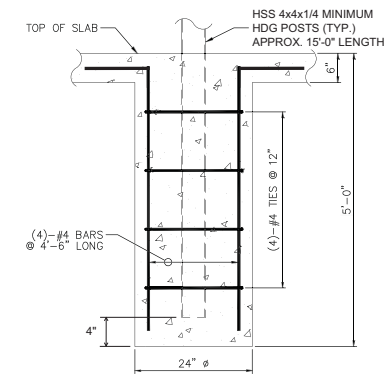


③ ROOF & WALL DETAIL

SCALE: 1" = 1'-0"



PLAN

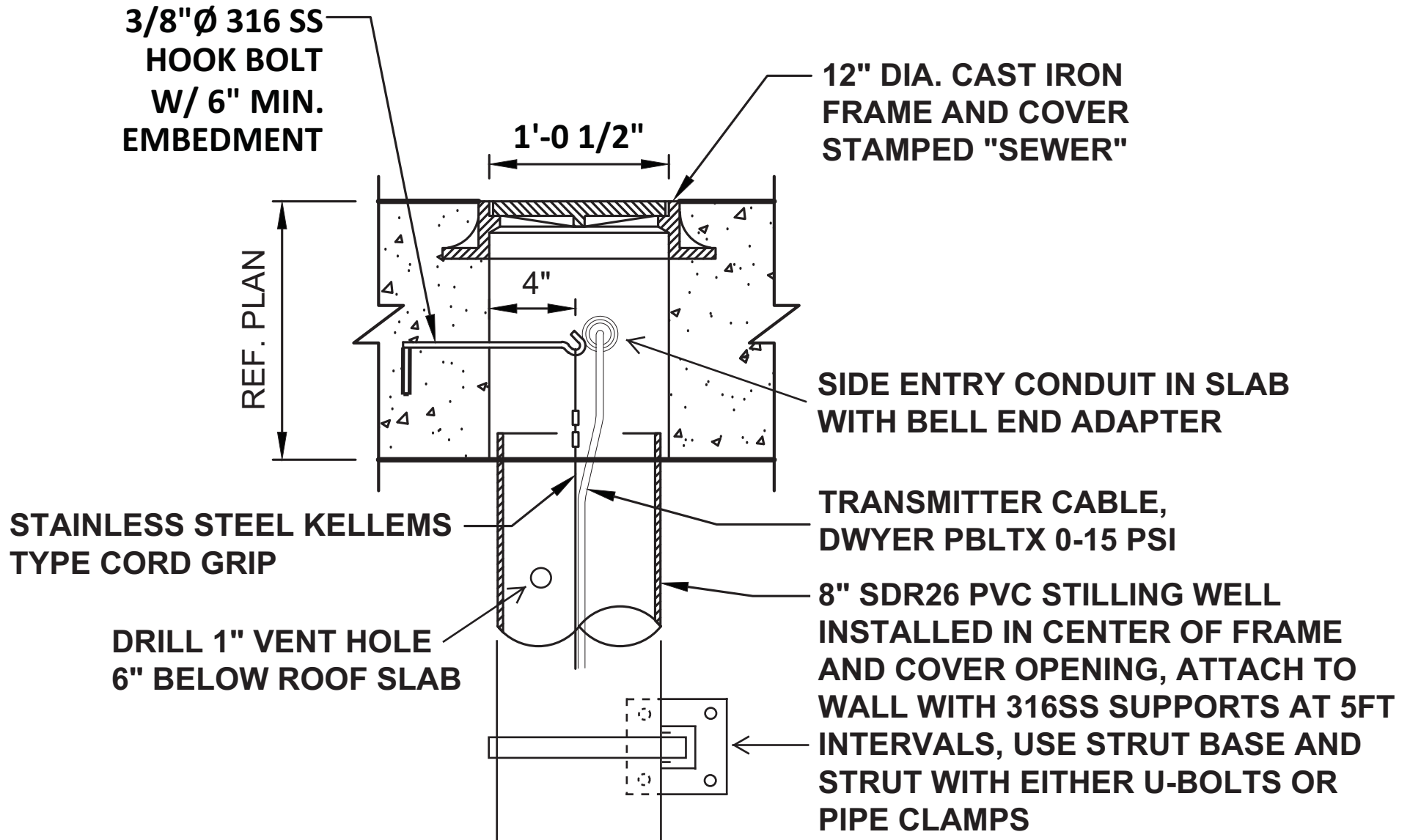


SECTION

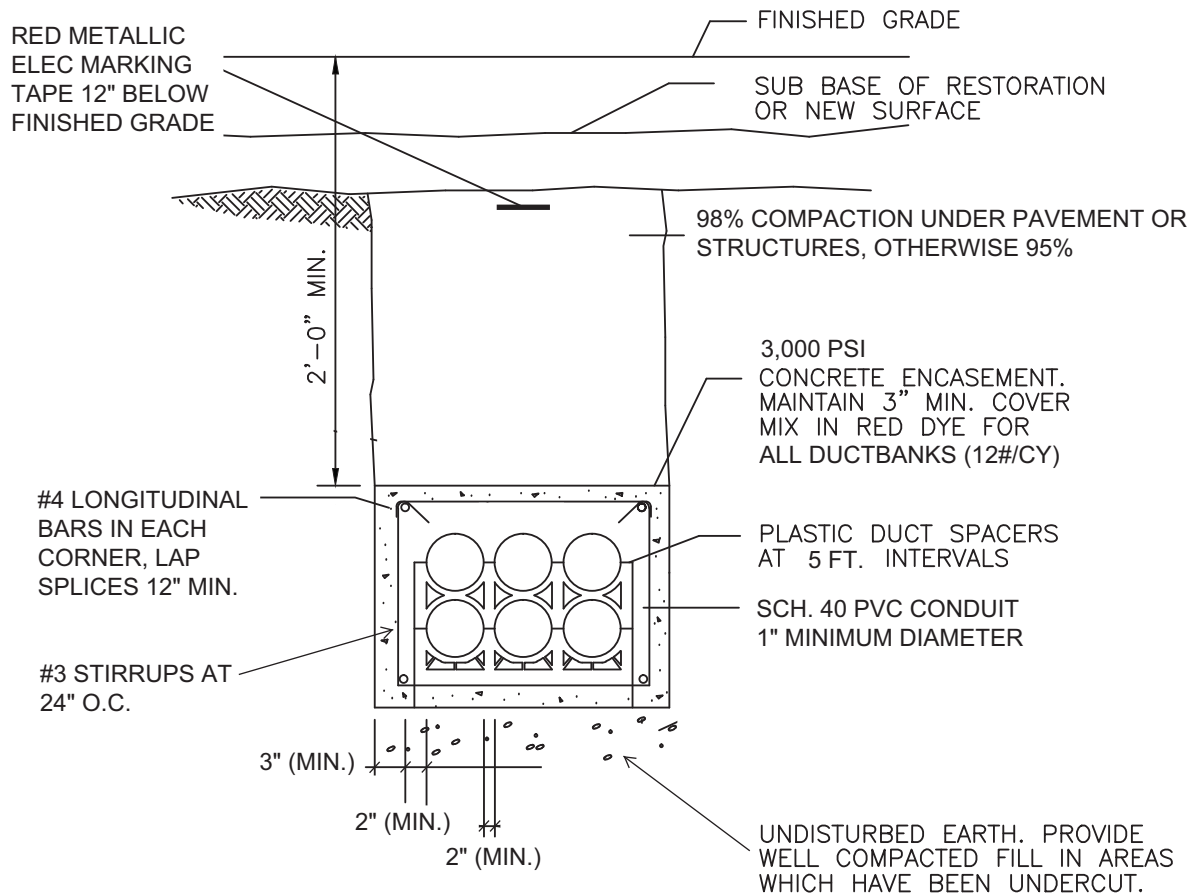
④ SHAFT DETAIL

SCALE: 1" = 1'-0"





## **STILLING WELL**

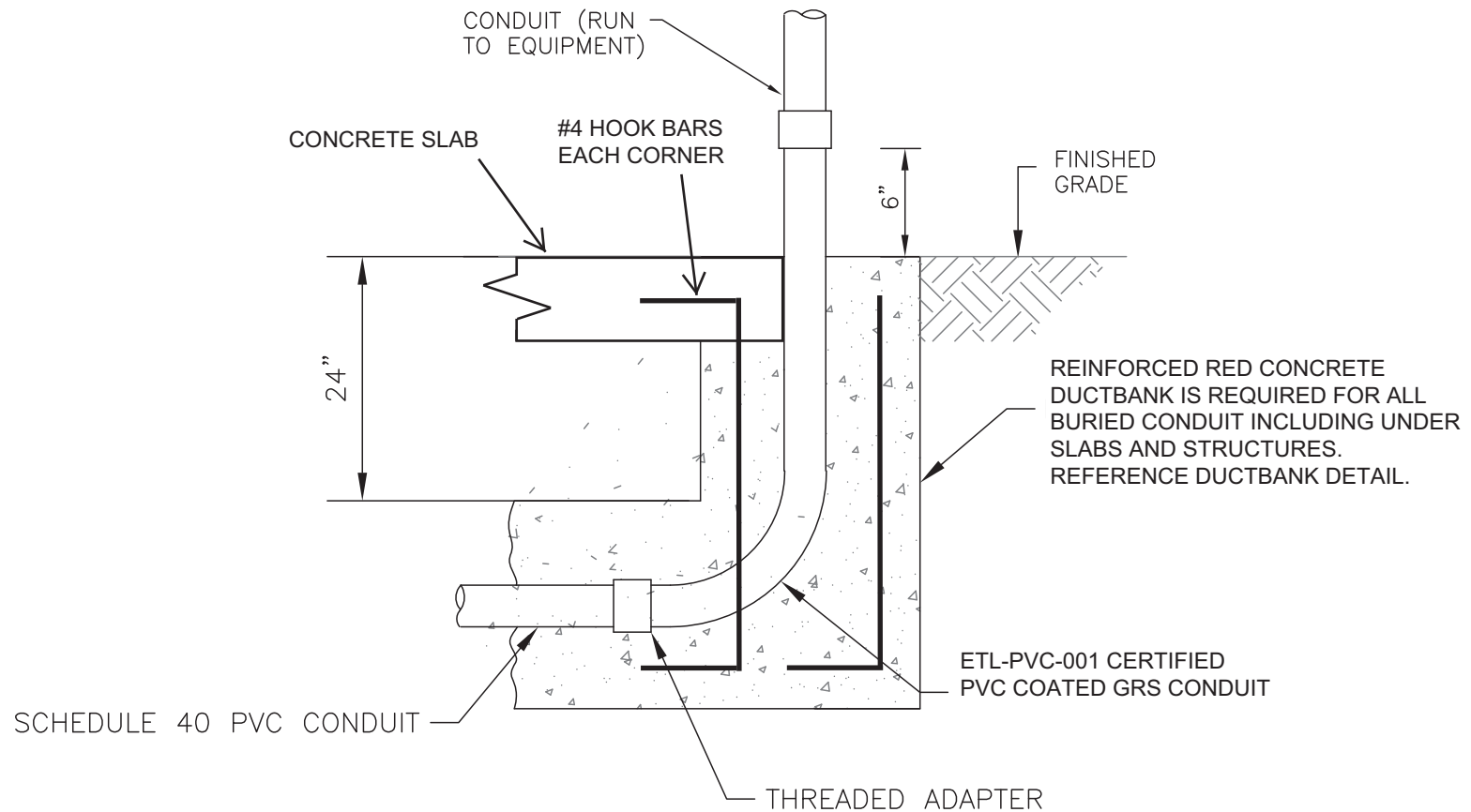


**NOTES:**

- 1) CONCRETE AND REBAR ARE REQUIRED FOR ALL DUCT BANKS, INCLUDING UNDER SLABS AND STRUCTURES.
- 2) DUCT BANK REBAR SHALL BE DOWELLED INTO SLABS AND STRUCTURES.
- 3) MINIMUM 2" SEPARATION BETWEEN DUCTS FOR LIKE SERVICES.
- 4) SIGNALS, POWER, AND CONTROLS SHALL BE ROUTED IN SEPARATE DUCTS.
- 5) MINIMUM 12" SEPARATION BETWEEN SIGNAL DUCTS AND POWER OR CONTROLS DUCTS.
- 6) DO NOT MIX VOLTAGES IN THE SAME CONDUIT.
- 7) MINIMUM 2" CLEARANCE BETWEEN REBAR AND CONDUIT.
- 8) MINIMUM 3" CONCRETE COVER AROUND REBAR.
- 9) PROVIDE ONE SPARE CONDUIT OF EACH SIZE AND TYPE IN ALL DUCT BANKS.
- 10) MAINTAIN 12" MINIMUM VERTICAL CLEARANCE BETWEEN DUCT BANK CONCRETE AND OTHER UTILITIES.
- 11) SHARED TRENCHES ARE NOT ALLOWED.

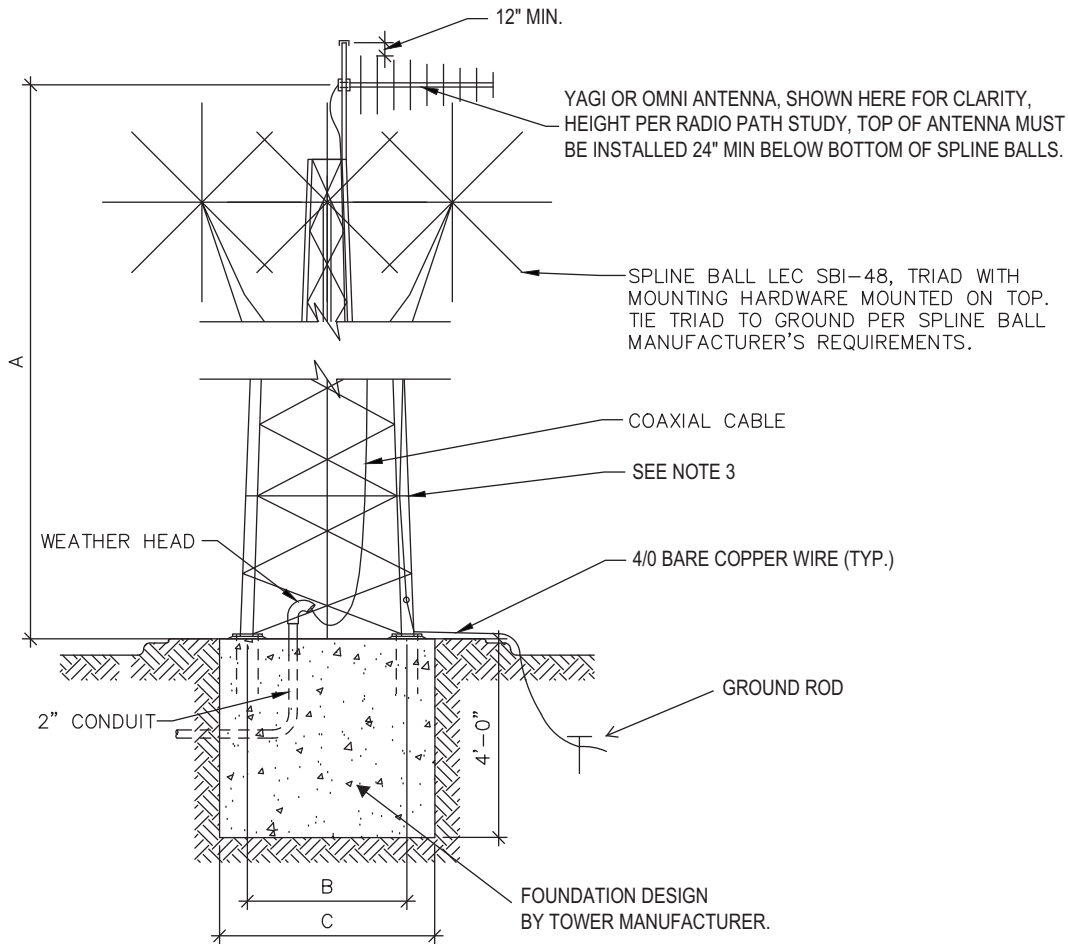
# **REINFORCED CONCRETE DUCT BANK**

Guadalupe-Blanco River Authority, 01/30/2018



## **CONDUIT STUBUP DETAIL**

Guadalupe-Blanco River Authority, 01/28/2018



#### GENERAL NOTES:

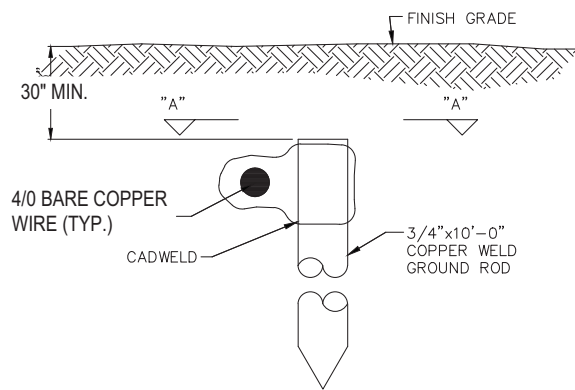
1. SUBMIT SPLINE BALL EQUIPMENT WITH STAINLESS STEEL MOUNTING HARDWARE. QUANTITY OF SPLINE BALLS PER MANUFACTURER RECOMMENDATION (3 MINIMUM).
2. COAXIAL AND GROUND CABLE SHALL BE SUPPORTED AT 3-FOOT INTERVALS IN ACCORDANCE WITH GBRA STANDARD SPECIFICATION SECTION 13428.
3. PROVIDE FALL PROTECTION AND ANTI-CLIMB DEVICES.
4. REFERENCE GBRA STANDARD SPECIFICATION 13428 FOR ADDITIONAL REQUIREMENTS.

### OPTIONAL MAST

PERFORM RADIO PATH STUDY. PROVIDE TOWER OR MAST IN ACCORDANCE WITH RADIO PATH STUDY. IF MAST IS PROPOSED, MINIMUM 2" SCH 40 HDG PIPE OR LARGER WILL BE REQUIRED DEPENDING ON HEIGHT, MAST SPLICES OR COUPLINGS ARE NOT ALLOWED. IT MAY BE POSSIBLE TO MOUNT ANTENNA MASTS ON TOP OF GROUND STORAGE TANKS OR ATTACHED TO ELECTRICAL SHELTERS. EXTEND CONDUIT TO ROOF OF GROUND STORAGE TANKS. DEDICATED DIRECT GROUNDING AND LIGHTNING PROTECTION ARE REQUIRED. TOP OF ANTENNA TO BE 12" MIN BELOW TOP OF MAST. INSTALL THREADED HDG CAP ON TOP OF MAST.

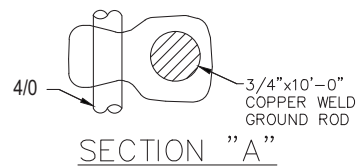
# ANTENNA TOWER DETAIL

Guadalupe-Blanco River Authority, 01/28/2018



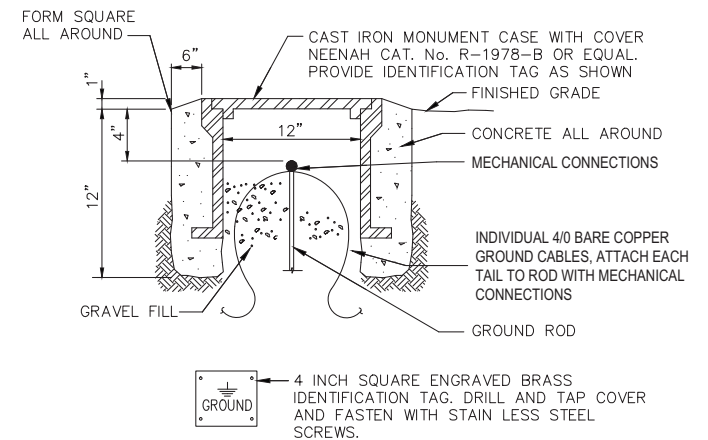
**GROUND ROD**

NTS



**NOTE:**

ANY EXPOSED OR ABOVE GRADE CONNECTIONS SHALL BE MECHANICAL TYPE WITH CRIMP LUGS. USE CADWELD FOR BURIED LOCATIONS.



**GROUND TEST WELL**

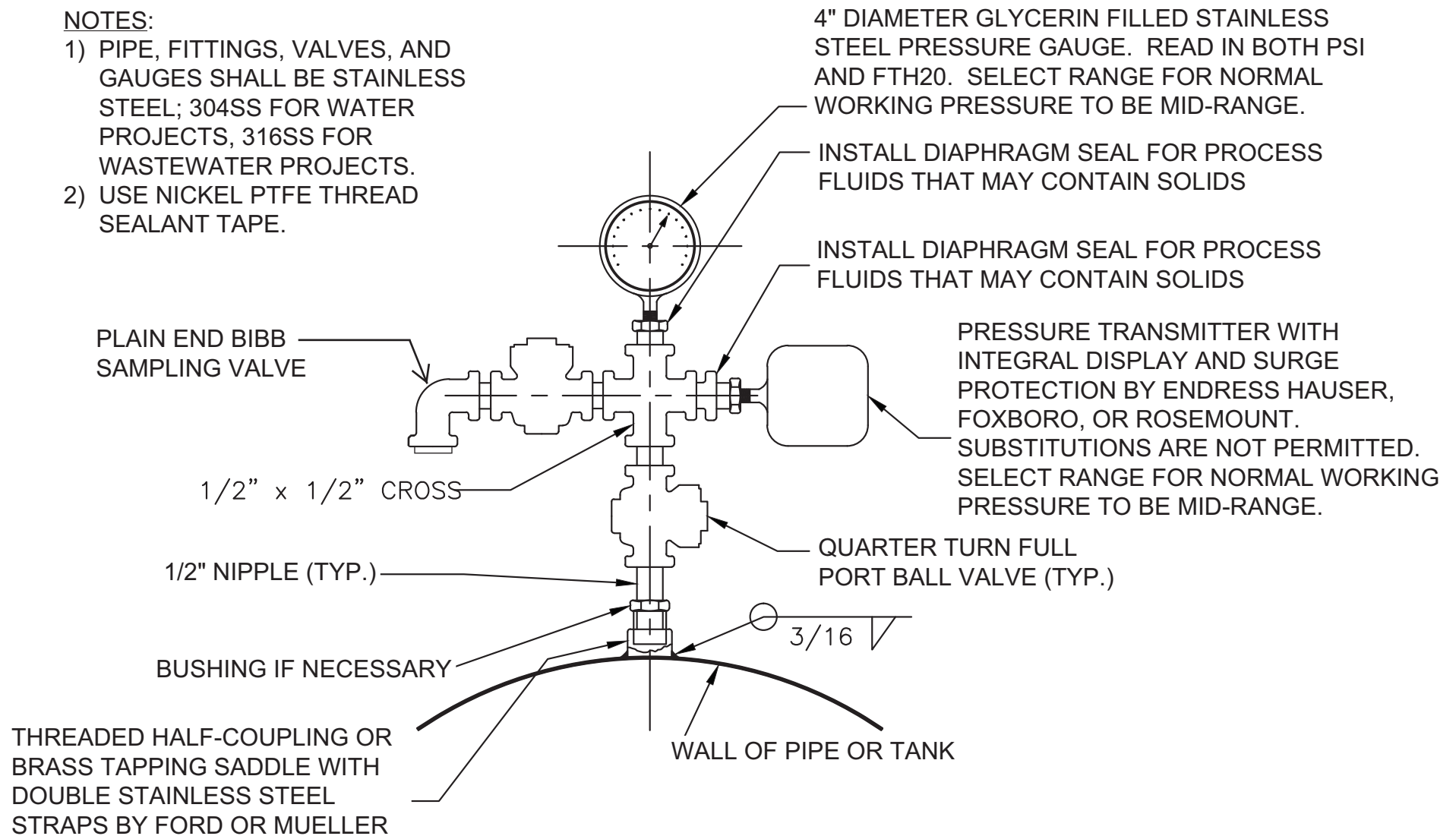
NTS

# **GROUNDING DETAILS**

Guadalupe-Blanco River Authority, 01/28/2018

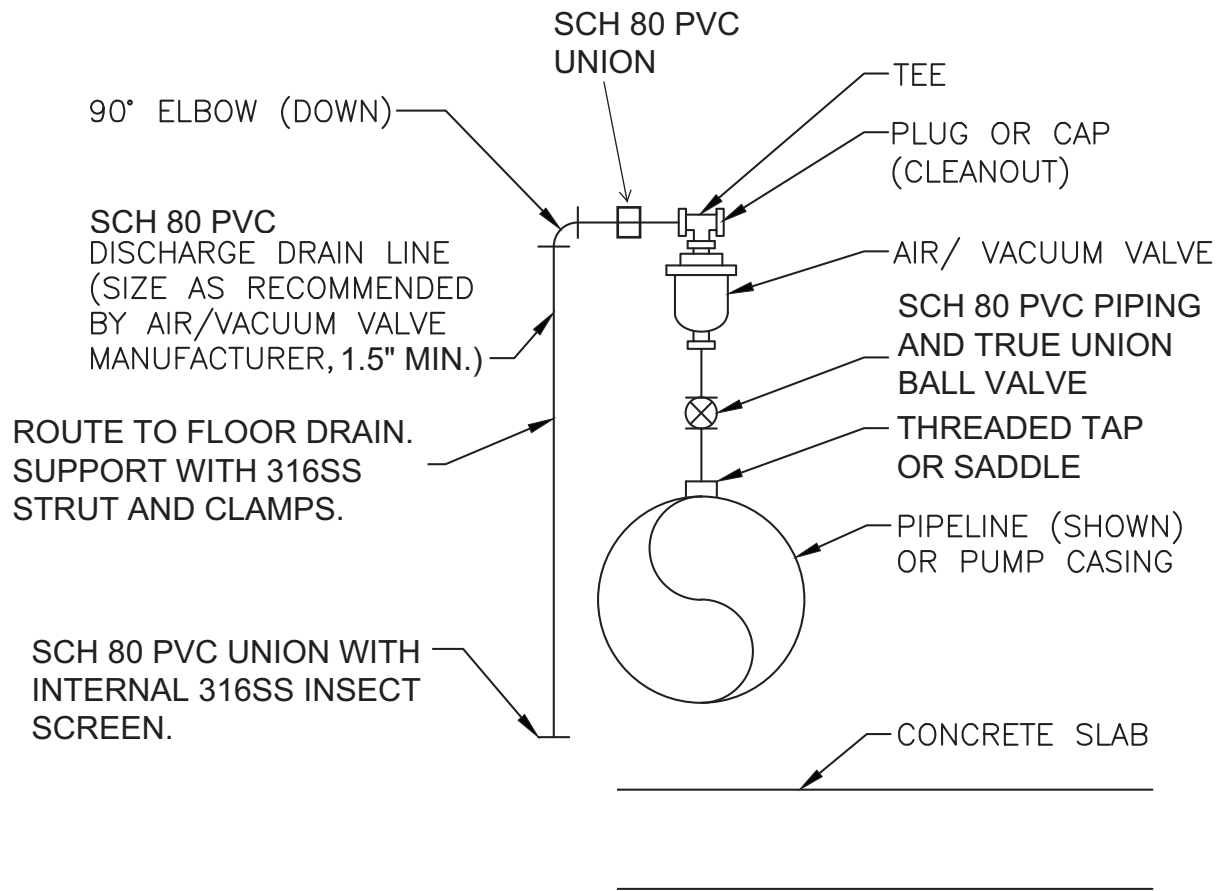
**NOTES:**

- 1) PIPE, FITTINGS, VALVES, AND GAUGES SHALL BE STAINLESS STEEL; 304SS FOR WATER PROJECTS, 316SS FOR WASTEWATER PROJECTS.
- 2) USE NICKEL PTFE THREAD SEALANT TAPE.



## **PRESSURE TRANSMITTER AND GAUGE ASSEMBLY**

Guadalupe-Blanco River Authority, 01/29/2018

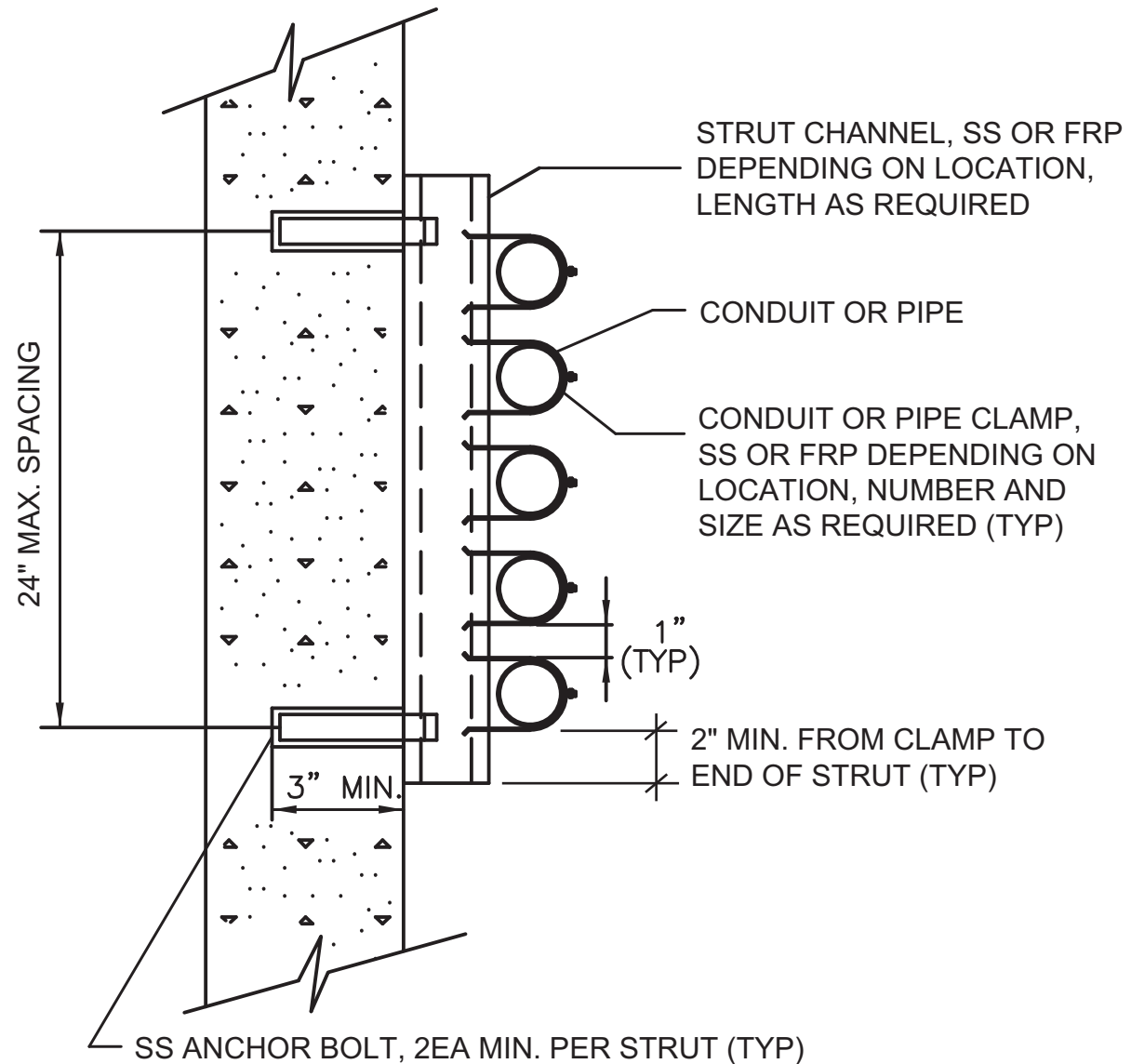


**NOTES:**

- 1) AIR RELEASE VALVE SHALL BE A.R.I. MODEL D-025, 2" MINIMUM.
- 2) SCH 80 PVC TRUE UNION BALL VALVES SHALL BE GF, HAYWARD, NIBCO, OR SPEARS.
- 3) TAPPING SADDLES SHALL BE BRASS WITH DOUBLE STAINLESS STEEL STRAPS BY FORD OR MUELLER.

## **AIR/VACUUM VALVE DETAIL**

Guadalupe-Blanco River Authority, 01/30/2018



**NOTE:**

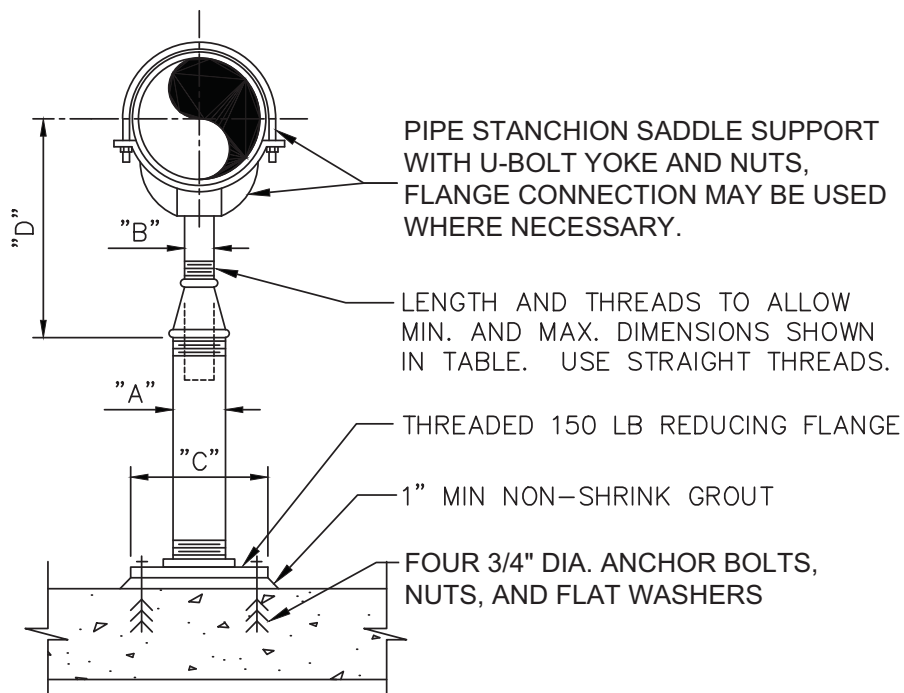
STAINLESS STEEL (SS) SHALL BE 304SS FOR WATER PROJECTS AND 316SS FOR WASTEWATER PROJECTS.

## **STRUT AND CLAMP DETAIL**

Guadalupe-Blanco River Authority, 01/28/2018



ADJUSTABLE PIPE SUPPORT SCHEDULE DIMENSIONS IN INCHES					
PIPE SIZE	"A"	"B"	"C"	"D"	
				MINIMUM	MAXIMUM
≤ 2 1/2	2 1/2	1 1/2	9	8	13
3	2 1/2	1 1/2	9	8 1/2	13 1/2
3 1/2	2 1/2	1 1/2	9	8 1/2	13 1/2
4	3	2 1/2	9	9 1/2	14
6	3	2 1/2	9	10 1/2	15 1/2
8	3	2 1/2	9	11 1/2	16 1/2
10	3	2 1/2	9	13 1/2	18 1/2
12	3	2 1/2	9	15	19 1/2
14	4	3	11	16 1/2	20 1/2
16	4	3	11	17 1/2	22 1/2
18	6	3 1/2	13 1/2	19 1/2	24
20	6	3 1/2	13 1/2	21	25 1/2
24	6	4	13 1/2	23 1/2	28 1/2
30	6	4	13 1/2	27	31 1/2
32	6	4	13 1/2	28 1/2	32 1/2
36	6	4	13 1/2	30 1/2	34 1/2

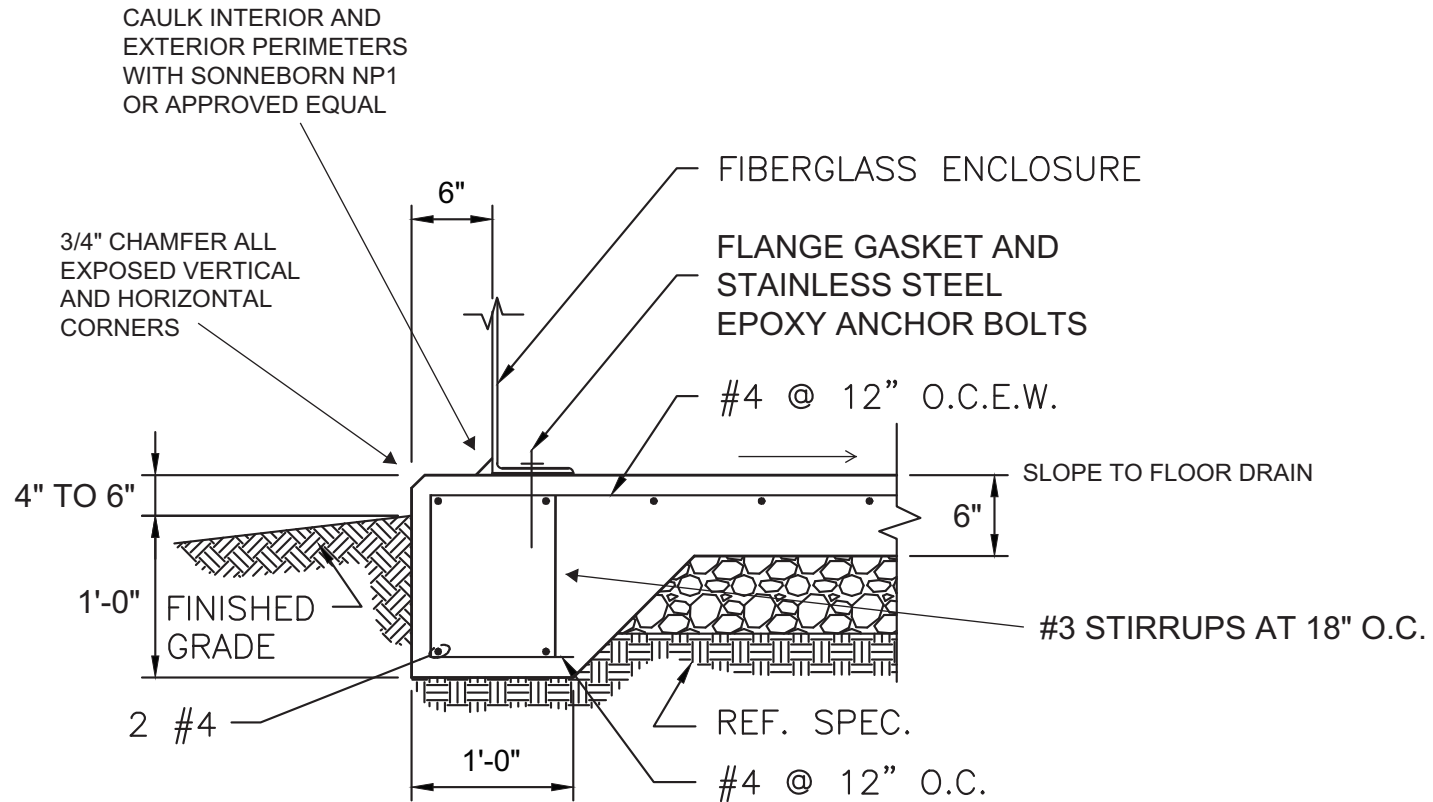


**NOTES:**

1. INSTALL WHERE SHOWN ON DRAWINGS.
2. ALL MATERIAL TO BE 316 STAINLESS STEEL.
3. PIPE SHALL BE SCHEDULE 40.

## ADJUSTABLE STANCHION PIPE SUPPORT DETAIL

Guadalupe-Blanco River Authority, 01/28/2018



**NOTES:**

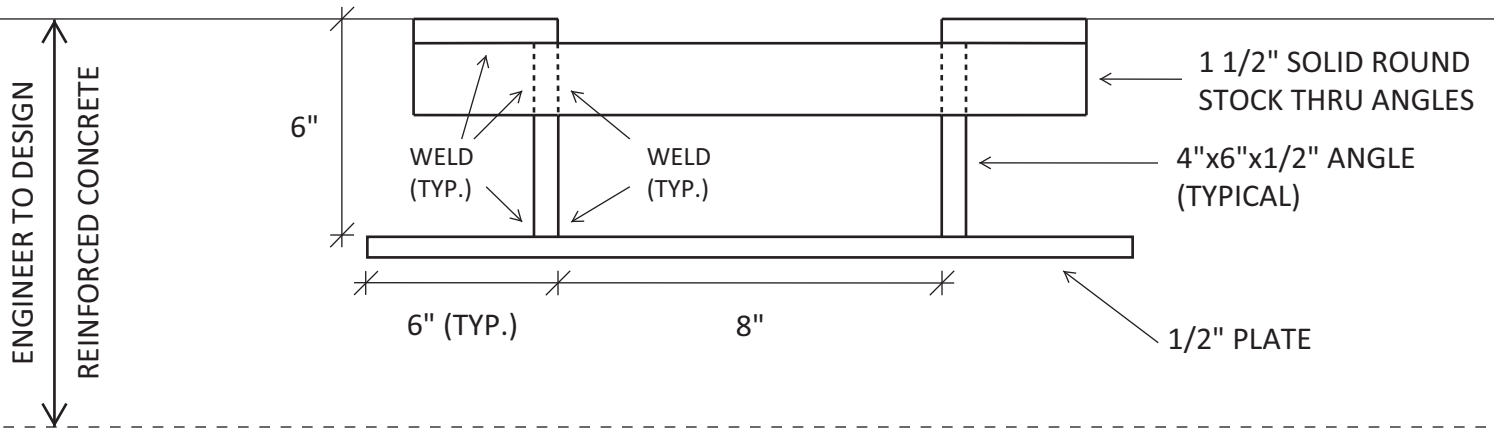
EMBED 2"x2"x1/4" HDG ANGLES ACROSS DOOR OPENINGS. PROVIDE CAST IRON FLOOR DRAIN WITH BRASS STRAINER IN CENTER OF BUILDINGS. SLOPE FLOOR TO DRAIN. REFERENCE CIVIL DRAWINGS FOR ROUTING. REFERENCE GBRA STANDARDS FOR FLOOR FINISH, CONCRETE SEALER, CURB CONTAINMENT, AND SUMP PITS.

## **EQUIPMENT PAD DETAIL**

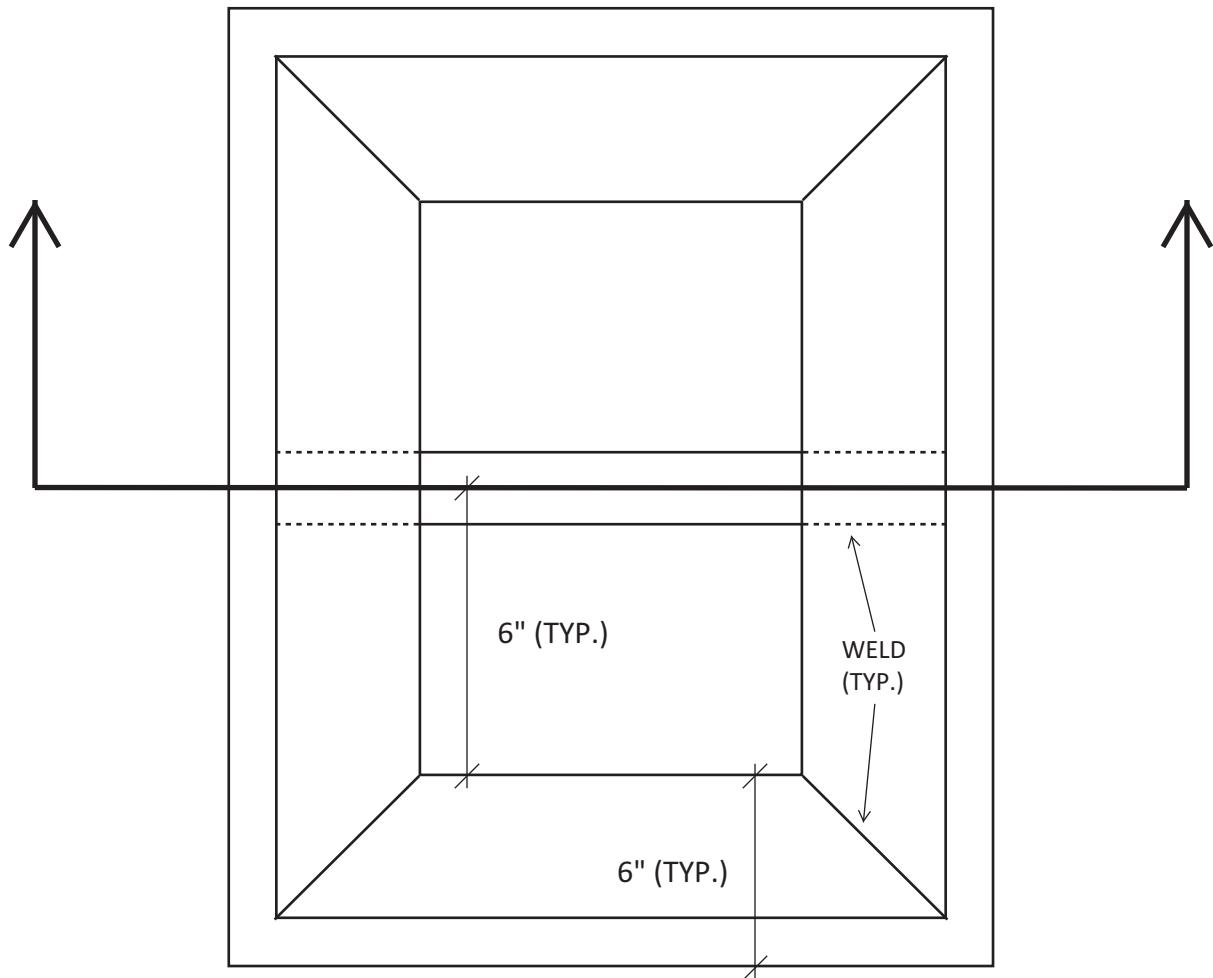
**TYPICAL FOR FIBERGLASS BUILDINGS, GENERATORS, TRANSFORMERS, BLOWERS, MISC. EQUIP., ETC.**

Guadalupe-Blanco River Authority, 01/28/2018

## SECTION VIEW

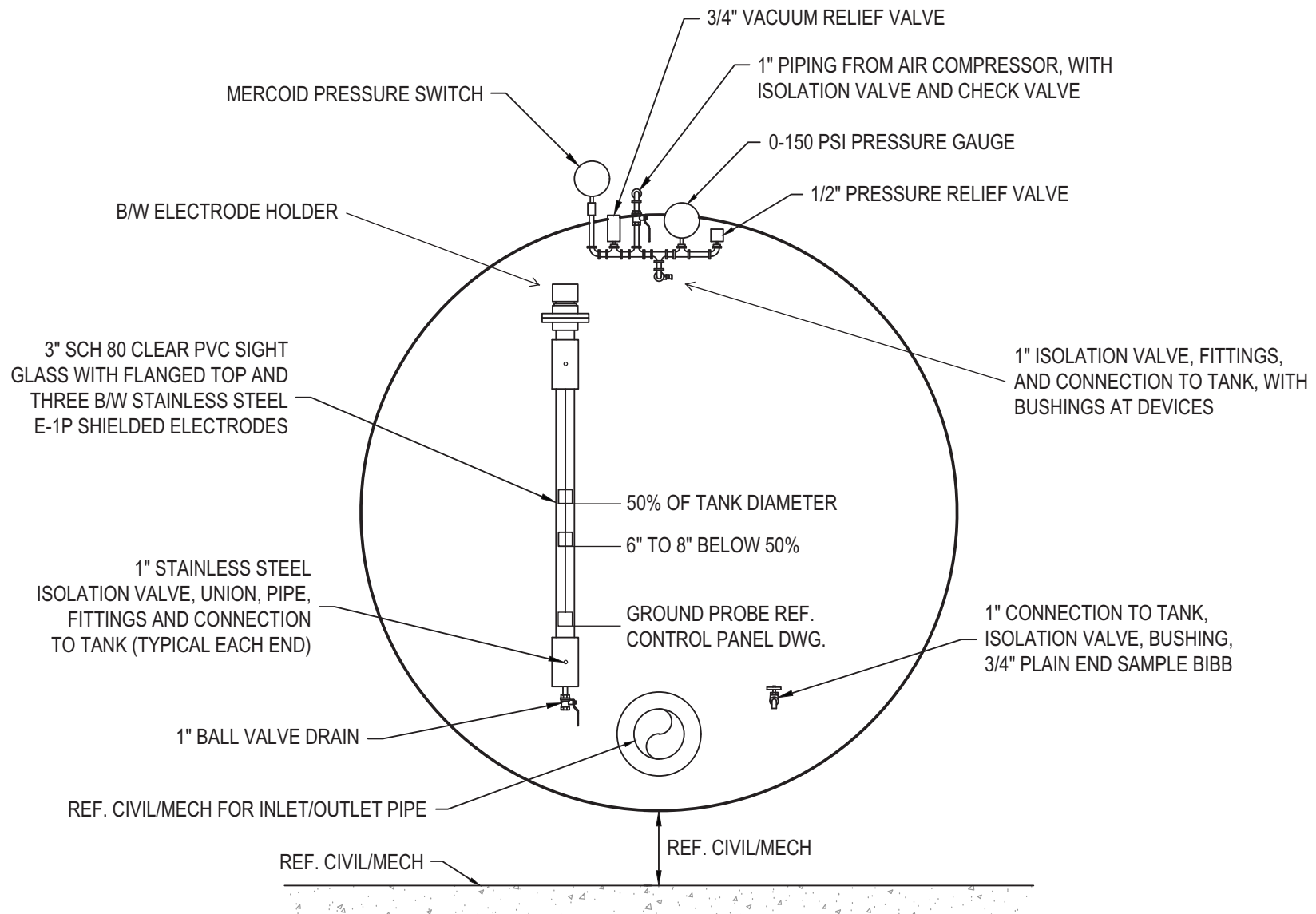


## PLAN VIEW



### NOTES:

- 1) ALL MATERIAL SHALL BE STEEL, HOT DIP GALVANIZE AFTER FABRICATION.
- 2) WELDS SHALL BE CONTINUOUS.



**NOTES:**

- 1) ALL PIPE, FITTINGS, AND VALVES TO BE TYPE 316 STAINLESS STEEL WITH NICKEL PTFE THREAD SEALANT TAPE. PIPING TO BE SCH 40. ISOLATION VALVES TO BE LEVER HANDLE FULL PORT BALL VALVES.
- 2) REFERENCE AIR CUSHION CONTROL AND MAINTENANCE NARRATIVE.

# HYDROPNEUMATIC TANK CONNECTIONS DETAIL

Guadalupe-Blanco River Authority, 01/30/2018

**Hydropneumatic Tanks**  
**Air Cushion Control & Maintenance Narrative**  
**01/27/2018**

Design Capacity

- TCEQ: minimum 20 gallons per connection
- Pump Runtime: water volume should be 50% of tank capacity (ideally 60% air, 40% water); verify maximum 15% of the water volume provides minimum 1 minute pump runtime (e.g. 500 GPM pump requires 6,667 GAL tank minimum; calc.  $500/0.15 \times 2 = 6,667$ )

Probes (3ea)

- The probes control the add air solenoid valve only, not the pumps
- The pumps should be controlled by pressure transmitters
- The air solenoid valve should not be allowed to open while pumps are running
- Top probe enables the add air solenoid valve to open, install bottom of probe at 50% tank capacity
- Middle probe closes/disables the add air solenoid valve, install this probe 6" to 8" below top probe
- Bottom probe is always submerged, it is a common/ground

Mercoird Switch

- This is for over pressure protection; it should lock the add air solenoid valve closed
- The switch should be normally closed
- High side should be set 5 PSI above system pressure for all pumps off (switch open)
- Low side should be set at system pressure for all pumps off (switch closed/reset)

Initial Startup

- Fill system with water
- Isolate tank from system
- Fill tank with water to 50% capacity
- Add air to system pressure for all pumps off
- Gradually introduce pressure from tank into system
- Allow system to stabilize
- Fully open valve from tank to system