Guadalupe-Blanco River Authority

Standards and Design Guidelines for Developer Constructed Facilities

GBRA approved revisions to the Standards and Design Guidelines for Developer Constructed Facilities on July 28, 2025. The revisions go into effect October 01, 2025.

PREFACE

The following standards are for the design of developer constructed facilities to be dedicated to GBRA or operated by GBRA. The developer is ultimately responsible for the adherence to these GBRA Standards and Design Guidelines; however, as referenced in this document, the developer may utilize contractors, engineers, or other agents to complete the requirements stated herein. Please review the following guidelines carefully and contact GBRA for a consultation meeting to address any design or construction related matters.

For procedures and requirements related to the provision of services by GBRA for new developments, please refer to the GBRA Developer's Resource Guide published on GBRA's Developer Resources web page. For information concerning the general availability of water and wastewater service to a tract of land and/or to set an initial meeting, please submit a Developer Inquiry through the link found on GBRA's Developer Resources web page.

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SECTION 1: REQUIRED DOCUMENTS AND SUBMITTALS

1.1 Design Documents

A. Provide complete design submittals for GBRA review, comment, and approval. Engineer must obtain GBRA design approval prior to advertising for bids. Include master plan, utilities master plan, plats, easements, design calculations, process flow diagrams, drawings, specifications, and contract documents. Provide complete project drawing sets including all sheets and all utilities, trades, and disciplines. Provide one (1) searchable electronic PDF copy and up to six (6) half scale 11”x17” simplex printed and bound copies. Confirm quantities with GBRA prior to printing. Scanned and/or photocopies are not acceptable.

B. All piping shown on drawings shall be labeled as to the size, type, class, process fluid contained, and flow direction.

C. Refer to Appendix A herein for additional design drawing requirements.

D. Engineer shall provide GIS and CAD data sets per Appendix B herein.

E. For submittal and review process of design documents, refer to the GBRA Developer’s Resource Guide - Section 8 published on GBRA’s Developer Resources web page.

F. 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.

G. If construction has not commenced within one (1) year of GBRA design approval, the approval will expire and the design must be resubmitted for GBRA review and will be re-evaluated in accordance with the most current GBRA Standards and Design Guidelines.

1.2 Easements

A. For easement requirements and easement document template, refer to the GBRA Developer’s Resource Guide - Section 7 published on GBRA’s Developer Resources web page.

B. Submit proposed easements and plats for GBRA review, comment, and approval.

C. 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.

D. For submittal and review process of easements, refer to the GBRA Developer’s Resource Guide - Section 8 published on GBRA’s Developer Resources web page.

1.3 Construction Submittals

A. Submit all proposed materials for GBRA review, comment, and approval.

B. Copies of each construction submittal (e.g. shop drawings, product data, etc.) shall be provided in searchable PDF format. Each submittal must be approved by GBRA prior to fabrication.

C. Limit one (1) submittal per PDF file.

D. Include project name, submittal number, and submittal description in the submittal file name and on the submittal cover sheet.

E. Submittals must be grouped and numbered logically.

F. If multiple materials are submitted in the same submittal package, include a table naming each material and corresponding manufacturer.

G. Use clouds, boxes, arrows, etc., to clearly mark all proposed options and part numbers.

H. Any proposed deviations must be listed on the submittal cover sheet. Any deviations that are not listed accordingly will not be reviewed and shall not be considered approved. The contractor must include documentation to substantiate each proposed deviation.

I. GBRA review of submittals is for general conformance only and shall not relieve the contractor of the duty and obligation to fully comply with all requirements of the contract documents and these guidelines. The contractor is responsible for dimensions and coordination with other submittals. The contractor is responsible for all errors and omissions.

J. For submittal and review process of construction documents, refer to the GBRA Developer's Resource Guide - Section 9 published on GBRA's Developer Resources web page.

1.4 Final Completion

A. GBRA will endeavor to provide a punchlist within twenty (20) business days after the Contractor has completed all testing with passing results. All punchlist items must be completed prior to GBRA acceptance of facilities.

B. Submit the following items for GBRA review, comment, and approval prior to GBRA acceptance of facilities; provide one (1) searchable electronic PDF copy of each applicable document unless noted otherwise:

1. Prior to placing a wastewater treatment facility in operation, the engineer must submit and obtain GBRA approval of a TCEQ 217.16 facility operation and maintenance manual. Submit one (1) searchable electronic PDF preliminary copy for GBRA review, comment, and approval prior to printing. Provide a final copy printed and bound in a D-ring binder. Include an electronic DOC file for future revisions.
2. Engineer shall submit certification of completion in accordance with approved drawings, specifications, and permits.
3. Developer, engineer, and contractor shall submit copies of all closeout submittals and approvals required by governmental entities having jurisdiction over development within the service area (e.g. city, county, TCEQ, etc.).
4. Contractor shall submit electronic copies of all test reports, video inspections, etc.
5. Contractor shall submit spare parts in accordance with Appendix C herein.
6. Contractor shall submit any special tools required for maintenance.
7. Contractor shall submit electronic backup copies of programming for flow meters, PLCs, OITs, HMIs, and control room(s). Include a "Read Me" text file providing a brief description of each file.
8. Operation and Maintenance Manuals:
    a. Contractor must submit all manuals at least ten (10) business days prior to demonstration testing.
    b. Indicate manual description, project name, contractor name, and specification section(s) on the title page.
    c. Include table of contents, section numbers, and page numbers for ease of navigation.

d. Include factory and field test reports and calibration certificates. Include all final settings, parameters, etc.

e. Include warranty certificates from the contractor and manufacturer(s) valid for one (1) year from the date of project final acceptance. Provide longer duration where specifically required. Warranty shall include labor, material, and equipment for removal, repair, and replacement. Contractor shall maintain service to customers while performing any warranty work.

f. All copies shall be manufacturer original quality. Scanned and/or photocopies are not acceptable.

g. Refer to Section 1.3 herein for submittal requirements.

9. As-Built and Record Drawings:

   a. Submit electronic preliminary copies for GBRA review, comment, and approval prior to printing final copies. Provide complete project drawing sets including all sheets and all utilities, trades, and disciplines.

   b. Contractor shall submit one (1) searchable electronic PDF copy of red lined as-built drawings, each sheet stamped “As-Built Drawing”.

   c. After GBRA approval of contractor red lined as-built drawings, engineer shall prepare corrected CAD drawings, each sheet stamped “Record Drawing” and sealed, signed, and dated by the engineer of record, and submit to GBRA one (1) searchable electronic PDF copy and up to three (3) half scale 11”x17” and two (2) full scale 22”x34” simplex printed and bound copies of the corrected CAD drawings. Confirm quantities with GBRA prior to printing. Scanned and/or photocopies are not acceptable.

   d. Engineer shall provide GIS and CAD data sets per Appendix B herein.

10. Developer shall submit a recorded warranty deed for the property where the project is located including metes and bounds and survey exhibits.

11. Developer shall submit Title Company review for release of all liens.

12. Developer shall submit all payments to GBRA as required by the applicable developer agreement.

13. Developer or engineer shall submit recorded final plats and easements including metes and bounds and survey exhibits.

14. Developer or engineer shall submit the address for each lot.

15. Developer shall submit an Affidavit as to Debt and Liens (on GBRA provided form).

16. Developer shall submit a Bill of Sale (on GBRA provided form) transferring ownership of the facilities to GBRA as required by the applicable developer agreement.

SECTION 2: CIVIL AND MECHANICAL GENERAL REQUIREMENTS

2.1 General Design Requirements

A. Design and installation shall be in accordance with TCEQ rules, AWWA standards, applicable federal, state and local laws, rules and regulations, and shall be in accordance with GBRA Standards and Design Guidelines as further described in this document. In the event of conflict among any such requirements, the most stringent requirement shall apply.

B. Noise and odor impacts shall be considered in design of facilities.

C. The designs of wastewater systems shall be based on minimum 250 GPD/LUE average daily flow with a 4.0 peaking factor and an I&I rate of zero.

D. Potable and reclaimed water distribution systems shall be designed to provide 45 PSI minimum at customer meters during maximum daily demands.

E. Buried pressure piping systems shall be mechanically restrained. Refer to Detail 480 for restrained length requirements. Engineer shall evaluate soils and determine if any additional restraints are required. If the engineer requires concrete thrust blocking in addition to mechanical restraints, the concrete thrust blocking must be installed in accordance with Detail 540.

F. Pressure piping friction losses shall be calculated with a Hazen-Williams coefficient of 120 for plastic pipe and 100 for concrete or metal pipe. Flow velocity shall be 2.0 FPS minimum and 6.0 FPS maximum.

G. Gravity piping flow velocity and capacity shall be calculated with Manning's formula, "n" value of 0.013, pipe actual inside diameter, and pipe flowing 100% full. Pipe slopes shall be sufficient to maintain a flow velocity of 2.0 FPS minimum and 10.0 FPS maximum when flowing 100% full. Surcharging is not allowed.

H. Low pressure sanitary sewer collection systems are not allowed.

I. Services are not allowed on water transmission mains.

J. All piping shall be designed in straight alignment vertically and horizontally between bend fittings for pressure systems and between manholes for gravity systems. Pipe curvature and/or deflection are not allowed.

K. Maintain a minimum of 10 feet horizontal and 12 inches vertical clearance between water and wastewater lines and other utilities. Shared trenches are not allowed.

L. Water mains, force mains, valves, hydrants, services, and cleanouts shall be located outside of roadways, pavement, curbs, driveways, sidewalks, etc., unless specifically approved otherwise, and shall be located a minimum of 4 FT behind back of curb.

M. Pipeline alignment at road crossings shall be perpendicular to roads.

N. Water and wastewater piping (including mains, services, and laterals) shall be sleeved if located under concrete channels, box culverts, or multiple barrel storm sewer crossings regardless of size and single barrels nominal 30" or larger, and other utilities nominal 30" or larger. Sleeves shall extend horizontally beyond the limits of these items for a distance equal to the maximum vertical separation plus outside diameter of sleeve plus 10 LF minimum on each end.

O. Pipe lengths shall be centered at all water and wastewater crossings. Both pipes shall be centered at each crossing including but not limited to mains, services, fire hydrant leads, appurtenances, etc.

P. Engineer shall field verify vertical and horizontal location of all existing utilities prior to submitting design for GBRA review.

Q. Engineer shall field verify configuration of all proposed tie-ins to existing facilities prior to submitting design for GBRA review.

R. Provide overall utilities plan sheets. Show all existing and proposed utilities.

S. Provide plan and profile sheets for all piping. Show all existing and proposed utilities in plan and profile views. Include air release valves at all high points.

T. Fenced Facilities

1. Provide a minimum 200-foot buffer zone from the facility property line on all sides. No occupied structure shall be permitted within the buffer zone.
2. Comply with TCEQ requirements for fencing. If chain link fencing is utilized, refer to Detail 240 for requirements.
3. GBRA will provide signs on perimeter fencing and gates only. Contractor to provide all other signs required by rules, regulations, codes, etc. Fabricate signs in accordance with TxDOT Item 636 Type B.
4. Access roads shall be a minimum of 16 feet wide. Include turnaround and turning radius for semi-tractor-trailer trucks.
5. 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 per Detail 320. Transition from brass piping to PVC yard piping shall occur 5 FT beyond either side of the concrete pad. Install a pipe union inside the enclosure on each side of the RPZ. Assembly minimum clearances inside the enclosure shall be 12” below, 3” above, and 6” sides. The RPZ shall be field tested and certified by a licensed professional. Contractor shall arrange and pay for testing and provide a copy of certification for GBRA review and approval prior to placing the RPZ into service.
6. Provide a 1” hose station in each process area for wash down purposes; each with 50 FT 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 (3 FT minimum bury depth, with brass pipe and fittings between hydrant and PVC yard piping, transition from brass piping to PVC yard piping shall occur 5 FT from hydrant). In elevated locations, provide 1” lever operated ball valves with hose adapters. Clearly label as non-potable.
7. All outdoor exposed piping 4” and smaller conveying liquids shall be heat traced, insulated, and covered with aluminum jacketing. Heat tracing system shall be controlled by a master thermostat. Self-regulating heating cable is not allowed. Pipes with continuous flow are exempt from this requirement.
8. Where suitable, process piping 2” nominal pipe size and smaller shall be Schedule 80 PVC unless noted otherwise.
9. All equipment, piping, valves, and appurtenances shall be labeled for identification purposes (e.g. pipe labels, color coding, banding, flow arrows, equipment numbers, instrument and valve tags, etc.).

10. All steps, stair treads, and ladders shall have abrasive nosings. The maximum allowable slope for steps and stairs is 32.5 degrees. Provide approximately 7" risers and 11" treads.
11. All immersed steel shall have a minimum thickness of ¼".
12. Each air compressor tank shall be equipped with an automatic drain valve.
13. Pumping systems shall be selected based on maximum wire-to-water efficiency. Pump duty point shall be within 70% to 120% of pump flow at best efficiency point for each pump operating individually and for each combination of pumps in operation. Field draw down testing is required to demonstrate the specified performance for each pump operating individually and for each combination of pumps in operation.
14. All pumps shall be equipped with mechanical seals.
15. All motors shall be Premium Efficiency, totally enclosed, with minimum 1.15 service factor. Motors shall not operate within the service factor. All motors driven by variable frequency drives shall be inverter-duty rated.
16. All equipment shall have elapsed time meters.
17. All equipment shall be designed to automatically reset after power outages.

U. Buildings

1. Buildings shall be designed for human occupancy.
2. Buildings shall have an appropriately sized HVAC system capable of maintaining an appropriate working environment within the building.
3. Interim operations buildings are exempt from requirements 4 through 15 listed hereafter.
4. Building foundation/floor, steps/stairs, perimeter curbs, and entrance/exit ramps shall be cast-in-place reinforced concrete.
5. Buildings shall be split-face CMU construction, precast concrete, or pre-engineered metal building. Provide for CMU cleaning, water repellant, and clear sealer. Wooden materials are not allowed.
6. Roof shall be monolithic single panel precast or cast-in-place concrete (i.e. no joints) or metal framing with metal roofing. Roof shall be sloped; minimum 3:12 for metal, minimum 1/4:12 for concrete. Flat roofs, wooden materials, and shingles are not allowed. Provide broom finish and clear sealer for concrete roofs; broom finish shall be parallel to roof slope.
7. Buildings shall be insulated, including minimum R-30 insulation in ceiling. Concrete roofs are exempt from this requirement.
8. Provide sidewalk and ramps at entrance to each chemical building/room.
9. For rooms where chemical containment is not required, install a cast iron floor drain with brass strainer in the center of the room and slope floor to drain. Provide floor with smooth trowel finish and clear concrete sealer.
10. Chemical containment shall be accomplished by elevating the room on a perimeter curb with floor sloped to a sump pit for a portable pump. Provide floor with broom finish and clear concrete sealer. Broom finish shall be parallel to floor slope.
11. Doors and frames shall be seamless and shall be hot dip galvanized, aluminum, or FRP; aluminum or FRP must be utilized in chemical areas and other corrosive environments. Size doors to accommodate removal of equipment. Minimum single door size: 3'-0" wide, 7'-0" high, 1 ¾" thick. Minimum double door size: pair 2'-6" wide, 7'-0" high, 1 ¾" thick.

Doors shall open to exterior. Mount each door with three stainless steel NRP butt hinges 4 ½" long. All other hardware and accessories shall be aluminum and/or stainless steel. All fasteners for all items shall be stainless steel. Hardware shall be mortised. Provide drip caps, 18" wide x 12" tall safety wired glass in each door, panic hardware with keyed external lever, Best Access key system (Model SSS-1C6D1626, including control keys), hydraulic closers (Dorma STA8900FMC or equal), door stops, door holders, 12" tall kick plates, rubber gaskets, silencers, single flap insert type neoprene sweeps, 4" wide seamless black vinyl thresholds (Home Depot GFTHRESH10MB or equal, attach with adhesive and evenly spaced drive pin anchors, 6 anchors for single doors, 10 anchors for double doors). Embed 2"x2"x1/4" hot dip galvanized angle in edge of slab across each door opening. Install "Danger" signs indicating any type of chemicals or hazards present.

12. Provide aluminum windows with Low-E break resistant glass.
13. Caulking sealants shall be MasterSeal NP1, Sikaflex, or equal. Use self-leveling sealant for flatwork. Color shall match adjacent finishes.
14. Provide identification signs for all buildings and rooms; white background with black block lettering, 2" lettering for buildings, 1" lettering for rooms within buildings.
15. Provide hoisting provisions for pumps and motors.

V. Water Storage Tanks

1. Tanks shall be welded steel or prestressed concrete; design and installation shall comply with AWWA standards.
2. Tank foundations shall be cast-in-place reinforced concrete or reinforced concrete ring beam.
3. Provide floor drain, interior and exterior ladders, sample ports, pressure gauge, submersible level transmitter, and exterior inlet pipe with air gap.
4. Provide interior ladder with safety climb devices.
5. Provide exterior ladder to ground level with cage, single leaf anti-climb door at bottom of cage, and single leaf self-closing gate at top of ladder.
6. Submersible level transmitter shall be Dwyer PBLT2 and shall be monitored via SCADA. Submersible level transmitters installed on customer tanks shall be owned and maintained by the customer.
7. Provide handrail at hatch and all other roof appurtenances.
8. Provide anti-vortex protection inside tank for pump suction pipe.
9. Provide bypass piping (same size as inlet piping) to allow for tank maintenance and repair and water quality issues if redundant tanks are not provided.

W. Water Pumping Systems

1. General
   a. Surge control shall be considered in design. Evaluate loss of power while all pumps are running.
   b. Pumping systems shall be certified for municipal service for 20-years minimum service life. Agricultural grade systems are not allowed.
   c. Pumping systems shall be manufactured by Fairbanks Nijhuis, Flowserve, Goulds, Peerless, or Sulzer.

d. Impellers shall be low-zinc bronze, stainless steel, or nickel-aluminum-bronze. Zinc content shall be less than 5%.

e. Provide lead/lag/standby pump operation, first on/first off alternation, and start delay relay timers.

2. Potable and Reclaimed

a. Pumping systems shall be installed within buildings designed for human occupancy; refer to "Buildings" herein for general design requirements.

b. Provide a flanged magnetic flow meter to measure pump discharge. Refer to GBRA Standard Specification Section 13442 for flanged magnetic flow meter requirements.

c. Pumping systems shall include hydropneumatic tanks equipped with B&W probe controls installed inside a sight glass in accordance with Details 390.1 and 390.2. Tank volume shall be minimum 20 gallons per LUE. Water volume shall be 2/3 of tank volume. For freeze protection, install the controls end of tank inside the pump building (i.e. tank penetrating building wall). Provide 24" minimum diameter tank access manway.

d. Engineer shall evaluate system demand and additional capacity requirements.

3. Interim Non-Potable (NPW)

a. NPW system shall be designed to maintain 80 PSI minimum working pressure.

b. Suction for NPW pumps shall be from the chlorine contact basin 24" above floor.

c. Provide freeze protection, basket strainer, flow meter, and minimum 250-gallon pressure tank.

d. Engineer shall evaluate system demand and additional capacity requirements.

4. Permanent Non-Potable (NPW)

a. Pumping systems shall be installed within buildings designed for human occupancy; refer to "Buildings" herein for general design requirements.

b. NPW system shall be designed to maintain 80 PSI minimum working pressure.

c. Suction for NPW pumps shall be from the chlorine contact basin 24" above floor.

d. Provide basket strainer, flanged magnetic flow meter, and minimum 250-gallon pressure tank. Refer to GBRA Standard Specification Section 13442 for flanged magnetic flow meter requirements.

e. Engineer shall evaluate system demand and additional capacity requirements.

X. Chemical Feed Systems

1. Chemical feed systems shall be rated for ultimate peak flow.

2. Provide redundancy for each chemical feed system.

3. Provide automatic flow pacing for each chemical feed system.

4. Chemical feed systems shall be installed within buildings designed for human occupancy; refer to "Buildings" herein for general design requirements. If fiberglass buildings are utilized, refer to GBRA Standard Specification Section 13124 for additional requirements.

5. Each chemical storage tank shall be equipped with an ultrasonic level indicator with local display.

6. All equipment and hardware in chemical areas shall be PVC, FRP, or other chemical resistant materials.
7. Provide an intake fan and exhaust louver.
8. Provide non-freeze combination eyewash showers adjacent to chemical areas.
9. Peristaltic metering pumps shall be Blue-White or Watson-Marlow.
10. For chemical feed systems that require NPW supply, provide a potable water hose connection with isolation valve in the chemical room for backup supply during NPW system maintenance and repair, and provide a hose connection with isolation valve on the NPW supply piping in the chemical room.

Y. Chlorination

1. Refer to “Chemical Feed Systems” herein for general design requirements.
2. Chlorination equipment shall be gas type by Hydro Instruments or Superior. Provide 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 chlorination 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. The intake fan shall automatically shut down when a chlorine leak is detected.
5. Provide standard preventative maintenance kits for each chlorinator, injector, and vacuum regulator.
6. Provide a Chlorine Institute Emergency Kit.
7. Provide Scott SCBA with fully charged carbon fiber tank and Scott AV-2000 face mask. Install storage cabinet in a non-chemical area/location.

2.2 General Material Requirements

A. Hardware and Fasteners

1. Field apply nickel anti-seize compound to threads of all metallic fasteners prior to assembly. Where in contact or potentially in contact with water to be treated or intended for human consumption NSF 61 certified anti-seize compound shall be utilized.
2. All bolts and nuts shall be heavy hex.
3. Trim and deburr bolts such that 2 to 4 threads extend beyond nuts.
4. Anchor bolts installed within hydraulic structures shall be epoxy type.
5. In buried locations all hardware and fasteners for piping, fittings, valves, hydrants, appurtenances, etc. shall be high strength low alloy steel or stainless steel including those for factory assembly of components.
6. Within collection or influent lift station wet wells, headworks areas, aeration zones, anoxic zones, digesters, contact basins, and confined corrosive environments all hardware and fasteners for piping, fittings, valves, supports, pumps, motors, equipment, appurtenances, etc. shall be Type 316 stainless steel including those for factory assembly of components. Non-submerged motors are exempt from this requirement if factory

coatings meet or exceed the requirements specified herein. Interim facilities are exempt from this requirement.

7. In all other areas hardware and fasteners on painted assemblies may be carbon steel, zinc plated, hot dip galvanized, or stainless steel unless specifically noted otherwise. Provide paint coatings as specified herein.
8. In all other areas hardware and fasteners on unpainted assemblies shall be hot dip galvanized or stainless steel unless specifically noted otherwise.

B. Supports

1. Within collection or influent lift station wet wells, headworks areas, aeration zones, anoxic zones, digesters, contact basins, and confined corrosive environments all supports for piping, valves, equipment, and appurtenances shall be Type 316 stainless steel (e.g. braces, struts, clamps, brackets, stanchions, hangers, cable support grips, etc.). Interim facilities are exempt from this requirement.
2. Within chemical areas all supports shall be FRP. Secure supports to concrete or masonry structures with FRP epoxy type anchors, for other structures utilize aluminum rivets unless noted otherwise.
3. In all other areas supports may be carbon steel, zinc plated, hot dip galvanized, or stainless steel unless specifically noted otherwise. Provide paint coatings as specified herein.
4. Deburr and install a plastic plug in each end of each strut.

C. Paint and Coatings

1. Unless specifically noted otherwise the following requirements are applicable to all metals including but not limited to hardware, fasteners, piping, fittings, valves, supports, pumps, motors, equipment, appurtenances, etc.
    a. Field painting is not required if factory coatings meet or exceed the requirements specified herein.
    b. Do not paint manhole covers, stainless steel, hot dip galvanized, brass, bronze, or aluminum items unless specifically noted otherwise.
    c. All non-immersed and non-buried ferrous metals shall be coated with zinc rich primer, high build epoxy second coat, and polyurethane topcoat. Provide topcoat colors in accordance with TCEQ rules. High build epoxy color shall contrast with primer and topcoat.
    d. Immersed ferrous metals shall be coated with minimum two (2) coats of coal tar epoxy.
    e. Immersed hot dip galvanized items shall be coated with minimum two (2) coats of coal tar epoxy from 12” above the maximum operating water surface elevation to 12” below the minimum operating water surface elevation. Aeration drop pipes shall be coated full length.
    f. Coat aluminum items only where in contact with cementitious materials unless specifically noted otherwise.
    g. Galvanizing repairs shall be minimum two (2) brush coats of ZRC Galvilite.
2. PVC piping not exposed to weather shall not be coated. PVC piping exposed to weather shall be coated with high build epoxy followed by polyurethane topcoat. Provide topcoat colors in accordance with TCEQ rules. High build epoxy color shall contrast with substrate

and topcoat. Surface preparation shall be accomplished by sanding with 60 grit sandpaper.

3. Install in accordance with published manufacturer recommendations.

D. Tracing Wire and Test Stations

1. Gravity piping installed in straight alignment between manholes is exempt from requirements 2 through 8 listed hereafter.
2. For buried non-metallic piping, provide color coded tracing wire (copper clad steel, 12-gauge, 30 mil HDPE jacket).
3. For buried metallic piping, provide either color coded tracing wire as described for non-metallic piping or dual bonding jumpers at all joints (pipe and fittings).
4. Tape tracing wire to top of pipe at 4 FT intervals. Provide coil slack at all valves, fittings, and splices.
5. Splice kits shall be 3M Model DBR/Y-6. Wrap splices with tape.
6. Test stations shall be color coded Copperhead Model RB14TP. Install test stations at isolation valves, or otherwise to achieve 500 LF maximum spacing, within valve box concrete collars with 6” minimum concrete encasement horizontally on all sides. Leave 12” slack inside test stations.
7. At hydrants and pipe stubups, extend wire 12” minimum above finished grade and secure wire to pipe with stainless steel band clamps.
8. For pipes that penetrate structures below grade, extend wire 12” minimum above finished grade and secure wire to exterior of structure with hot dip galvanized or stainless steel hardware (epoxy anchor, fender washer, and lock nut).

E. All buried metal pipe, fittings, valves, hydrants, and appurtenances shall be wrapped with 8 mil polywrap.

F. Valves and hydrants shall open counter-clockwise, except reclaimed shall open clockwise.

G. Gate valves shall be American Flow Control Series 2500 or equal. Exposed gate valves shall be rising stem. Buried gate valves shall have 2” operator nut.

H. Gate valves are not allowed for wastewater use. Wastewater valves shall be epoxy lined and coated round port plug valves, horizontal shaft, closing downward, by Crispin, GA, Milliken, or Pratt. Engineer shall label orientation of seat end on drawings as directed by GBRA.

I. Service saddles for pressure piping systems shall be Smith Blair Model 317 or equal. Unless specifically noted otherwise, saddles shall be installed 24” minimum from the nearest pipe bell or flange as measured from the nearest edge of the saddle to the nearest end or taper of bell or face of flange whichever is closer.

J. Flange adapters shall be Smith Blair Model 911 or equal. Flange adapters are not allowed within hydraulic structures.

K. Lever operated ball valves shall be quarter turn, full port, brass/bronze or stainless steel body, with stainless steel levers and hardware.

L. Brass and bronze materials are not allowed where in contact with wastewater.

M. Thread sealant for stainless steel piping shall be nickel PTFE anti-seize tape, unless chemical compatibility requires otherwise.

N. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.

O. PVC male adapters are not allowed.

P. PVC solvent weld primer shall be clear color, Sch 40 cement shall be clear color, Sch 80 cement shall be gray color.

Q. Caulking sealants shall be MasterSeal NP1, Sikaflex, or equal. Use self-leveling sealant for flatwork. Color shall match adjacent finishes.

R. Flexible base shall be TxDOT Item 247, Type A, Grades 1 or 2.

S. Pumping systems shall be selected based on maximum wire-to-water efficiency. Pump duty point shall be within 70% to 120% of pump flow at best efficiency point for each pump operating individually and for each combination of pumps in operation. Field draw down testing is required to demonstrate the specified performance for each pump operating individually and for each combination of pumps in operation.

T. All equipment shall be configured to automatically reset after power outages.

U. All materials and equipment shall be new and unused.

2.3 Water Lines

A. This section is applicable to potable and reclaimed water lines.

B. Refer to Section 2.1 herein for general design requirements.

C. Refer to Section 2.2 herein for general material requirements.

D. Utilize single services for water 5 FT from high lot corner.

E. Fire hydrants shall be installed at 500 LF maximum station intervals, typically at lot corners.

F. Air release valves shall be provided for all water mains regardless of main size. Install an air release valve at each high point.

G. Drains shall be installed for all water mains regardless of main size.

H. An automatic flushing valve shall be installed for each dead end main.

I. Buried water pipe shall be C909 CL235 minimum for pipe diameters 6” through 12”. Diameters greater than 12” shall be C909 CL235 minimum, C900 DR18 minimum, or ductile iron. PVC pipe shall be blue color for potable water and purple for reclaimed water. Ductile iron pipe shall be cement lined and asphaltic coated. Fittings shall be fusion bonded epoxy lined and coated AWWA C153 compact mechanical joint ductile iron with Ford Uni-Flange Series 1500 restraints for PVC pipe and Series 1400 for ductile iron pipe, or equal. Pipe bell joint restraints shall be Ford Uni-Flange Series 1390 for PVC pipe and Series 1450 for ductile iron pipe, or equal. Restrained joint pipe may be utilized in lieu of bell joint restraints; gripper type gaskets for ductile iron pipe shall be any color other than black. Refer to Detail 480 for restrained length requirements. In all other locations water pipe and fittings shall be cement lined flanged ductile iron with paint coatings as specified in Section 2.2 herein.

J. Tapping sleeves shall be Smith Blair Model 624 or equal, with pressure rating greater than or equal to pipe pressure rating. All tapping sleeves shall have split mechanical restraints; restraints shall be Ford Uni-Flange Series 1300 for PVC pipe and Series 1405 for ductile iron pipe, or equal. Tapping sleeves shall be installed 24” minimum from the nearest pipe bell as measured from the nearest edge of the tapping sleeve to the nearest end or taper of bell whichever is closer. Concrete blocking to undisturbed earth is required under and behind tapping sleeves and valves. Install mechanical restraints on existing piping 60 LF minimum

each way; restraints shall be Ford Uni-Flange Series 1390 for PVC pipe and Series 1490 for ductile iron pipe, or equal. Size on size taps are not allowed.

K. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:

1. Detail 100 --- 2” Drain Valve
2. Detail 110 --- 2” Flush Valve
3. Detail 120 --- 6” Drain Valve
4. Detail 130 --- Adjustable Stanchion Pipe Support
5. Detail 140 --- Air Release Valve Type 1
6. Detail 160 --- Air Release Valve Type 3
7. Detail 190 --- Barbed Wire Fence Gate
8. Detail 200 --- Barbed Wire Fence Repair
9. Detail 210 --- Bollard
10. Detail 220 --- Buried Valve
11. Detail 230 --- Casing and Spacers
12. Detail 270 --- Corrosion Test Station
13. Detail 280 --- Dual PRV Vault
14. Detail 300 --- Ductile Iron Pipe and Fitting Joint Bonding
15. Detail 330 --- Existing C303 Pipe Connection to New Ductile Iron Pipe
16. Detail 340 --- Existing C303 Pipe Welded Restraint
17. Detail 350 --- Fire Hydrant
18. Detail 410 --- Meter with Bypass Vault
19. Detail 420 --- Pipe Trench
20. Detail 430 --- Pipeline Concrete Cap Type 1
21. Detail 440 --- Pipeline Concrete Cap Type 2
22. Detail 450 --- Pipeline Concrete Encasement
23. Detail 460 --- Pipeline Markers
24. Detail 470 --- Pressure Transmitter and Gauge
25. Detail 480 --- Restrained Lengths
26. Detail 500 --- Split Casing - Bolted
27. Detail 510 --- Split Casing - Welded
28. Detail 540 --- Thrust Blocking
29. Detail 550 --- Valve Marker
30. Detail 640 --- Water Service

2.4 Wastewater Lines

A. Gravity

1. Refer to Section 2.1 herein for general design requirements.

2. Refer to Section 2.2 herein for general material requirements.
3. Utilize single services for wastewater 5 FT from low lot corner. Provide 8 FT where lot corner is shared with dry utilities and 10 FT where lot corner is shared with a fire hydrant or air release valve.
4. Gravity wastewater mains may be installed within roadways. For streets with curbside parking, install mains in center of roadway. For streets without curbside parking, center mains in one lane of traffic.
5. Manholes shall be located such that ring concrete encasements are not within curbs, driveways, sidewalks, ramps, landings, etc.
6. Gravity wastewater mains shall be 8" minimum pipe size.
7. Gravity wastewater main depths shall be limited to 20 FT maximum, as measured from pipe invert to finished grade.
8. Drop manholes shall be accomplished with external drop pipes. Internal drop pipes are not allowed. Drop pipes are not allowed for force main connections to manholes.
9. Length of manhole future stub outs shall be equal to depth plus 20 LF minimum.
10. Change in flow direction within manholes shall not exceed 90-degrees, including service laterals.
11. Manholes shall be precast reinforced cementitious concrete with chemical resistant lining or admixture, or precast reinforced chemical resistant polymer concrete. Chemical resistant material shall be SCP DropLiner or SpectraShield lining, ConShield or Xypex Bio-San C500 admixture, Armorock or RockHardscp or U.S. Composite Pipe polymer concrete, or pre-approved equal prior to bid. Install in accordance with published manufacturer recommendations. Concrete surface preparation for lining shall be CSP 5 minimum. Provide a minimum 10-year manufacturer warranty for chemical resistant materials to include labor, material, and equipment for removal, repair, and replacement.
12. Sanitary tapping saddles are not allowed for new construction. For existing lines, sanitary tapping saddles shall be NAPCO Part H4308-6R or equal (adjust part number for size required). Saddles shall be installed 24" minimum from the nearest pipe bell as measured from the nearest edge of the saddle to the nearest end or taper of bell whichever is closer.
13. Cleanouts shall have shrouds with sewer pole markers and cast iron caps in accordance with Detail 570.
14. Buried gravity wastewater pipe and fittings shall be green color gasketed ASTM D3034 SDR26. Pipe bell joint restraints, where required, shall be Ford Uni-Flange Series 1390-P or equal; restrained joint pipe may be utilized in lieu of bell joint restraints. At water crossings, including but not limited to water mains, services, fire hydrant leads, appurtenances, etc., white color gasketed 150 PSI minimum pressure rated pipe and fittings shall be utilized for wastewater mains and laterals. In all other locations wastewater pipe and fittings shall be epoxy lined flanged ductile iron with paint coatings as specified in Section 2.2 herein.
15. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
    a. Detail 190 --- Barbed Wire Fence Gate
    b. Detail 200 --- Barbed Wire Fence Repair
    c. Detail 210 --- Bollard

d. Detail 230 --- Casing and Spacers
e. Detail 420 --- Pipe Trench
f. Detail 430 --- Pipeline Concrete Cap Type 1
g. Detail 440 --- Pipeline Concrete Cap Type 2
h. Detail 450 --- Pipeline Concrete Encasement
i. Detail 460 --- Pipeline Markers
j. Detail 500 --- Split Casing - Bolted
k. Detail 510 --- Split Casing - Welded
l. Detail 560 --- Wastewater Drop Manhole
m. Detail 570 --- Wastewater Lateral and Cleanout
n. Detail 580 --- Wastewater Lateral Vertical Stack
o. Detail 590 --- Wastewater Manhole Cast in Place Base
p. Detail 600 --- Wastewater Manhole Ring Encasement
q. Detail 610 --- Wastewater Manhole Vent
r. Detail 620 --- Wastewater Precast Manhole

B. Force Mains

1. Refer to Section 2.1 herein for general design requirements.
2. Refer to Section 2.2 herein for general material requirements.
3. Air release valves shall be provided for all force mains regardless of main size. Install an air release valve at each high point.
4. A force main that terminates at a collection system manhole must enter the manhole directly opposite from and in straight alignment (horizontally and vertically) with the gravity pipe leaving the manhole, and the manhole must be vented. Drop pipes are not allowed for force main connections to manholes.
5. Force main alignment changes shall be accomplished with maximum 45-degree bend fittings.
6. Buried pressure wastewater pipe shall be C909 CL235 minimum for pipe diameters 6” through 12”. Diameters greater than 12” shall be C909 CL235 minimum, C900 DR18 minimum, or ductile iron. PVC pipe shall be green color. Ductile iron pipe shall be epoxy lined and asphaltic coated. Fittings shall be fusion bonded epoxy lined and coated AWWA C153 compact mechanical joint ductile iron with Ford Uni-Flange Series 1500 restraints for PVC pipe and Series 1400 for ductile iron pipe, or equal. Pipe bell joint restraints shall be Ford Uni-Flange Series 1390 for PVC pipe and Series 1450 for ductile iron pipe, or equal. Restrained joint pipe may be utilized in lieu of bell joint restraints; gripper type gaskets for ductile iron pipe shall be any color other than black. Refer to Detail 480 for restrained length requirements. In all other locations wastewater pipe and fittings shall be epoxy lined flanged ductile iron with paint coatings as specified in Section 2.2 herein.
7. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
   a. Detail 160 --- Air Release Valve Type 3
   b. Detail 190 --- Barbed Wire Fence Gate

c. Detail 200 --- Barbed Wire Fence Repair
d. Detail 210 --- Bollard
e. Detail 220 --- Buried Valve
f. Detail 230 --- Casing and Spacers
g. Detail 270 --- Corrosion Test Station
h. Detail 300 --- Ductile Iron Pipe and Fitting Joint Bonding
i. Detail 420 --- Pipe Trench
j. Detail 430 --- Pipeline Concrete Cap Type 1
k. Detail 440 --- Pipeline Concrete Cap Type 2
l. Detail 450 --- Pipeline Concrete Encasement
m. Detail 460 --- Pipeline Markers
n. Detail 480 --- Restrained Lengths
o. Detail 500 --- Split Casing - Bolted
p. Detail 510 --- Split Casing - Welded
q. Detail 540 --- Thrust Blocking
r. Detail 550 --- Valve Marker

2.5 Water Delivery Points

A. GENERAL

The following standards are for the design of customer water delivery points where GBRA's responsibility is limited to delivery of water to customer tanks (i.e. customer storage and pumping facilities operated by others). Refer to "Additional Requirements" below for storage and pumping facilities to be operated by GBRA.

1. Refer to Section 2.1 herein for general design requirements.
2. Refer to Section 2.2 herein for general material requirements.
3. Refer to Section 2.3 herein for water line general requirements.
4. Provide a flanged magnetic flow meter and electronic control valve within a prefabricated fiberglass building.
5. GBRA ownership shall terminate 5 feet downstream of the flow meter building.
6. Provide exterior inlet pipe with air gap on storage tanks.
7. Provide security fencing along the entire perimeter of the facility property. Include personnel and vehicular access gates.
8. All unpaved areas of site within fenced boundaries shall be covered with DeWitt Pro 5 weed barrier or equal and a 6" layer of TxDOT Item 421 Grade 1 crushed stone coarse aggregate.
9. Access roads and parking areas shall be asphalt or concrete.

B. ADDITIONAL REQUIREMENTS

If storage and pumping facilities are to be operated by GBRA, the design shall meet the requirements set forth above and shall be in accordance with the following additional requirements.

1. Storage Tanks (additional requirements)
    a. Refer to Section 2.1 "Water Storage Tanks" herein for general design requirements.
    b. At each delivery point, provide a minimum of two (2) storage tanks if welded steel, or one (1) prestressed concrete tank with bypass. Total storage capacity at each delivery point shall not be less than the maximum daily demands plus fire flows. Engineer shall calculate and incorporate fire flows and any commercial demands into the design per state and local requirements. Any volume below pump minimum suction requirements shall not be used in calculations.
    c. Bypass piping shall include an aboveground physical separation to be accomplished with a removable 90-bend and blind flanges.
2. Pump Stations (additional requirements)
    a. Refer to Section 2.1 "Water Pumping Systems" herein for general design requirements.
    b. Pumping systems shall be designed to meet peak hourly demands with the largest pump out of service, and maximum daily demands plus fire flows with the largest pump out of service. Engineer shall calculate and incorporate fire flows and any commercial demands into the design per state and local requirements.
3. Chlorination (additional requirements)
    a. Refer to Section 2.1 "Chlorination" herein for general design requirements.
4. Chemical Feed Systems (additional requirements)
    a. Refer to Section 2.1 "Chemical Feed Systems" herein for general design requirements.
    b. Engineer shall evaluate the need for a LAS feed system and shall incorporate such into the project design as necessary.

C. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:
1. Generic Control Narrative (engineer to customize for each project)
2. Section 13124 Prefabricated Fiberglass Buildings
3. Section 13442 Flanged Magnetic Flow Meters

D. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
1. Detail 130 --- Adjustable Stanchion Pipe Support
2. Detail 150 --- Air Release Valve Type 2
3. Detail 170 --- Air Release Valve Type 4
4. Detail 210 --- Bollard
5. Detail 210 --- Chain Link Fence and Gates
6. Detail 320 --- Equipment Pad
7. Detail 370 --- Flow Meter Building Piping

8. Detail 390.1 --- Hydropneumatic Tank Appurtenances
9. Detail 390.2 --- Hydropneumatic Tank Design and Control Narrative
10. Detail 420 --- Pipe Trench
11. Detail 470 --- Pressure Transmitter and Gauge
12. Detail 480 --- Restrained Lengths
13. Detail 530 --- Strut and Clamp
14. Detail 540 --- Thrust Blocking

2.6 Interim Wastewater Treatment Plants

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. 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.

A. General

1. Any items or components that are intended to be permanent shall be furnished and installed in accordance with GBRA standards for permanent facilities.
2. Refer to Section 2.1 herein for general design requirements.
3. Refer to Section 2.2 herein for general material requirements.
4. Refer to Section 2.3 herein for potable and reclaimed water line general requirements.
5. Refer to Section 2.4 herein for wastewater line general requirements.
6. Refer to Section 2.8 herein for lift station general requirements.
7. The treatment process shall be conventional extended aeration.
8. 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.
9. 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 L/360 maximum deflection under 100 PSF live load.
10. Provide access ladders from clarifier bridge into effluent launder trough for cleaning and maintenance purposes.
11. All submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a mast, winch, and full-length lifting chains. Wire rope and chains shall be hot dip galvanized or stainless steel.
12. Airlift pumps shall be 3” minimum with expansion box, air release vent pipe, top entry hot dip galvanized or stainless steel interior stinger air pipe through 4” minimum flanged top cleanout with union, lever operated ball valve, and hot dip galvanized or stainless steel lifting chains. Vertical inlet pipe shall extend above top of discharge pipe inside expansion box. Centerline of cleanout shall be 24” maximum outside handrail.

13. Each basin and clarifier shall have drain piping with a hose connection. Each hose connection shall be equipped with an aluminum or stainless steel 3" female camlock and plug.
14. Each basin and clarifier shall have gates or valves to allow it to be hydraulically isolated.
15. Non-potable water (NPW) shall be utilized for all in-plant uses. Refer to Section 2.1 "Water Pumping Systems" herein for general design requirements.
16. Provide influent flow metering. For gravity fed facilities, provide a Parshall flume with integral staff gauge, and Greyline OCF 6.1 flow meter or pre-approved equal prior to bid. For force main fed facilities, provide a flanged magnetic flow meter per GBRA Standard Specification Section 13442. Provide a digital logger for each flow meter. Digital loggers must retrieve and record 2-hour peak flows. All flow meters and digital loggers must be either Ethernet IP or Modbus RTU compatible. Install flow meter displays and digital loggers inside the Operations Building.
17. Provide effluent flow metering. Provide a V-notch weir for the chlorine contact basin and another for plant discharge after the final treatment unit. Staff gauges shall be painted aluminum with white background displaying feet, tenths, and hundredths in black. Flow meters shall be Greyline OCF 6.1 or pre-approved equal prior to bid. Provide a digital logger for each flow meter. Digital loggers must retrieve and record 2-hour peak flows. All flow meters and digital loggers must be either Ethernet IP or Modbus RTU compatible. Install flow meter displays and digital loggers inside the Operations Building.
18. Provide security fencing along the entire perimeter of the facility property. Include personnel and vehicular access gates.

B. Headworks
   1. The screening area shall be fabricated of 3/16" minimum thickness materials.
   2. For force main fed facilities, provide manual bar screens.
   3. For gravity fed facilities, provide mechanical screens with bypass manual bar screens.
   4. Mechanical and manual screens shall have maximum 1/4" openings.
   5. Manual screens shall have drying decks; design screens and decks to be removable by one person.
   6. Mechanical screens shall be Lakeside Equipment Raptor Micro Strainer or Huber Technology Rotamat Micro Strainer Ro9. Provide local control panel with OIT.

C. Anaerobic/Anoxic Zones
   1. For systems utilizing an internal recycle of MLSS, provide ability to control recycle rate proportional to plant influent flow.
   2. Provisions shall be made for initial low flows. Provide an anoxic zone sized for ultimate plant capacity that can also be utilized as aeration during initial low flow phases.

D. Aeration Zone
   1. Drop pipes for diffusers shall be hot dip galvanized, aluminum, or light-wall stainless steel. If hot dip galvanized drop pipes are utilized, they shall be limited to maximum 2" size. PVC pipe is not acceptable for diffuser drops. Each diffuser drop pipe assembly shall consist of a lever operated ball valve for the purpose of shut off and regulation of air supply, a union to allow for ease of removal, 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.

2. Provisions shall be made for initial low flows. Provide an anoxic zone sized for ultimate plant capacity that can also be utilized as aeration during initial low flow phases.

E. 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 Filter Minder 136501, or equal, 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 (one assembly per train), in accordance with Detail 470, for monitoring and to provide low pressure alarm via auto dialer.
5. PVC piping is not allowed for aeration piping.

F. 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. Scum collection system shall include dual scum skimmers, a scum collection box at the outer radius of the clarifier, and scum piping valved to discharge to either the digester or the headworks.
5. Provide scum spray system with brass nozzles and an isolation valve at each nozzle and a master valve to isolate the entire system. Pipe, valves, and fittings shall be Sch 80 PVC.
6. Weirs and scum baffle fasteners shall allow for elevation adjustment.

G. RAS/WAS pumping

1. RAS/WAS piping shall be minimum 6" diameter with maximum 45-degree bends.
2. Air lift pumps are acceptable for RAS and WAS pumping but shall be provided with sludge measurement box and weir. Refer to "General" above for additional requirements.

3. 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).

H. Aerobic Digesters, Sludge Dewatering and Disposal

1. Provide telescoping valve, airlift pump, or other means of decanting digester and returning supernatant to plant headworks. Provide OPW 3000 Series swivel joint or equal for decant airlift pumps.
2. Provide a staff gauge in each digester extending from floor to top of wall. Staff gauges shall be painted aluminum with white background displaying feet and tenths in black. Provide minimum 4" tall numbering at every foot increment.
3. Provide a high level float alarm for digesters.

I. 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 ultimate peak flow.
3. Provide chlorine injection upstream of filters.
4. Provide hoist and access platform.

J. Chlorination

1. Refer to Section 2.1 "Chlorination" herein for general design requirements.
2. If filtration is required, provide chlorine injection upstream of filters.
3. UV disinfection is not allowed.

K. Chemical Feed (if required)

1. Refer to Section 2.1 "Chemical Feed Systems" herein for general design requirements.
2. For facilities with effluent phosphorus limitations, provide a chemical feed system for phosphate precipitation.
3. 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.

L. Operations Building

1. Provide an insulated portable building, 12'x16' minimum, with the following items:
    a. Must have sufficient space for records retention, desk, chair, visitor's chair, and large layout table.
    b. Plywood interior.
    c. Minimum 12' countertop and base cabinets.
    d. Sink with potable water for lab purposes.
    e. Minimum 36"x36" window above lab sink.
    f. Toilet with separate sink.
    g. High-speed internet service.
    h. Lights.
    i. Receptacles.

j. Window A/C unit.

k. Portable electric space heater.

l. Door hardware with Best Access key system (Model SSS-1C6D1626 including control keys).

M. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:

1. Generic Control Narrative (engineer to customize for each project)
2. Section 13124 Prefabricated Fiberglass Buildings
3. Section 13442 Flanged Magnetic Flow Meters

N. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:

1. Detail 130 --- Adjustable Stanchion Pipe Support
2. Detail 150 --- Air Release Valve Type 2
3. Detail 170 --- Air Release Valve Type 4
4. Detail 210 --- Bollard
5. Detail 220 --- Buried Valve
6. Detail 240 --- Chain Link Fence and Gates
7. Detail 250 --- Concrete Pedestal Pipe Support
8. Detail 320 --- Equipment Pad
9. Detail 420 --- Pipe Trench
10. Detail 470 --- Pressure Transmitter and Gauge
11. Detail 480 --- Restrained Lengths
12. Detail 530 --- Strut and Clamp
13. Detail 540 --- Thrust Blocking

2.7 Permanent Wastewater Treatment Plants

A. General

1. Refer to Section 2.1 herein for general design requirements.
2. Refer to Section 2.2 herein for general material requirements.
3. Refer to Section 2.3 herein for potable and reclaimed water line general requirements.
4. Refer to Section 2.4 herein for wastewater line general requirements.
5. Refer to Section 2.8 herein for lift station general requirements.
6. The treatment process shall be conventional extended aeration.
7. All hydraulic structures and basins shall be of reinforced concrete construction.
8. Each basin and clarifier shall have gates or valves to allow it to be hydraulically isolated.
9. The floor in each basin and clarifier shall be sloped at 0.5% minimum to drain piping that penetrates the floor. Drain piping and valves shall be 4” minimum. Where suitable, route drain piping to the influent lift station. Any hose connections shall be equipped with an aluminum or stainless steel 3” female camlock and plug.

10. Provide UV and chemical resistant lining or admixture for headworks and anoxic zones. Material shall be SCP DropLiner or SpectraShield lining, ConShield or Xypex Bio-San C500 admixture, or pre-approved equal prior to bid. Install in accordance with published manufacturer recommendations. Concrete surface preparation for lining shall be CSP 5 minimum. Provide a minimum 10-year manufacturer warranty for chemical resistant materials to include labor, material, and equipment for removal, repair, and replacement.
11. Provide security fencing along the entire perimeter of the facility property. Include personnel and vehicular access gates.
12. All unpaved areas of site within fenced boundaries shall be covered with DeWitt Pro 5 weed barrier or equal and a 6" layer of TxDOT Item 421 Grade 1 crushed stone coarse aggregate.
13. Access roads and parking areas shall be asphalt or concrete.
14. Cleanouts shall have cast iron frames and covers with reinforced concrete collars.
15. Walkways, stairs, clarifier equipment and bridge support beams shall be hot dip galvanized.
16. 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.
17. 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 L/360 maximum deflection under 100 PSF live load.
18. All handrails shall be aluminum or stainless steel. All grating shall be aluminum. Checker plate and galvanized grating are not acceptable. Fasteners shall be stainless steel or hot dip galvanized.
19. Provide aluminum access ladders from clarifier bridge into effluent launder trough for cleaning and maintenance purposes.
20. All submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hot dip galvanized mast, stainless steel winch with stainless steel wire rope, and full-length Type 316 stainless steel lifting chains.
21. Airlift pumps shall be 3" minimum and hot dip galvanized with expansion box, air release vent pipe, top entry hot dip galvanized or stainless steel interior stinger air pipe through 4" minimum flanged top cleanout with union, lever operated ball valve, and stainless steel lifting chains. Vertical inlet pipe shall extend above top of discharge pipe inside expansion box. Centerline of cleanout shall be 24" maximum outside handrail.
22. Non-potable water (NPW) shall be utilized for all in-plant uses. Refer to Section 2.1 "Water Pumping Systems" herein for general design requirements.
23. Provide influent flow metering. For gravity fed facilities, provide a Parshall flume with integral staff gauge, and Greyline OCF 6.1 flow meter or pre-approved equal prior to bid. For force main fed facilities, provide a flanged magnetic flow meter per GBRA Standard Specification Section 13442. Install flow meter displays inside the Operations Building. Communication with PLC shall be Ethernet IP or Modbus RTU. All flow meter data shall be logged via the SCADA system. Configure the SCADA system to record 2-hour peak flows.

24. Provide effluent flow metering. Provide a V-notch weir for the chlorine contact basin and another for plant discharge after the final treatment unit. Staff gauges shall be painted aluminum with white background displaying feet, tenths, and hundredths in black. Flow meters shall be Greyline OCF 6.1 or pre-approved equal prior to bid. Install flow meter displays inside the Operations Building. Communication with PLC shall be Ethernet IP or Modbus RTU. All flow meter data shall be logged via the SCADA system. Configure the SCADA system to record 2-hour peak flows.

B. Headworks

1. The screening area shall be fabricated of aluminum or Type 316 stainless steel. Hot dip galvanized or painted steel are not acceptable. Minimum thickness shall be 3/16".
2. Provide mechanical screens with bypass manual bar screens.
3. Mechanical and manual screens shall have maximum 1/4" openings.
4. Mechanical screens shall be Lakeside Equipment Raptor Micro Strainer or Huber Technology Rotamat Micro Strainer Ro9. Provide local control panel with OIT.
5. Manual screens shall have drying decks; design screens and decks to be removable by one person.

C. Anaerobic/Anoxic Zones

1. For systems utilizing an internal recycle of MLSS, provide ability to control recycle rate proportional to plant influent flow.
2. Provisions shall be made for initial low flows. Provide an anoxic zone sized for ultimate plant capacity that can also be utilized as aeration during initial low flow phases.

D. Aeration Zone

1. Drop pipes for diffusers shall be aluminum or light-wall stainless steel. PVC and hot dip galvanized pipe are not acceptable for diffuser drops. Each diffuser drop pipe assembly shall consist of a lever operated ball valve for the purpose of shut off and regulation of air supply, a union to allow for ease of removal, 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.
2. Provisions shall be made for initial low flows. Provide an anoxic zone sized for ultimate plant capacity that can also be utilized as aeration during initial low flow phases.

E. 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.
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 HSI.
    c. Multi-stage centrifugal blowers by Gardner Denver, Hoffman, or HSI.
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 Filter Minder 136501, or equal, inlet air filter monitor gauges.

e. Secure blowers to equipment pad with vibration isolators and anchor bolts.

5. Provide a pressure gauge and transmitter assembly on the common discharge header (one assembly per train), in accordance with Detail 470, for monitoring and to provide low pressure alarm via SCADA.

6. PVC piping is not allowed for aeration piping.

F. 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. Scum collection system shall include dual scum skimmers, a scum collection box at the outer radius of the clarifier, and scum piping valved to discharge to either the digester or the headworks.

6. Provide scum spray system with brass nozzles and an isolation valve at each nozzle and a master valve to isolate the entire system. Pipe, valves, and fittings shall be Sch 80 PVC.

7. Weirs and scum baffle shall be aluminum or stainless steel, with stainless steel fasteners to allow for elevation adjustment. The clarifier trough may be concrete, hot dip galvanized, or stainless steel.

G. RAS/WAS pumping

1. RAS/WAS piping shall be minimum 6” diameter with maximum 45-degree bends.

2. Air lift pumps are acceptable for RAS and WAS pumping but shall be provided with sludge measurement box and weir. Refer to “General” above for additional requirements.

3. 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); reference GBRA Standard Specification 13442 for additional requirements.

H. Aerobic Digesters, Sludge Dewatering and Disposal

1. Provide telescoping valve, airlift pump, or other means of decanting digester and returning supernatant to plant headworks. Provide OPW 3000 Series swivel joint or equal for decant airlift pumps.

2. Provide a staff gauge in each digester extending from floor to top of wall. Staff gauges shall be painted aluminum with white background displaying feet and tenths in black. Provide 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 two (2) sludge dewatering boxes and provisions (e.g. process piping, electrical, etc.) for a mobile belt press and staging for two sludge disposal boxes. Mobile belt press to be provided by GBRA.
    c. For facilities greater than 300,000 GPD AADF, provide belt presses and staging for two sludge disposal boxes. Engineer may propose alternate dewatering equipment during the design phase for GBRA consideration.
5. For sludge dewatering boxes, provide the following:
    a. Pumping systems shall be installed within buildings designed for human occupancy; refer to Section 2.1 "Buildings" herein for general design requirements.
    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 per GBRA Standard Specification 13442.
    e. Inline 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 hot dip galvanized tracks for wheels. Provide 3 feet minimum clearance around boxes. Provide gravity drains or two (2) sump pumps; each pump capable of 80 GPM minimum and rated for ¾" solids.
6. For belt presses, provide the following:
    a. Comply with TCEQ redundancy requirements.
    b. Roof structure over all equipment, including sludge disposal boxes.
    c. Two (2) rotary lobe VFD pumps.
    d. Sludge suction piping shall be minimum 6" diameter with maximum 45-degree bends.
    e. Flanged magnetic flow meter per GBRA Standard Specification 13442.
    f. Inline polymer injection system with two (2) peristaltic metering pumps.
    g. Install a concrete pad for the sludge disposal boxes, with hot dip galvanized tracks for wheels and electric winch to slide boxes. Provide 3 feet minimum clearance around boxes.

I. 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 cloth media type manufactured by Aqua-Aerobic Systems, Five Star Filtration, or Municipal Filtration Company. Engineer may propose alternate filtration equipment during the design phase for GBRA consideration.
3. Provide two (2) independent filter basins, each with independent OIT and controls, and each rated for ultimate peak flow with one (1) element out of service.
4. Metal components shall be aluminum or stainless steel.

5. Design overflow piping to accommodate ultimate peak flow.
6. Algae covers shall be aluminum or stainless steel and removable by one person.
7. Provide chlorine injection upstream of filters.
8. Provide hoist and access platform. Hoist shall include a hot dip galvanized mast and stainless steel winch with stainless steel wire rope.

J. Chlorination
1. Refer to Section 2.1 “Chlorination” herein for general design requirements.
2. If filtration is required, provide chlorine injection upstream of filters.
3. UV disinfection is not allowed.

K. Chemical Feed (if required)
1. Refer to Section 2.1 “Chemical Feed Systems” herein for general design requirements.
2. For facilities with effluent phosphorus limitations, provide a chemical feed system for phosphate precipitation.
3. 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.

L. Operations Building and Equipment Buildings
1. General
   a. Buildings shall be designed for human occupancy; refer to Section 2.1 “Buildings” herein for general design requirements.
2. Operations Buildings
   a. Provide high-speed internet service.
   b. Provide smoke detector with alarm to SCADA.
   c. 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
   d. Laboratory facilities shall be provided with the following minimum capacities:
      1. 150 SF floor area
      2. 60 CF base cabinets with drawers
      3. 30 CF wall cabinets
      4. 12 LF and 24 SF countertops
   e. Corner cabinets shall have a lazy Susan.
   f. Countertops and sinks shall be 1” thick black epoxy resin.
   g. Provide a 4” tall backsplash.
   h. Lab sink shall be Durcon D68E or equal. Bathroom sink shall be Durcon D25 or equal.
   i. Base and wall cabinets shall be ¾” thick plywood with prefinished dark oak veneer.
   j. Provide electrical and water connections for a full-size refrigerator.

M. Effluent Storage and Reclaimed Systems (if required)
1. Refer to Section 2.1 “Water Storage Tanks” herein for general design requirements.
2. Refer to Section 2.1 “Water Pumping Systems” herein for general design requirements.

3. Total storage capacity shall not be less than the maximum daily demands. Any volume below pump minimum suction requirements shall not be used in calculations.
4. Tank floor drain and overflow piping shall be connected to plant discharge piping and flow meter.

N. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:
1. Generic Control Narrative (engineer to customize for each project)
2. Section 13124 Prefabricated Fiberglass Buildings
3. Section 13442 Flanged Magnetic Flow Meters

O. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
1. Detail 130 --- Adjustable Stanchion Pipe Support
2. Detail 150 --- Air Release Valve Type 2
3. Detail 170 --- Air Release Valve Type 4
4. Detail 210 --- Bollard
5. Detail 220 --- Buried Valve
6. Detail 240 --- Chain Link Fence and Gates
7. Detail 250 --- Concrete Pedestal Pipe Support
8. Detail 320 --- Equipment Pad
9. Detail 390.1 --- Hydropneumatic Tank Appurtenances
10. Detail 390.2 --- Hydropneumatic Tank Design and Control Narrative
11. Detail 420 --- Pipe Trench
12. Detail 470 --- Pressure Transmitter and Gauge
13. Detail 480 --- Restrained Lengths
14. Detail 490 --- Sludge Dewatering Box Snatch Block Embed
15. Detail 530 --- Strut and Clamp
16. Detail 540 --- Thrust Blocking

2.8 Lift Stations

A. General
1. Refer to Section 2.1 herein for general design requirements.
2. Refer to Section 2.2 herein for general material requirements.
3. Refer to Section 2.3 herein for potable and reclaimed water line general requirements.
4. Refer to Section 2.4 herein for wastewater line general requirements.
5. Surge control shall be considered in design. Evaluate loss of power while all pumps are running.
6. Pumps and pump control panels shall be Flygt, KSB, or Sulzer/ABS; substitutions are not permitted. Grinder pumps are not allowed. Each pump shall be equipped with a mix/flush valve, or provide a mixing device within the wet well. Provide wire rope for

each pump with 4 FT minimum lifting chain and chain grip eye rated for twice the combined pump/motor weight, all Type 316 stainless steel. Provide non-clogging impellers in stock sizes; trimmed impellers are not allowed. Lift station design and pump selection shall incorporate the future ability to increase impeller one size without changing pump bases, motors, electrical, or controls.

7. A propeller type mixer, if utilized in lieu of mix/flush valves, shall be installed in-line with pumps in an outer edge pump slot to create rotational agitation within the wet well. The pump crane/hoist and hatch shall be configured to accommodate the mixer. Provide adequate clearances to avoid interference with other equipment, appurtenances, floats, etc. Top of mixer propeller radius shall be located below the low float. Guide rails with intermediate brackets are required for mixers similar to pumps. Mixer materials of construction, components, and accessories shall be the same as for pumps. Any redesign and/or additional construction costs necessary to accommodate a propeller type mixer shall be the contractor's responsibility, including but not limited to increased wet well diameter.
8. All supports, guide rails, brackets, and anchors within the wet well shall be Type 316 stainless steel; any associated bolts, rods, and nuts shall have flat washers; nuts shall be lock nuts.
9. Orientation of influent pipes shall be such that influent flow does not fall directly onto pumps, mixers, guide rails, discharge pipes, or supports.
10. Wet well roof/top slab shall be cast-in-place reinforced cementitious concrete with chemical resistant lining or admixture. Wet well base and walls shall be cast-in-place or precast reinforced cementitious concrete with chemical resistant lining or admixture, or precast reinforced chemical resistant polymer concrete. Chemical resistant material shall be SCP DropLiner or SpectraShield lining, ConShield or Xypex Bio-San C500 admixture, Armorock or RockHardscp or U.S. Composite Pipe polymer concrete, or pre-approved equal prior to bid. Install in accordance with published manufacturer recommendations. Concrete surface preparation for lining shall be CSP 5 minimum. Provide a minimum 10-year manufacturer warranty for chemical resistant materials to include labor, material, and equipment for removal, repair, and replacement.
11. The floor and first wall section of the wet well shall be precast integrally. Where this is not feasible, waterstop shall be utilized to seal the walls to a cast-in-place floor. Reference Detail 400.2 for additional requirements.
12. 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 equal, and non-shrink grout.
13. Wet wells shall have a 4" minimum cast-in-place Type 316 stainless steel or epoxy lined ductile iron gooseneck vent with welded waterstop ring at pipe penetration. Terminate with a ring flange and aluminum insect screen 24" above top of roof slab.
14. 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 Type 316 stainless steel. Hatch assemblies shall be EJCO Safe Hatch or equal. Provide two (2) hatch keys. Size and position hatch to provide 4" minimum clearance in all directions from pumps and mixers to hatch clear opening.
15. Every lift station shall be equipped with a permanent mounted crane and electric hoist. Minimum lifting capacity shall be twice the combined pump and motor weight. Crane

shall be hot dip galvanized. Electric hoist shall be epoxy coated. Wire rope shall be stainless steel.

16. Lift station valve assembly shall be installed above ground on a reinforced concrete slab/pad. Include an emergency bypass pumping port same size as pump discharge flange.
17. Provide a flanged flow meter on the pump discharge header per GBRA Standard Specification Section 13442. All flow meter data shall be logged via the SCADA system. Configure the SCADA system to record 2-hour peak flows.
18. Provide a pressure gauge assembly on the common discharge header in accordance with Detail 470. Pressure transmitter is not required unless specifically noted otherwise.
19. Provide security fencing along the entire perimeter of the facility property. Include personnel and vehicular access gates.
20. All unpaved areas of site within fenced boundaries shall be covered with DeWitt Pro 5 weed barrier or equal and a 6” layer of TxDOT Item 421 Grade 1 crushed stone coarse aggregate.
21. Access roads and parking areas shall be asphalt or concrete.

B. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:
   1. Lift Station Demonstration Testing Procedure
   2. Generic Control Narrative (engineer to customize for each project)
   3. Section 13442 Flanged Magnetic Flow Meters

C. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
   1. Detail 130 --- Adjustable Stanchion Pipe Support
   2. Detail 150 --- Air Release Valve Type 2
   3. Detail 170 --- Air Release Valve Type 4
   4. Detail 210 --- Bollard
   5. Detail 240 --- Chain Link Fence and Gates
   6. Detail 320 --- Equipment Pad
   7. Detail 400.1 --- Lift Station Plan View
   8. Detail 400.2 --- Lift Station Section View
   9. Detail 400.3 --- Lift Station Details
   10. Detail 470 --- Pressure Transmitter and Gauge
   11. Detail 520 --- Stilling Well
   12. Detail 530 --- Strut and Clamp

SECTION 3: CIVIL AND MECHANICAL TESTING

3.1 General

A. All other utilities must be complete prior to performing any water or wastewater testing.

B. If allowed by the inspector from the jurisdiction overseeing street installation, the contractor may pave streets at the contractor's own risk prior to testing water and wastewater systems.

C. All testing shall be performed by the contractor and witnessed by GBRA.

D. All testing shall be arranged and paid for by the contractor.

E. Testing equipment must be calibrated within the previous 12 months.

F. Field and laboratory testing firms shall include GBRA on the distribution list for all test reports related to GBRA facilities.

G. Contractor shall perform pre-testing to verify passing results prior to requesting GBRA inspection.

H. Any work that fails testing must be corrected and retested.

I. Any work that is disturbed must be retested.

J. All testing must be complete, with passing results, prior to performing tie-ins to existing water or wastewater systems. Tie-ins must be tested as well.

K. Contractor shall provide all water, equipment, hoses, temporary ports, caps, plugs, piping, valves, fittings, air releases, and appurtenances necessary for testing.

L. Contractor shall provide connection point for GBRA digital test gauge.

M. Perform trench backfill density testing as follows unless specified more stringent by the design engineer or authority with jurisdiction (e.g. HOA/POA, city, county, state, etc.). Test each lift at maximum 100 LF intervals, including unpaved areas, minimum two (2) tests for each lift at all road crossings including but not limited to services and fire hydrant leads, 95% to 102% compaction, +/- 2% optimum moisture, exact locations to be randomly selected by GBRA inspector. Jetting and/or potholing are not allowed. Test each lift prior to installing subsequent lifts. Schedule GBRA to witness testing. Provide copies of test reports to GBRA. Failed lifts shall be removed and recompacted 50 LF each way from test location and shall be retested.

N. Examine paint, coatings, and associated surface preparation. Perform dry film thickness testing for each coat prior to application of subsequent coat. Repair any delamination, deficiencies, or other defects.

O. Examine grout and concrete work and perform nondestructive testing in accordance with ACI 201.1R and ACI 228.2R. Repair any delamination, voids, cracks, or other defects.

P. Examine chemical resistant lining inside manholes, wet wells, and structures. Perform holiday testing. Perform nondestructive testing in accordance with ACI 201.1R and ACI 228.2R. Repair any delamination, voids, cracks, blisters, holidays, or other defects.

Q. Fenced Facilities

1. Hydraulic structures must pass leakage testing after installation of any penetrations, prior to backfilling or otherwise covering the work, and prior to application of any toppings, 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. Adjacent basins, chambers, and exterior surfaces must be clean and dry. Any areas of visible moisture shall be repaired and retested.

2. Water storage tanks must be tested in accordance with the procedures described herein for hydraulic structures, and shall be further tested and disinfected in accordance with applicable AWWA standards.
3. Pumping systems shall be selected based on maximum wire-to-water efficiency. Pump duty point shall be within 70% to 120% of pump flow at best efficiency point for each pump operating individually and for each combination of pumps in operation. Field draw down testing is required to demonstrate the specified performance for each pump operating individually and for each combination of pumps in operation.
4. All measuring and/or recording devices and instruments shall be field calibrated by a licensed professional. Contractor shall arrange and pay for calibration and provide copies of calibration certificates to GBRA prior to demonstration testing.
5. Contractor shall perform operational demonstration testing of the entire project and each specified phase thereof. Prior to demonstration testing, contractor shall: (1) retain the services of qualified manufacturer technical representatives to startup, test, and verify all devices, instruments, equipment, and systems are installed properly and are fully functional and calibrated; and (2) submit all O&M manuals in accordance with Section 1.4 herein. Once the contractor verifies the work is ready for demonstration testing, the contractor shall request GBRA to inspect the project. Within ten (10) business days after the inspection, GBRA will endeavor to provide a list of critical items that must be corrected prior to demonstration testing. After the contractor has corrected all critical items, the contractor shall request GBRA to inspect the project. Once all critical items are completed to GBRA's satisfaction, the contractor shall utilize clean water to perform demonstration testing. The demonstration testing must be witnessed by GBRA. During demonstration testing, contractor shall retain the services of qualified manufacturer technical representatives to demonstrate all devices, instruments, equipment, and systems are fully functional and calibrated. Contractor shall coordinate demonstration testing schedule, and any reschedule, with GBRA at least ten (10) business days in advance.
6. Contractor shall provide onsite training of GBRA operating personnel after successful operational demonstration testing of the entire project and each specified phase thereof. Training shall not occur on the same day as testing. All training must be complete prior to placing the facility, or specified phase thereof, into service and prior to issuing substantial completion. Contractor shall operate the facility, or specified phase thereof, with clean water during training. Contractor shall retain the services of qualified manufacturer technical representatives to conduct the training. These shall be the same manufacturer representatives who performed the respective field installation and functional testing services. Provide training for all devices, instruments, equipment, and systems. Training shall include operation, adjustments, calibration, troubleshooting, and maintenance procedures. Contractor shall coordinate schedule, and any reschedule, with GBRA at least ten (10) business days in advance.

3.2 Water Lines

A. This section is applicable to potable and reclaimed water lines.

B. Refer to Section 3.1 herein for general testing requirements.

C. Follow AWWA pipe testing procedures and allowable leakage for water lines. Test every valved section (i.e. test against every valve in closed position). Test pressure shall be the maximum rating of material installed. Test duration shall be 2 hours.

D. Follow AWWA procedures for flushing and disinfection of water piping. Flushing and disinfection must be complete prior to performing tie-ins to existing systems. Provide copies of laboratory reports to GBRA.

E. Tapping sleeve and valve assemblies must be successfully disinfected and pressure tested prior to tapping. Perform 100 PSI air test for 10 minutes duration, no allowable leakage.

3.3 Wastewater Lines

A. Refer to Section 3.1 herein for general testing requirements.

B. All gravity wastewater piping shall be subject to low pressure air testing in accordance with TCEQ requirements. Infiltration and exfiltration testing are not allowed.

C. Mandrel testing shall be performed for all gravity wastewater mains after final backfill has been in place for at least thirty (30) calendar days, but prior to installation of manhole interior grouting and lining.

D. All manholes shall be vacuum tested after completion of backfill, compaction, and final grading, including compaction and final grading of road base where applicable, but prior to installation of manhole interior grouting and lining. Vacuum testing shall be performed with a plate type test head placed on top of manhole metal casting ring that has been installed and encased in concrete at final grade. Manholes shall be tested at 10 inches of mercury for 2 minutes duration. Allowable loss is 1 inch of mercury. Any grout necessary to remedy a failed vacuum test must be applied to the exterior of the manhole. Infiltration and exfiltration testing are not allowed.

E. Perform video inspection and golf ball testing of gravity wastewater piping after successful vacuum, grout, and lining testing. Pipe and manholes must be cleaned free of dirt, rocks, scale, mud, silt, and any other foreign matter prior to performing video inspection and golf ball testing. Flood system with water immediately prior to performing video inspection and golf ball testing. Hang and drag a golf ball in front of camera. Pipe grade is out of tolerance if golf ball becomes fully submerged. Any visible piping imperfections must be corrected. Schedule GBRA to witness video inspection and golf ball testing. Provide copies of videos and reports to GBRA onsite immediately upon conclusion of each inspection.

F. Follow TCEQ pipe testing procedures and allowable leakage for force mains. Test every valved section (i.e. test against every valve in closed position). Test pressure shall be the maximum rating of material installed.

3.4 Water Delivery Points

A. Refer to Section 3.1 herein for general testing requirements.

B. Refer to Section 3.2 herein for water line testing requirements.

3.5 Interim Wastewater Treatment Plants

A. Refer to Section 3.1 herein for general testing requirements.

B. Refer to Section 3.2 herein for potable and reclaimed water line testing requirements.
C. Refer to Section 3.3 herein for wastewater line testing requirements.
D. Refer to Section 3.7 herein for lift station testing requirements.

3.6 Permanent Wastewater Treatment Plants

A. Refer to Section 3.1 herein for general testing requirements.
B. Refer to Section 3.2 herein for potable and reclaimed water line testing requirements.
C. Refer to Section 3.3 herein for wastewater line testing requirements.
D. Refer to Section 3.7 herein for lift station testing requirements.

3.7 Lift Stations

A. Refer to Section 3.1 herein for general testing requirements.
B. Refer to Section 3.2 herein for potable and reclaimed water line testing requirements.
C. Refer to Section 3.3 herein for wastewater line testing requirements.
D. Refer to Appendix D herein for the Lift Station Demonstration Testing Procedure.

SECTION 4: CIVIL AND MECHANICAL CONSTRUCTION NOTES

4.1 General

A. All work shall be in accordance with approved conformed drawings, specifications and contract documents, TCEQ rules, AWWA standards, applicable federal, state and local laws, rules and regulations, and shall be in accordance with GBRA Standards and Design Guidelines published on GBRA's Developer Resources web page. In the event of conflict among any such requirements, the most stringent requirement shall apply.

B. Submit all proposed materials in accordance with GBRA Standards and Design Guidelines Section 1.3.

C. Contractor's superintendent must be on-site to supervise all work, including work performed by subcontractors and vendors.

D. All work must be inspected and approved by GBRA prior to backfilling, closing walls or forms, placing concrete, or otherwise covering the work. This includes crossings by other utilities. Any work that is covered prior to inspection and approval must be uncovered. GBRA will perform a maximum of one (1) inspection daily for one (1) hour duration between 8:00am and 5:00pm excluding weekends and holidays. Advance notice of two (2) business days (48 hours) is required for all inspections. Contractor shall utilize SharePoint to submit all requests for inspections. SharePoint instructions will be provided by GBRA. Contractor shall provide safe access to the work for inspector. Contractor shall provide assistance for inspector to verify lines and grades. Photos will not be accepted as substitute for inspections.

E. Existing water and wastewater systems shall remain in service at all times during construction unless specifically approved otherwise by GBRA. Any work involving tie-ins, shutdowns, power outages, or any other interruptions, must be performed between 8:00am and 5:00pm excluding weekends and holidays, unless specifically approved otherwise by GBRA. All temporary power, bypass pumping, pump and haul, temporary plugs, etc., necessary to maintain system operations and accomplish the work, shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least ten (10) business days in advance.

F. In the event bypass pumping or pump and haul are required, the contractor shall provide a pumping and monitoring plan for GBRA review, comment, and approval. The pumping system for each diversion must be fully redundant and rated for peak flow with the largest pump out of service. The contractor shall furnish, install, operate, and maintain all necessary pumping, plugs, and associated appurtenances including automatic controls and 24-hour remote monitoring or onsite pump watch personnel to ensure that no overflows or spills occur. The contractor shall be responsible for all necessary cleanup and reporting efforts due to failure of equipment or activities associated with the pumping operations contributing to either a surcharge or Sanitary Sewer Overflow (SSO). The cost of any related fines, penalties, or damages and the cost of any effort by GBRA or other third parties to mitigate damages resulting from any surcharging or SSOs shall be the direct and sole responsibility of the contractor.

G. Contractor shall field verify vertical and horizontal location of all existing utilities prior to ordering materials and prior to performing any work. Schedule GBRA to witness. Notify engineer of any discrepancies or conflicts.

H. Contractor shall field verify configuration of all proposed tie-ins to existing facilities prior to ordering materials and prior to performing any work. Schedule GBRA to witness. Notify engineer of any discrepancies or conflicts.

I. Survey staking and layout shall be performed by the contractor for all work. Survey staking and layout must be installed prior to and maintained during performance and inspection of the work. Survey staking and layout shall include vertical and horizontal control at maximum 50-foot station intervals, grade/alignment changes, structures, sitework, equipment, etc. Horizontal offsets shall be 15 feet maximum. Install property pins and stakes. Mark finished grade lines with cut/fill on offset stakes and property stakes. All marks shall face the work.

J. Trench excavation and installation of utilities will not be permitted until subgrade has been established.

K. Pipe bells shall be installed in upstream direction.

L. All piping shall be installed in straight alignment vertically and horizontally between bend fittings for pressure systems and between manholes for gravity systems. Pipe curvature and/or deflection are not allowed.

M. Maintain a minimum of 10 feet horizontal and 12 inches vertical clearance between water and wastewater lines and other utilities. Shared trenches are not allowed.

N. Pipe lengths shall be centered at all water and wastewater crossings. Both pipes shall be centered at each crossing including but not limited to mains, service laterals, fire hydrant leads, appurtenances, etc.

O. Water and wastewater piping (including mains, services, and laterals) shall be sleeved if located under concrete channels, box culverts, or multiple barrel storm sewer crossings regardless of size and single barrels nominal 30” or larger, and other utilities nominal 30” or larger. Sleeves shall extend horizontally beyond the limits of these items for a distance equal to the maximum vertical separation plus outside diameter of sleeve plus 10 LF minimum on each end.

P. Buried pressure piping systems shall be mechanically restrained. Refer to Detail 480 for restrained length requirements. Engineer shall evaluate soils and determine if any additional restraints are required. If the engineer requires concrete thrust blocking in addition to mechanical restraints, the concrete thrust blocking must be installed in accordance with Detail 540.

Q. Base plates shall bear on non-shrink grout unless specifically approved otherwise (e.g. columns, towers, equipment, stanchion pipe supports, light poles, etc.). Shims must be removed and leveling nuts must be lowered during the grouting process. Bevel edges of grout pads at 45-degrees.

R. Valve boxes, equipment, piping, valves, and appurtenances shall be painted. Field painting is not required if factory coatings meet or exceed the requirements specified in GBRA Standards and Design Guidelines Section 2.2.

S. Provide painted curb cut markings at water and wastewater valves and services. Markings shall be placed on lip of gutter. Provide “V” marking for each valve and “X” marking for each service. Paint shall be color coded polyurethane.

T. Provide 6” minimum clearance between concrete penetrations, and between concrete penetrations and concrete joints, as measured from nearest edge to nearest edge.

U. All exposed vertical and horizontal concrete edges shall be formed with ¾" chamfer strips. Sidewalks are exempt from this requirement.

V. For formed concrete surfaces exposed to weather or earth, rebar clearance shall be 2" minimum. For concrete surfaces cast against earth, rebar clearance shall be 3" minimum. All other rebar clearances shall be 1 1/2" minimum, including clearances from embedded items.

W. Rub finish all exposed vertical concrete surfaces. Inside hydraulic structures, rub finish 2 feet below the lowest operating level and all surfaces above that level.

X. Provide broom finish and clear sealer for all horizontal concrete surfaces exposed to weather unless noted otherwise. Broom finish shall be parallel to any specified slope. Clean and remove stains from concrete prior to applying sealer.

Y. The contractor shall adjust existing water and wastewater facilities to proposed finished grades including but not limited to manholes, cleanouts, valves, hydrants, appurtenances, etc.

Z. Existing facilities that are disturbed shall be restored and tested to be in full compliance with current GBRA standards.

AA. Existing manholes that are disturbed shall be restored to be in full compliance with current GBRA standards including testing, chemical resistant lining, rings and covers, etc.

BB. All restoration must be complete prior to installing tie-ins.

CC. The contractor shall furnish and install backflow prevention in the form of a reduced pressure backflow assembly for all temporary connections to existing water lines. Backflow devices must be tested and certified by a licensed professional. Contractor shall arrange and pay for testing and provide a copy of certification for GBRA review and approval prior to installation.

DD. Contractor shall furnish, install, maintain, and remove temporary fencing and gates as necessary to secure and access the work and to prevent livestock from entering the work area.

EE. Contractor shall perform dewatering as necessary to accomplish the work.

FF. Contractor shall restore and revegetate all disturbed areas.

GG. Unless noted otherwise, contractor shall properly dispose of excess spoils off site in accordance with local laws, ordinances, and regulations.

HH. Burial or burning of refuse is not allowed, contractor shall properly dispose of such material off site in accordance with local laws, ordinances, and regulations.

II. Explosives and blasting are not allowed.

JJ. Submit all items required for final completion in accordance with GBRA Standards and Design Guidelines Section 1.4.

4.2 Fenced Facilities

A. Refer to Section 4.1 herein for general civil and mechanical construction notes.

B. All equipment shall be configured to automatically reset after power outages.

C. All outdoor exposed piping 4" and smaller conveying liquids shall be heat traced, insulated, and covered with aluminum jacketing. Heat tracing system shall be controlled by a master

thermostat. Self-regulating heating cable is not allowed. Pipes with continuous flow are exempt from this requirement.

D. All equipment, piping, valves, and appurtenances shall be labeled for identification purposes (e.g. pipe labels, color coding, banding, flow arrows, equipment numbers, instrument and valve tags, etc.).

SECTION 5: ELECTRICAL, INSTRUMENTATION, AND CONTROLS GENERAL REQUIREMENTS

5.1 General Design Requirements

A. Coordinate with Section 2 herein for civil and mechanical general requirements.

B. Design and installation shall be in accordance with NEC, TCEQ rules, AWWA standards, applicable federal, state and local laws, rules and regulations, and shall be in accordance with GBRA Standards and Design Guidelines as further described in this document. In the event of conflict among any such requirements, the most stringent requirement shall apply.

C. Engineer shall provide complete design drawings and specifications. Include site plan, load calculations, one-line diagrams, control narratives, control schematics, etc. Provide interior and exterior layout details for all control enclosures. Include types, sizes, quantities, routing, and schedules for all raceways and conductors. Provide a detail drawing for each duct bank section. Include plan and profile sheets for all duct banks. Show all existing and proposed utilities in plan and profile views. Duct banks shall be sloped to promote drainage.

D. Contractor shall retain the services of a professional engineer licensed in the State of Texas to conduct a short circuit study, protective device coordination study, and incident energy analysis. These shall be performed in accordance with ANSI/NETA standards and shall be sealed, signed, and dated by said engineer. Contractor shall submit these for GBRA review, comment, and approval prior to energizing the facility.

E. Engineer to design site grounding system to include fencing, gates, tanks, buildings, structures, enclosures, generator, antenna, etc. Resistance to ground for site grounding system shall be 5 Ohms or less. Resistance to ground for individual electrodes shall be 25 Ohms or less.

F. Engineer shall field verify vertical and horizontal location of all existing utilities prior to submitting design for GBRA review.

G. Engineer shall field verify configuration of all proposed tie-ins to existing facilities prior to submitting design for GBRA review.

H. Maintain a minimum of 10 feet horizontal and 12 inches vertical clearance between electrical and other utilities. Shared trenches are not allowed.

I. Main electrical service shall be provided with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.

J. All equipment shall be designed to automatically reset after power outages.

K. All equipment shall have elapsed time meters.

L. All outdoor exposed piping 4” and smaller conveying liquids shall be heat traced, insulated, and covered with aluminum jacketing. Heat tracing system shall be controlled by a master thermostat. Self-regulating heating cable is not allowed. Pipes with continuous flow are exempt from this requirement.

M. A separate grounding conductor is required for every raceway including electrical, instrumentation, and controls. Minimum size is 12 AWG.

N. A separate neutral conductor is required for every 120VAC circuit.

O. Emergency Generators

1. Generators shall be manufactured by Caterpillar, Cummins, Generac, Kohler, MTU, or Stewart & Stevenson; substitutions are not allowed. Size generator to operate the facility at 100% capacity with 20% maximum voltage drop at ultimate build-out of facility.
2. Generators 105 kW or less shall utilize natural gas or propane fuel. Generators larger than 105 kW shall utilize diesel, natural gas, or propane fuel. Fuel capacity at 100% of nameplate kW shall be equal to the longest power outage on record for the previous 60 months or 48 hours minimum, whichever is greater. Maximum storage for fuel calculations shall be 90% of tank capacity.
3. External hardware and fasteners for generator base, fuel tank, sound attenuation enclosure, and appurtenances shall be in accordance with Section 2.2 herein.
4. Maximum noise level shall be 78 dBA at 23 feet.
5. Generator shall be mounted on a cast-in-place reinforced concrete pad with perimeter beam.
6. Provide 48" minimum clearance on all sides around exterior of generator sound attenuation enclosure.
7. Provide an automatic transfer switch (ATS) with maintenance bypass and programmable exerciser (with load).
8. Generator shall have a battery charger and dry contacts for all alarms. Provide the following generator and ATS alarms:
    a. Generator run.
    b. Generator common fault.
    c. Power failure (from load side of ATS).
    d. ATS in emergency.

5.2 General Material Requirements

A. Coordinate with Section 2 herein for civil and mechanical general requirements.

B. All materials and equipment shall be new and unused.

C. All equipment shall be configured to automatically reset after power outages.

D. All equipment shall have elapsed time meters.

E. All PLCs shall be of the same communication type. Provide 10% minimum spare I/O for each PLC; provide expansion I/O modules as necessary.

F. Any equipment furnished with an OIT shall display all statuses, process values, and control variables on the OIT. All parameters and setpoints shall be operator adjustable on the OIT. Include minimum one (1) week alarm historian.

G. Contractor shall perform all PLC, OIT, and HMI programming; software and firmware must be the latest stable version available on the date of project substantial completion. The program for each PLC must be set to load on uninitialized memory.

H. All electrical enclosures shall be provided with continuous hinge, non-removable external mounting lugs, and 3-point latch system with padlocking handle. Provide slotted flush-mount ¼-turn latches and padlock staple for enclosures that are not available with a 3-point latch system. Mount all enclosures on vertical strut.

I. Do not penetrate the top or upper two-thirds of outdoor enclosures.

J. Removable bottom access covers are not allowed for mini power zones.

K. Control panels installed in indoor locations shall not have a dead front inner door. Control panels installed in outdoor locations shall have an aluminum dead front inner door. Do not mount any components on the exterior door of outdoor control panels.

L. All control panels shall have a Hoffman type thermostatically controlled enclosure heater.

M. Indicator lights shall be LED push-to-test type (red/run/open, green/stop/closed, amber/fault, white/power).

N. Alarm beacons shall be LED and red color.

O. 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.

P. Install a white color duplex 110V 20A GFCI receptacle in each control panel. All other receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations and buildings/rooms with process piping/equipment shall have aluminum while-in-use covers. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

Q. All disconnects shall be lockable in on and off positions.

R. All floats shall have one normally open and one normally closed set of contacts.

S. Cable support grips shall be woven wire mesh type.

T. All motors shall be Premium Efficiency, totally enclosed, with minimum 1.15 service factor. Motors shall not operate within the service factor. All motors driven by variable frequency drives shall be inverter-duty rated.

U. 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.

V. Solid State Reduced-Voltage (SSRV) soft starters shall be utilized for motors 25 HP and larger or as required by the site electrical service size.

W. Provide external bypass for SSRVs and VFDs for motors 75 HP and smaller.

X. Allowable manufacturers for SSRVs and VFDs are ABB, Eaton/Cutler Hammer, GE, and Schneider/SQD; substitutions are not allowed.

Y. All 4-20mA signal wire shall be minimum 20 AWG twisted shielded.

Z. All control panel and MCC control wiring shall be color coded as follows:

1.	AC controls	Red
2.	DC controls	Blue
3.	DC (+) power	Red
4.	DC (-) power	Black
5.	AC hot	Black with red tracer
6.	AC neutral	White

AA. Splicing of conductors is not allowed. Terminations shall be made utilizing terminal strips mounted on a backplane. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.

BB. All electrical enclosures shall have black phenolic labels with white 3/8" block lettering, attach with aluminum rivets.

CC. Provide type written as-built schematics, diagrams, and panel directories in all electrical panels. Schematics and diagrams shall be laminated. Provide plastic adhesive-backed pockets for schematics and diagrams. Provide clear vinyl adhesive-backed envelopes for panel directories.

DD. All instruments and conduits shall have round shaped black phenolic tags with white 1/4" block lettering, attach with stainless steel cable. Install a tag on each end of each conduit.

EE. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.

FF. Label each group of conductors inside vaults, pull boxes, junction boxes, manholes, and handholes. Labels shall be black phenolic tags with white 3/16" block lettering to include the group designation, origin, and destination. Secure tag around group with a cable tie.

GG. All electrical conduit, enclosures, devices, and light fixtures shall be mounted on strut.

HH. Hardware, fasteners, and supports shall be in accordance with Section 2.2 herein.

II. Flexible conduit shall be Type LFNC-B for 3/4" to 2" sizes, connectors shall be nylon and UL listed (1/2" LFNC will be allowed for instruments with ½" threaded hub entries, all other LFNC shall be 3/4" minimum). Flexible conduit shall be aluminum core Type LFMC for sizes 2 1/2" and larger, connectors shall be aluminum. Maximum length of flexible conduit shall be 18".

JJ. Install aluminum Myers hubs with insulated throats for all conduit penetrations into enclosures. Hubs for metallic conduits shall be grounding type.

KK. Install seal-off fittings where shown on drawings and where required by NEC, seal with 3M Scotchcast 2123 re-enterable resin. Seal-off fittings shall be cast aluminum Type EYS.

LL. Field apply non-grit, petroleum base, anti-oxidizing agent to aluminum conduit threads prior to assembly. Anti-oxidizing agent shall be ILSCO DE-OX or equal.

MM. Field apply copper anti-seize compound to steel conduit threads prior to assembly. Anti-seize compound shall be Kopr-Kote, Permatex, or equal.

NN. Wire pulling lubricant shall be clear and non-staining. Wire pulling lubricant shall be Ideal ClearGlide or equal.

OO. Install pull tape and PVC caps for all spare conduits. Pull tape shall be rated for 1,250 pounds; splices are not allowed. Pull tape shall be wrapped and tied around outside of conduit at each end. Cap each end of each spare conduit.

PP. Interior light fixtures shall be 48" strip LED, vapor tight, 4000K and minimum 4,000 lumens.

QQ. Outdoor switches shall have aluminum weatherproof toggle covers.

RR. Caulking sealants shall be MasterSeal NP1, Sikaflex, or equal. Use self-leveling sealant for flatwork. Color shall match adjacent finishes.

5.3 Water Delivery Points

A. GENERAL

The following standards are for the design of customer water delivery points where GBRA's responsibility is limited to delivery of water to customer tanks (i.e. customer storage and pumping facilities operated by others). Refer to "Additional Requirements" below for storage and pumping facilities to be operated by GBRA.

1. Refer to Section 5.1 herein for general design requirements.
2. Refer to Section 5.2 herein for general material requirements.
3. Electrical service shall be 120/240V 1-phase. Phase converters are not allowed.
4. An emergency generator and ATS are not required.
5. Provide a SCADA system appropriate for the applicable service area. All equipment shall be monitored via SCADA. Engineer must submit system design and field radio path studies for GBRA review, comment, and approval. Engineer must obtain GBRA design approval prior to advertising for bids. Coordinate with GBRA to determine service area, site specific requirements, and appropriate equipment. Refer to GBRA Standard Specification Sections 13410 and 13428, Generic Control Narrative, and Detail 630 for additional requirements.
6. Each water storage tank shall be equipped with a level transmitter per Section 2.1 herein and shall be monitored via GBRA SCADA. The transmitter(s) shall be owned and maintained by the customer.
7. RTU shall be Allen-Bradley Micro850 PLC with Connected Components Workbench Software; substitutions are not allowed. In the event Modbus RTU communications must occur between the RTU and a Modbus device, an Allen-Bradley 5069-SERIAL module shall be utilized. In the event Modbus TCP communications must occur between the RTU and a Modbus device, an Anybus or Spectrum Universal Gateway communication module shall be utilized.
8. RTU backup power supply shall be a 24V battery system with a DIN rail mounted PSU. The battery system shall have sufficient capacity to power the RTU for a minimum of four (4) hours duration. Batteries shall be AGM or gel cell rechargeable sealed lead acid. PSU shall be Meanwell DRS-240-24 or equal, with integral battery charging circuit. Provide an alarm to SCADA for battery system low voltage.
9. All control panel and MCC control wiring shall be flexible 41 strand tinned copper with 600V insulation; Type SIS for control panels, Type MTW for MCCs. Control wiring from terminal blocks to PLCs shall be size 16 AWG minimum. All other control panel and MCC control wiring shall be size 14 AWG minimum.
10. All other conductors shall be stranded copper XHHW-2.
11. Phase colored insulation is required for all conductors. Phase tape is not allowed.
12. Label wiring with yellow or white heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit. Label each end of all conductors. All printing shall face the panel door and must be visible and unobstructed. Print orientation shall be left to right for horizontal conductors. Print orientation shall be bottom to top for vertical conductors. Printing shall include origin and destination, and equipment and termination for each. Edge of labels shall be ¼" from end of insulation unless such placement will obstruct visibility.

13. Enclosures in buildings/rooms with intake/exhaust fans only shall be NEMA 4. Service disconnect shall be NEMA 3R; all other exterior enclosures shall be NEMA 4X stainless steel.
14. Electrical panels shall have tinned or silver plated copper bus and 20A minimum bolt-on type circuit breakers.
15. Transformers shall have copper windings.
16. Underground conduit shall be Sch 40 PVC (1" minimum) installed in steel reinforced red-dyed concrete duct banks in accordance with Detail 290. Stub-ups from underground to 6" above finished grade including the 90-degree bends shall be ETL-PVC-001 certified PVC coated GRS conduit in accordance with Detail 260; submit installer certification. Exposed/above ground conduit in chemical areas shall be Sch 40 PVC (¾" minimum). All other exposed/above ground conduit shall be aluminum rigid (¾" minimum).
17. Route conduit inside slabs and building walls, not surface mounted; these conduits shall be Sch 40 PVC (1" minimum); walls of prefabricated fiberglass buildings are exempt from this requirement. Unless noted otherwise, do not penetrate exterior walls, including prefabricated fiberglass buildings.
18. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and stainless steel screws. Snap-on covers are not allowed.
19. Unions shall be aluminum UNF or UNY. Galvanized unions are not allowed.
20. All device boxes shall have stainless steel cover screws.
21. Surface mounted device boxes shall be PVC in chemical areas, all other areas shall be FD type sand cast aluminum.
22. Exterior wall mount light fixtures shall be weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W minimum, bronze finish. Provide one light fixture centered above each door frame.

B. ADDITIONAL REQUIREMENTS

If storage and pumping facilities are to be <u>operated by GBRA</u>, the design shall meet the requirements set forth above <u>and</u> shall be in accordance with the following additional requirements.

1. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
2. Provide a permanent emergency generator and ATS at each pump station. ATS shall be manufactured by ASCO or Russelectric; substitutions are not allowed. Generator and ATS alarms shall be monitored via SCADA.
3. Provide a Power Quality Meter (PQM) in its own separate enclosure. PTs and CTs shall be installed on the load side of the ATS. PQM shall be Shark Model 200, Modbus RTU or Ethernet IP compatible, with 10/100 BaseT Ethernet connection; substitutions are not allowed. Display amperage and voltage readings for each phase and KWH on the onsite master HMI and at remote control room(s).
4. Electrical panels and control system shall be installed within buildings. Refer to Section 2.1 herein for building design requirements.
5. Pump controller shall be Allen-Bradley CompactLogix 5069 PLC with Studio 5000 Logix Designer Software; substitutions are not allowed. Pump protection relays must be furnished by the pump manufacturer. The PLC pump controller shall serve as the RTU. In the event Modbus RTU communications must occur between the RTU and a Modbus

device, an Allen-Bradley 5069-SERIAL module shall be utilized. In the event Modbus TCP communications must occur between the RTU and a Modbus device, an Anybus or Spectrum Universal Gateway communication module shall be utilized. Refer to Section 2.1 “Water Pumping Systems” herein for general design requirements.

6. Provide a master HMI for the site. The HMI shall be C-more CM5 Series touch screen, 12”color TFT LCD, analog resistive, widescreen, 1280 x 800 pixel, with a minimum of two (2) Ethernet ports, two (2) serial ports, and two (2) USB ports; substitutions are not allowed. Display all statuses, process values, and control variables for the entire project on the onsite master HMI; all parameters and setpoints shall be operator adjustable on the onsite master HMI; display PQM ampacities, voltages, and KWH on the onsite master HMI; include minimum one (1) week alarm historian.
7. Enclosures in climate-controlled areas shall be NEMA 12. Enclosures mounted on pump skids shall be NEMA 4X FRP, PVC, or stainless steel. Enclosures in chemical areas shall be NEMA 4X FRP or PVC.
8. Provide manually-controlled full cutoff LED site lighting in each process area. Pole mounted fixtures shall be 4000K and minimum 15,000 lumens. Poles shall be 4” square hot dip galvanized. Stanchion mounted fixtures shall be 4000K and minimum 5,000 lumens. Provide switches, photocells, and receptacles at all stanchions and poles.

C. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:
   1. Generic Control Narrative (engineer to customize for each project)
   2. Section 13410 Water Delivery Point Process Control Descriptions
   3. Section 13428 Supervisory Control and Data Acquisition (SCADA)
   4. Section 13442 Flanged Magnetic Flow Meters
D. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
   1. Detail 180 --- Antenna Tower
   2. Detail 260 --- Conduit Stubup
   3. Detail 290 --- Duct Bank
   4. Detail 320 --- Equipment Pad
   5. Detail 360 --- Flow Meter Building Electrical and HVAC
   6. Detail 380 --- Grounding
   7. Detail 390.1 --- Hydropneumatic Tank Appurtenances
   8. Detail 390.2 --- Hydropneumatic Tank Design and Control Narrative
   9. Detail 470 --- Pressure Transmitter and Gauge
   10. Detail 530 --- Strut and Clamp
   11. Detail 630 --- Water Delivery Point Process and Instrumentation Diagram

5.4 Interim Wastewater Treatment Plants

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. 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.

A. General

1. Any items or components that are intended to be permanent shall be furnished and installed in accordance with GBRA standards for permanent facilities.
2. Refer to Section 5.1 herein for general design requirements.
3. Refer to Section 5.2 herein for general material requirements.
4. Refer to Section 5.6 herein for lift station general requirements.
5. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
6. Provide a permanent emergency generator and ATS at each treatment plant. Generator and ATS alarms shall be monitored via auto dialer.
7. Provide a cellular auto dialer to monitor all equipment. Provide voice alarm notifications via phone. 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. Batteries shall be AGM or gel cell rechargeable sealed lead acid. Include a battery system low voltage alarm. Refer to the Generic Control Narrative for additional requirements.
8. Enclosures in climate-controlled areas shall be NEMA 12. Enclosures in chemical areas shall be NEMA 4X FRP or PVC. All other enclosures shall be NEMA 4.
9. Electrical panels shall have aluminum bus.
10. Duct bank conduit (1” minimum) may be IMC installed on top of ground in lieu of buried. Route conduit inside slabs, not surface mounted; these conduits shall be Sch 40 PVC (1” minimum). All other conduit may be Sch 40 PVC (¾” minimum).
11. Phase colored tape is required for all conductors.
12. Label wiring with Ideal pre-printed wire markers. Label each end of all conductors. All printing shall face the panel door and must be visible and unobstructed. Print orientation shall be left to right for horizontal conductors. Print orientation shall be bottom to top for vertical conductors. Edge of labels shall be ¼” from end of insulation unless such placement will obstruct visibility.

B. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:

1. Generic Control Narrative (engineer to customize for each project)
2. Section 13442 Flanged Magnetic Flow Meters

C. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:

1. Detail 320 --- Equipment Pad
2. Detail 380 --- Grounding
3. Detail 470 --- Pressure Transmitter and Gauge

4. Detail 530 --- Strut and Clamp

5.5 Permanent Wastewater Treatment Plants

A. General

1. Refer to Section 5.1 herein for general design requirements.
2. Refer to Section 5.2 herein for general material requirements.
3. Refer to Section 5.6 herein for lift station general requirements.
4. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
5. Provide a permanent emergency generator and ATS at each treatment plant. ATS shall be manufactured by ASCO or Russelectric; substitutions are not allowed. Generator and ATS alarms shall be monitored via SCADA.
6. Provide a Power Quality Meter (PQM) in its own separate enclosure. PTs and CTs shall be installed on the load side of the ATS. PQM shall be Shark Model 200, Modbus RTU or Ethernet IP compatible, with 10/100 BaseT Ethernet connection; substitutions are not allowed. Display amperage and voltage readings for each phase and KWH on the onsite master HMI and at remote control room(s).
7. Provide a centralized climate-controlled environment for electrical panels and control system. Any equipment control panels installed in outdoor locations shall be equipped with a roof and single wall shelter in accordance with Details 310.1, 310.2, 310.3, and 310.4. Orientation of shelter shall be such that panels face east or north with shelter wall on west or south side. Equipment must be within direct line of sight from panel front. Panels installed on top of elevated structures are exempt from the shelter requirement.
8. Provide a SCADA system appropriate for the applicable service area. All equipment shall be monitored via SCADA. Engineer must submit system design and field radio path studies for GBRA review, comment, and approval. Engineer must obtain GBRA design approval prior to advertising for bids. Coordinate with GBRA to determine service area, site specific requirements, and appropriate equipment. Refer to GBRA Standard Specification Section 13428 and Generic Control Narrative for additional requirements.
9. RTU shall be Allen-Bradley CompactLogix 5069 PLC with Studio 5000 Logix Designer Software; substitutions are not allowed. In the event Modbus RTU communications must occur between the RTU and a Modbus device, an Allen-Bradley 5069-SERIAL module shall be utilized. In the event Modbus TCP communications must occur between the RTU and a Modbus device, an Anybus or Spectrum Universal Gateway communication module shall be utilized.
10. RTU backup power supply shall be a 24V battery system with a DIN rail mounted PSU. The battery system shall have sufficient capacity to power the RTU for a minimum of four (4) hours duration. Batteries shall be AGM or gel cell rechargeable sealed lead acid. PSU shall be Meanwell DRS-240-24 or equal, with integral battery charging circuit. Provide an alarm to SCADA for battery system low voltage.
11. GBRA will provide a PC to serve as the master HMI for the site. Contractor shall provide Ignition Limited Edition software with a Vision module and a minimum of three (3) client licenses. Ignition software must be licensed to GBRA. Contractor shall perform all HMI programming and development. Display all statuses, process values, and control variables for the entire project on the onsite master HMI; all parameters and setpoints

shall be operator adjustable on the onsite master HMI; display PQM ampacities, voltages, and KWH on the onsite master HMI; include minimum three (3) month alarm historian.

12. Pump controllers for water pumping systems shall be Allen-Bradley CompactLogix 5069 PLC with Studio 5000 Logix Designer Software; substitutions are not allowed. OIT shall be Automation Direct CM5-T7W or approved equal. Pump controllers shall be connected to the plant RTU. Pump protection relays must be furnished by the pump manufacturer. Refer to Section 2.1 "Water Pumping Systems" herein for general design requirements.
13. All control panel and MCC control wiring shall be flexible 41 strand tinned copper with 600V insulation; Type SIS for control panels, Type MTW for MCCs. Control wiring from terminal blocks to PLCs shall be size 16 AWG minimum. All other control panel and MCC control wiring shall be size 14 AWG minimum.
14. All other conductors shall be stranded copper XHHW-2.
15. Phase colored insulation is required for all conductors. Phase tape is not allowed.
16. Label wiring with yellow or white heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit. Label each end of all conductors. All printing shall face the panel door and must be visible and unobstructed. Print orientation shall be left to right for horizontal conductors. Print orientation shall be bottom to top for vertical conductors. Printing shall include origin and destination, and equipment and termination for each. Edge of labels shall be ¼" from end of insulation unless such placement will obstruct visibility.
17. Enclosures in climate-controlled areas shall be NEMA 12. Enclosures in buildings/rooms with intake/exhaust fans only shall be NEMA 4. Enclosures mounted on pump skids shall be NEMA 4X FRP, PVC, or stainless steel. Enclosures in chemical areas shall be NEMA 4X FRP or PVC. Enclosures at the headworks or within confined corrosive environments shall be NEMA 4X Type 316 stainless steel. All other enclosures shall be NEMA 4X stainless steel.
18. Electrical panels shall have tinned or silver plated copper bus and 20A minimum bolt-on type circuit breakers.
19. Transformers shall have copper windings.
20. Underground conduit shall be Sch 40 PVC (1" minimum) installed in steel reinforced red-dyed concrete duct banks in accordance with Detail 290. Stub-ups from underground to 6" above finished grade including the 90-degree bends shall be ETL-PVC-001 certified PVC coated GRS conduit in accordance with Detail 260; submit installer certification. Exposed/above ground conduit in chemical areas shall be Sch 40 PVC (¾" minimum). All other exposed/above ground conduit shall be aluminum rigid (¾" minimum).
21. Route conduit inside slabs and building walls, not surface mounted; these conduits shall be Sch 40 PVC (1" minimum); walls of prefabricated fiberglass buildings are exempt from this requirement. Unless noted otherwise, do not penetrate exterior walls, including prefabricated fiberglass buildings.
22. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and stainless steel screws. Snap-on covers are not allowed.
23. Unions shall be aluminum UNF or UNY. Galvanized unions are not allowed.
24. All device boxes shall have stainless steel cover screws.

25. Surface mounted device boxes shall be PVC in chemical areas, all other areas shall be FD type sand cast aluminum.
26. Exterior wall mount light fixtures shall be weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W minimum, bronze finish. Provide one light fixture centered above each door frame.
27. Provide manually-controlled full cutoff LED site lighting in each process area. Pole mounted fixtures shall be 4000K and minimum 15,000 lumens. Poles shall be 4" square hot dip galvanized. Stanchion mounted fixtures shall be 4000K and minimum 5,000 lumens. Provide switches, photocells, and receptacles at all stanchions and poles.

B. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:
   1. Generic Control Narrative (engineer to customize for each project)
   2. Section 13428 Supervisory Control and Data Acquisition (SCADA)
   3. Section 13442 Flanged Magnetic Flow Meters

C. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
   1. Detail 180 --- Antenna Tower
   2. Detail 260 --- Conduit Stubup
   3. Detail 290 --- Duct Bank
   4. Detail 310.1 --- Electrical Shelter Front View
   5. Detail 310.2 --- Electrical Shelter End View
   6. Detail 310.3 --- Electrical Shelter Roof & Wall Detail
   7. Detail 310.4 --- Electrical Shelter Notes & Shaft Details
   8. Detail 320 --- Equipment Pad
   9. Detail 380 --- Grounding
   10. Detail 390.1 --- Hydropneumatic Tank Appurtenances
   11. Detail 390.2 --- Hydropneumatic Tank Design and Control Narrative
   12. Detail 470 --- Pressure Transmitter and Gauge
   13. Detail 530 --- Strut and Clamp

5.6 Lift Stations

A. General
   1. Refer to Section 5.1 herein for general design requirements.
   2. Refer to Section 5.2 herein for general material requirements.
   3. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
   4. Provide a permanent emergency generator and ATS at each lift station. ATS shall be manufactured by ASCO or Russelectric; substitutions are not allowed. Generator and ATS alarms shall be monitored via SCADA.
   5. Provide a Power Quality Meter (PQM) in its own separate enclosure. PTs and CTs shall be installed on the load side of the ATS. PQM shall be Shark Model 200, Modbus RTU or

Ethernet IP compatible, with 10/100 BaseT Ethernet connection; substitutions are not allowed. Display amperage and voltage readings for each phase and KWH on the pump controller OIT and at remote control room(s).

6. Any equipment control panels installed in outdoor locations shall be equipped with a roof and single wall shelter in accordance with Details 310.1. 310.2, 310.3, and 310.4. Orientation of shelter shall be such that panels face east or north with shelter wall on west or south side. Equipment must be within direct line of sight from panel front.
7. Provide a SCADA system appropriate for the applicable service area. All equipment shall be monitored via SCADA. Engineer must submit system design and field radio path studies for GBRA review, comment, and approval. Engineer must obtain GBRA design approval prior to advertising for bids. Coordinate with GBRA to determine service area, site specific requirements, and appropriate equipment. Refer to GBRA Standard Specification Section 13428 and Generic Control Narrative for additional requirements. At a minimum, the following points shall be monitored in the applicable 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 common fault.
    f. Power failure (from load side of ATS).
    g. ATS in emergency.
    h. High float.
    i. Low float.
    j. System in backup.
    k. Daily pump run time hour meter for each pump (display on control room screens, reset daily at noon).
    l. Pump control panel intrusion.
    m. Submersible transmitter level.
    n. Flow meter (instantaneous flow rate and 2-hour peak flows).
    o. RTU battery system low voltage.
    p. Communications fail.
    q. PQM ampacities, voltages, and KWH.
8. Pump controller shall be Allen-Bradley CompactLogix 5069 PLC with Studio 5000 Logix Designer Software; substitutions are not allowed. OIT shall be Automation Direct CM5-T7W or approved equal. Pump protection relays must be furnished by the pump manufacturer.
9. For remote lift stations, the PLC pump controller shall serve as the RTU. For lift stations located at a plant site, the PLC pump controller shall be connected to the plant RTU. In the event Modbus RTU communications must occur between the RTU and a Modbus device, an Allen-Bradley 5069-SERIAL module shall be utilized. In the event Modbus TCP communications must occur between the RTU and a Modbus device, an Anybus or Spectrum Universal Gateway communication module shall be utilized.

10. RTU backup power supply shall be a 24V battery system with a DIN rail mounted PSU. The battery system shall have sufficient capacity to power the RTU for a minimum of four (4) hours duration. Batteries shall be AGM or gel cell rechargeable sealed lead acid. PSU shall be Meanwell DRS-240-24 or equal, with integral battery charging circuit. Provide an alarm to SCADA for battery system low voltage.
11. The primary level control shall be accomplished with the PLC pump controller and a Dwyer Model PBLTX (0-15psi) submersible level transmitter. Primary level control shall operate firm pumps only. Provide a stilling well for the transmitter. Route transmitter conductor cable directly to the pump control panel, not through the wet well junction box. Provide staggered lead/lag/standby pump operation and alternation. Backup level control shall be two floats with relay logic independent of the PLC pump controller. Backup level control shall operate all pumps (firm and standby). Provide one high level float and one low level float. Provide a single rail system for floats. Both floats, when either is activated, shall disengage primary level control, engage and latch in backup level control, 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 high float or HOA position. Pumps shall remain in backup level control until manually reset locally. System in backup alarm shall latch in until manually reset locally; including horn, beacon, and SCADA.
12. Provide operator adjustable start delay relay timers for each pump to stagger starts in hand and auto, and primary and backup level control modes, regardless of power source whether normal or emergency.
13. All control panel and MCC control wiring shall be flexible 41 strand tinned copper with 600V insulation; Type SIS for control panels, Type MTW for MCCs. Control wiring from terminal blocks to PLCs shall be size 16 AWG minimum. All other control panel and MCC control wiring shall be size 14 AWG minimum.
14. All other conductors shall be stranded copper XHHW-2.
15. Phase colored insulation is required for all conductors. Phase tape is not allowed.
16. Label wiring with yellow or white heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit. Label each end of all conductors. All printing shall face the panel door and must be visible and unobstructed. Print orientation shall be left to right for horizontal conductors. Print orientation shall be bottom to top for vertical conductors. Printing shall include origin and destination, and equipment and termination for each. Edge of labels shall be ¼" from end of insulation unless such placement will obstruct visibility.
17. Wet well junction box shall be minimum size 30"H x 24"W x 12"D. Mount bottom of box 24" above top of slab. Install seal-off fittings for all conduits that penetrate the box.
18. Enclosures in climate-controlled areas shall be NEMA 12. Enclosures in buildings/rooms with intake/exhaust fans only shall be NEMA 4. All other enclosures shall be NEMA 4X stainless steel.
19. Electrical panels shall have tinned or silver plated copper bus and 20A minimum bolt-on type circuit breakers.
20. Transformers shall have copper windings.
21. Underground conduit shall be Sch 40 PVC (1" minimum) installed in steel reinforced red-dyed concrete duct banks in accordance with Detail 290. Stub-ups from underground to

6" above finished grade including the 90-degree bends shall be ETL-PVC-001 certified PVC coated GRS conduit in accordance with Detail 260; submit installer certification. Exposed/above ground conduit shall be aluminum rigid (¾" minimum).

22. Route conduit inside slabs and building walls, not surface mounted; these conduits shall be Sch 40 PVC (1" minimum). Unless noted otherwise, do not penetrate exterior walls.
23. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and stainless steel screws. Snap-on covers are not allowed.
24. Unions shall be aluminum UNF or UNY. Galvanized unions are not allowed.
25. All device boxes shall have stainless steel cover screws.
26. Surface mounted device boxes shall be FD type sand cast aluminum.
27. Exterior wall mount light fixtures shall be weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W minimum, bronze finish. Provide one light fixture centered above each door frame.
28. Provide manually-controlled full cutoff LED site lighting in each process area. Pole mounted fixtures shall be 4000K and minimum 15,000 lumens. Poles shall be 4" square hot dip galvanized. Provide switches, photocells, and receptacles at all poles.

B. Refer to Appendix D herein for GBRA standard specifications. Include the following GBRA standard specifications in the design as applicable:
   1. Lift Station Demonstration Testing Procedure
   2. Generic Control Narrative (engineer to customize for each project)
   3. Section 13428 Supervisory Control and Data Acquisition (SCADA)
   4. Section 13442 Flanged Magnetic Flow Meters

C. Refer to Appendix E herein for GBRA standard details. Include the following GBRA standard details in the design as applicable:
   1. Detail 180 --- Antenna Tower
   2. Detail 260 --- Conduit Stubup
   3. Detail 290 --- Duct Bank
   4. Detail 310.1 --- Electrical Shelter Front View
   5. Detail 310.2 --- Electrical Shelter End View
   6. Detail 310.3 --- Electrical Shelter Roof & Wall Detail
   7. Detail 310.4 --- Electrical Shelter Notes & Shaft Details
   8. Detail 320 --- Equipment Pad
   9. Detail 380 --- Grounding
   10. Detail 520 --- Stilling Well
   11. Detail 530 --- Strut and Clamp

SECTION 6: ELECTRICAL, INSTRUMENTATION, AND CONTROLS TESTING

6.1 General

A. All testing shall be performed by the contractor and witnessed by GBRA.

B. All testing shall be arranged and paid for by the contractor.

C. Testing equipment must be calibrated within the previous 12 months.

D. Field and laboratory testing firms shall include GBRA on the distribution list for all test reports related to GBRA facilities.

E. Contractor shall perform pre-testing to verify passing results prior to requesting GBRA inspection.

F. Any work that fails testing must be corrected and retested.

G. Any work that is disturbed must be retested.

H. Perform trench backfill density testing as follows unless specified more stringent by the design engineer or authority with jurisdiction (e.g. HOA/POA, city, county, state, etc.). Test each lift at maximum 100 LF intervals, including unpaved areas, minimum two (2) tests for each lift at all road crossings including but not limited to services and fire hydrant leads, 95% to 102% compaction, +/- 2% optimum moisture, exact locations to be randomly selected by GBRA inspector. Jetting and/or potholing are not allowed. Test each lift prior to installing subsequent lifts. Schedule GBRA to witness testing. Provide copies of test reports to GBRA. Failed lifts shall be removed and recompacted 50 LF each way from test location and shall be retested.

I. Examine grout and concrete work and perform nondestructive testing in accordance with ACI 201.1R and ACI 228.2R. Repair any delamination, voids, cracks, or other defects.

J. Perform mandrel testing of all underground conduits including stubups. Mandrel diameter shall not be less than 80% of conduit inside diameter. Mandrel shall be Condux Short Rubber Slug or approve equal.

K. Megger test line and load conductors of all power circuits prior to termination and submit test reports. Requirement is 50 megaohms minimum.

L. Resistance to ground for site grounding system shall be 5 Ohms or less. Resistance to ground for individual electrodes shall be 25 Ohms or less. Contractor shall perform Fall-of-Potential three-point ground megger testing. Testing must be performed while soil is dry.

M. Simulate a loss of power condition and test each communications battery backup system for a minimum of four (4) hours duration and verify battery system low voltage alarm.

N. Perform onsite load bank testing for emergency generators as follows:

   1. Perform cold start block test at 100% of nameplate kW.
   2. Perform 4-hour load bank testing, 2 hours of which shall be at 100% of nameplate kW.
   3. Refill fuel tank to 90% capacity upon completion of testing.

O. All measuring and/or recording devices and instruments shall be field calibrated by a licensed professional. Contractor shall arrange and pay for calibration and provide copies of calibration certificates to GBRA prior to demonstration testing.

P. Contractor shall perform operational demonstration testing of the entire project and each specified phase thereof. Prior to demonstration testing, contractor shall: (1) retain the services of qualified manufacturer technical representatives to startup, test, and verify all devices, instruments, equipment, and systems are installed properly and are fully functional and calibrated; and (2) submit all O&M manuals in accordance with Section 1.4 herein. Once the contractor verifies the work is ready for demonstration testing, the contractor shall request GBRA to inspect the project. Within ten (10) business days after the inspection, GBRA will endeavor to provide a list of critical items that must be corrected prior to demonstration testing. After the contractor has corrected all critical items, the contractor shall request GBRA to inspect the project. Once all critical items are completed to GBRA's satisfaction, the contractor shall utilize clean water to perform demonstration testing. The demonstration testing must be witnessed by GBRA. During demonstration testing, contractor shall retain the services of qualified manufacturer technical representatives to demonstrate all devices, instruments, equipment, and systems are fully functional and calibrated. Contractor shall coordinate demonstration testing schedule, and any reschedule, with GBRA at least ten (10) business days in advance.

Q. Contractor shall provide onsite training of GBRA operating personnel after successful operational demonstration testing of the entire project and each specified phase thereof. Training shall not occur on the same day as testing. All training must be complete prior to placing the facility, or specified phase thereof, into service and prior to issuing substantial completion. Contractor shall operate the facility, or specified phase thereof, with clean water during training. Contractor shall retain the services of qualified manufacturer technical representatives to conduct the training. These shall be the same manufacturer representatives who performed the respective field installation and functional testing services. Provide training for all devices, instruments, equipment, and systems. Training shall include operation, adjustments, calibration, troubleshooting, and maintenance procedures. Contractor shall coordinate schedule, and any reschedule, with GBRA at least ten (10) business days in advance.

6.2 Water Delivery Points

A. Refer to Section 6.1 herein for general testing requirements.

B. Refer to GBRA Standard Specification Section 13428 for additional requirements.

6.3 Interim Wastewater Treatment Plants

A. Refer to Section 6.1 herein for general testing requirements.

B. Refer to Section 6.5 herein for lift station testing requirements.

6.4 Permanent Wastewater Treatment Plants

A. Refer to Section 6.1 herein for general testing requirements.

B. Refer to Section 6.5 herein for lift station testing requirements.

C. Refer to GBRA Standard Specification Section 13428 for additional requirements.

6.5 Lift Stations

A. Refer to Section 6.1 herein for general testing requirements.

B. Refer to Appendix D herein for the Lift Station Demonstration Testing Procedure.
C. Refer to GBRA Standard Specification Section 13428 for additional requirements.

SECTION 7: ELECTRICAL, INSTRUMENTATION, AND CONTROLS CONSTRUCTION NOTES

7.1 General

A. All work shall be in accordance with approved conformed drawings, specifications and contract documents, NEC, TCEQ rules, AWWA standards, applicable federal, state and local laws, rules and regulations, and shall be in accordance with GBRA Standards and Design Guidelines published on GBRA's Developer Resources web page. In the event of conflict among any such requirements, the most stringent requirement shall apply.

B. Submit all proposed materials in accordance with GBRA Standards and Design Guidelines Section 1.3.

C. A Texas licensed master or journeyman electrician must be on-site to supervise all electrical work, including work performed by subcontractors and vendors.

D. All work must be inspected and approved by GBRA prior to backfilling, closing walls or forms, placing concrete, or otherwise covering the work. This includes crossings by other utilities. Any work that is covered prior to inspection and approval must be uncovered. GBRA will perform a maximum of one (1) inspection daily for one (1) hour duration between 8:00am and 5:00pm excluding weekends and holidays. Advance notice of two (2) business days (48 hours) is required for all inspections. Contractor shall utilize SharePoint to submit all requests for inspections. SharePoint instructions will be provided by GBRA. Contractor shall provide safe access to the work for inspector. Contractor shall provide assistance for inspector to verify lines and grades. Photos will not be accepted as substitute for inspections.

E. Existing water and wastewater systems shall remain in service at all times during construction unless specifically approved otherwise by GBRA. Any work involving tie-ins, shutdowns, power outages, or any other interruptions, must be performed between 8:00am and 5:00pm excluding weekends and holidays, unless specifically approved otherwise by GBRA. All temporary power, bypass pumping, pump and haul, temporary plugs, etc., necessary to maintain system operations and accomplish the work, shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least ten (10) business days in advance.

F. In the event bypass pumping or pump and haul are required, the contractor shall provide a pumping and monitoring plan for GBRA review, comment, and approval. The pumping system for each diversion must be fully redundant and rated for peak flow with the largest pump out of service. The contractor shall furnish, install, operate, and maintain all necessary pumping, plugs, and associated appurtenances including automatic controls and 24-hour remote monitoring or onsite pump watch personnel to ensure that no overflows or spills occur. The contractor shall be responsible for all necessary cleanup and reporting efforts due to failure of equipment or activities associated with the pumping operations contributing to either a surcharge or Sanitary Sewer Overflow (SSO). The cost of any related fines, penalties, or damages and the cost of any effort by GBRA or other third parties to mitigate damages resulting from any surcharging or SSOs shall be the direct and sole responsibility of the contractor.

G. Contractor shall field verify vertical and horizontal location of all existing utilities prior to ordering materials and prior to performing any work. Schedule GBRA to witness. Notify engineer of any discrepancies or conflicts.

H. Contractor shall field verify configuration of all proposed tie-ins to existing facilities prior to ordering materials and prior to performing any work. Schedule GBRA to witness. Notify engineer of any discrepancies or conflicts.

I. Survey staking and layout shall be performed by the contractor for all work. Survey staking and layout must be installed prior to and maintained during performance and inspection of the work. Survey staking and layout shall include vertical and horizontal control at maximum 25-foot station intervals, grade/alignment changes, structures, sitework, equipment, etc. Horizontal offsets shall be 15 feet maximum. Install property pins and stakes. Mark finished grade lines with cut/fill on offset stakes and property stakes. All marks shall face the work.

J. Trench excavation and installation of utilities will not be permitted until subgrade has been established.

K. Maintain a minimum of 10 feet horizontal and 12 inches vertical clearance between electrical and other utilities. Shared trenches are not allowed.

L. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.

M. Base plates shall bear on non-shrink grout unless specifically approved otherwise (e.g. columns, towers, equipment, stanchion pipe supports, light poles, etc.). Shims must be removed and leveling nuts must be lowered during the grouting process. Bevel edges of grout pads at 45-degrees.

N. All outdoor exposed piping 4” and smaller conveying liquids shall be heat traced, insulated, and covered with aluminum jacketing. Heat tracing system shall be controlled by a master thermostat. Self-regulating heating cable is not allowed. Pipes with continuous flow are exempt from this requirement.

O. Provide 6” minimum clearance between concrete penetrations, and between concrete penetrations and concrete joints, as measured from nearest edge to nearest edge.

P. All exposed vertical and horizontal concrete edges shall be formed with ¾” chamfer strips. Sidewalks are exempt from this requirement.

Q. For formed concrete surfaces exposed to weather or earth, rebar clearance shall be 2” minimum. For concrete surfaces cast against earth, rebar clearance shall be 3” minimum. All other rebar clearances shall be 1 1/2” minimum, including clearances from embedded items.

R. Rub finish all exposed vertical concrete surfaces.

S. Provide broom finish and clear sealer for all horizontal concrete surfaces exposed to weather unless noted otherwise. Broom finish shall be parallel to any specified slope. Clean and remove stains from concrete prior to applying sealer.

T. The contractor shall adjust existing electrical facilities to proposed finished grades including but not limited to stubups, manholes, handholes, pull boxes, ground test wells, etc.

U. Existing facilities that are disturbed shall be restored and tested to be in full compliance with current GBRA standards.

V. All restoration must be complete prior to installing tie-ins.

W. All equipment shall be configured to automatically reset after power outages.

X. All PLCs shall be of the same communication type. Provide 10% minimum spare I/O for each PLC; provide expansion I/O modules as necessary.

Y. Any equipment furnished with an OIT shall display all statuses, process values, and control

variables on the OIT. All parameters and setpoints shall be operator adjustable on the OIT. Include minimum one (1) week alarm historian.

Z. Contractor shall perform all PLC, OIT, and HMI programming; software and firmware must be the latest stable version available on the date of project substantial completion. The program for each PLC must be set to load on uninitialized memory.

AA. Contractor shall furnish, install, maintain, and remove temporary fencing and gates as necessary to secure and access the work and to prevent livestock from entering the work area.

BB. Contractor shall perform dewatering as necessary to accomplish the work.

CC. Contractor shall restore and revegetate all disturbed areas.

DD. Unless noted otherwise, contractor shall properly dispose of excess spoils off site in accordance with local laws, ordinances, and regulations.

EE. Burial or burning of refuse is not allowed, contractor shall properly dispose of such material off site in accordance with local laws, ordinances, and regulations.

FF. Explosives and blasting are not allowed.

GG. Submit all items required for final completion in accordance with GBRA Standards and Design Guidelines Section 1.4.

APPENDIX A – DRAWING REQUIREMENTS

1. Drawings shall be 22”x34” full scale and 11”x17” half scale.
2. Survey and coordinate system shall be in NAD 83 State Plane Texas South Central FIPS 4204 Feet.
3. Provide complete project drawing sets including plats and all sheets and all utilities, trades, and disciplines (e.g. dry utilities, roads, grading, storm sewer, water, wastewater, etc.).
4. Include detail sheets for each utility, trade, and discipline.
5. All drawing sets must include a cover sheet with location map and sheet index. The sheet index must include sequential sheet number, drawing number, and drawing title.
6. Each sheet must have the engineer’s seal and dated signature, the date of the plans, and dated revision notes.
7. Each sheet must have an identification block with all pertinent information.
8. Each sheet must have a north arrow, scale callout, and applicable notes.
9. Include sheets for applicable general notes and legends.
10. All drawings must show all existing and proposed street names, street rights-of-way, lot lines, lot numbers, block numbers, easements, utilities, and property lines.
11. All easements must be labeled as to width and type.
12. Recorded easements must be referenced with volume and page numbers. All data must be referenced with applicable names or numbers.
13. Include an overall utilities layout plan sheet showing all utilities, trades, and disciplines. If more than one sheet, include a location map on each sheet. Show and label all existing and proposed underground and surface utilities and facilities. Show all existing and proposed driveways.
14. Include a separate overall layout plan sheet for each utility, trade, and discipline. If more than one sheet, include a location map on each sheet. In a lighter shade, show and label all existing and other proposed underground and surface utilities and facilities. Show all existing and proposed driveways.
15. Overall layout plan sheets must use a scale of 100 feet maximum per inch.
16. Show and label at least three vertical and horizontal survey control points on each overall layout plan sheet.
17. Show and label 100-year flood elevations, and existing and proposed contour lines at a maximum interval of 5 feet, on overall layout sheets and in plan views for each utility, trade, and discipline.
18. Include a location map on each plan and profile sheet for each utility, trade, and discipline.
19. In a lighter shade, show and label all existing and other proposed underground and surface utilities and facilities in plan views for each utility, trade, and discipline.
20. Show all existing and proposed driveways in plan views for each utility, trade, and discipline.
21. In a lighter shade, show and label all existing and proposed landscaping and structures affecting construction in plan views for each utility, trade, and discipline.
22. Show and label all existing and proposed utility crossings in profile views for each utility, trade, and discipline.
23. Show and label existing and proposed finished grade lines in profile views for each utility, trade, and discipline.
24. Include plan and profile sheets for water. Profile all water mains regardless of size.
25. Include plan and profile sheets for wastewater. Profile all wastewater mains regardless of size.
26. Each profile view shall be on the same sheet as the corresponding plan view, with plan view at top of sheet and profile view at bottom of sheet.
27. Acceptable horizontal scales for plan and profile sheets are 10 feet, 20 feet, 40 feet, and 50 feet per inch.

28. Acceptable vertical scales for plan and profile sheets are two feet, four feet, and five feet per inch.
29. Show and label wastewater service laterals in storm and water piping profiles.
30. In a lighter shade, show/overlay water, storm, and dry utilities piping profiles onto wastewater piping profiles and label each accordingly.
31. All water and wastewater mains must be identified by number, letter, or other identification as shown on the overall layout plan sheet(s) and must be identified as to length, size, material, class, grade, direction of flow, and other pertinent data.
32. All appurtenances must be identified by description, size, station, and other pertinent data.
33. All manholes must be identified by letter or number, station, diameter, proposed or existing drops, and other pertinent data.
34. Dimension each water main off back of curb and a right-of-way or property line and show all lengths from fitting to fitting/appurtenance.
35. In profile views, show invert elevations of each main to hundredths of a foot at each fitting, manhole, appurtenance, change of grade, dead end, and every 50 foot station. Show proposed finished grade elevations to hundredths of a foot at every 50 foot station.
36. Profile views of wastewater systems must be drawn from left to right, with low point on left and high point on right. Label manhole “out” inverts and line designations on the left side of manholes. Label manhole “in” inverts and line designations on the right side of manholes.
37. Label rim elevations of manholes in accordance with Detail 600. Show these elevations as “+/-”.
38. Show and label all water service lines and describe them as to station, size, length, domestic or irrigation use, and other pertinent information.
39. Show and label all wastewater service laterals and describe them as to station, size, length, vertical stack, and other pertinent information.
40. Show and label centering of pipe lengths at all water and wastewater crossings. Both pipes shall be centered at each crossing including but not limited to mains, services, fire hydrant leads, appurtenances, etc. For gravity wastewater mains and laterals at water crossings, show and label white color gasketed 150 PSI minimum pressure rated pipe and fittings.
41. Show and label the limits of all casings, bores, tunnels, street cuts, and sidewalk cuts.
42. Details or cross-sections, such as culvert crossings, must be shown on the same sheet if practical or referenced to the applicable sheet.
43. For continuation sheets, include a matchline from one sheet to the next showing sheet number, drawing number, and stationing and invert elevation where applicable.
44. After construction, a set of project record drawings sealed, signed, and dated by the engineer of record, in accordance with Section 1.4 herein, must be submitted prior to acceptance by GBRA.

APPENDIX B – GIS AND CAD DATA
(spatial data submittals must include both GIS and CAD data)

GIS DATA

- GIS data must be submitted as individual shapefiles or in file geodatabase (.gdb) format.
- **Data must be properly projected** (files must include .prj projection files). Any data submitted without defining the projection or improperly projected (i.e. spatially referenced to the wrong location) **will not be accepted**. Verify that GIS shapefiles provided are correctly spatially referenced and aligned with the project location.
- Data must be submitted in one of the following projections:
    - *NAD_1983_2011_StatePlane_Texas_South_Central_FIPS_4204_FtUS (WKID: 6588)*
    - *NAD_1983_StatePlane_Texas_South_Central_FIPS_4204_Feet (WKID: 2278)*
- **Shapefile/feature class names and required attribute fields that must be populated in the table are listed below.** Attribute table values must match what is reflected on the Record Drawings.
    - **Water**
        - **wMain** (transmission or distribution pipeline) [feature type = line]
            - Material (pipe material) [type = text]
            - Diameter (pipe diameter) [type = double]
        - **wService** (service line, as applicable) [feature type = line]
            - Material (pipe material) [type = text]
            - Diameter (pipe diameter) [type = double]
        - **wValve** [feature type = point]
            - Diameter (valve diameter) [type = double]
            - ValveType (valve type) [type = text] (e.g. Air and Vacuum, Air Release, Blow Off, Combination Air, Drain, Flush, Isolation)
        - **wMeter** [feature type = point]
            - MeterSize (size of meter) [type = double]
        - **wTestStation** [feature type = point]
        - **wFitting** [feature type = point]
        - **wHydrant** [feature type = point]
    - **Wastewater**
        - **wwManhole** [feature type = point]
            - ManholeID (same as Manhole ID as labeled on plan sets) [type = text]
            - RimElev (rim elevation value) [type = double]
            - FlowDir (downstream ManholeID) [type = text]
        - **wwCleanout** [feature type = point]
        - **wwValve** [feature type = point]
            - Diameter (valve diameter) [type = double]
            - ValveType (valve type) [type = text] (e.g. Air and Vacuum, Air Release, Blow Off, Combination Air, Drain, Flush, Isolation)
        - **wwTestStation** [feature type = point]
        - **wwFitting** [feature type = point]
        - **wwLiftStation** [feature type = point or polygon]
        - **wwGravityMain** [feature type = line]
            - Material (pipe material) [type = text]
            - Diameter (pipe diameter) [type = double]
            - Slope [type = double]

FromMH (ManholeID of upstream manhole) [type = text]
ToMH (ManholeID of downstream manhole) [type = text]
UpElev (invert elevation of upstream manhole) [type = double]
DownElev (invert elevation of downstream manhole) [type = double]

wwForceMain [feature type = line]
Material (pipe material) [type = text]
Diameter (pipe diameter) [type = double]

wwLateral [feature type = line]
Material (pipe material) [type = text]
Diameter (pipe diameter) [type = double]

- **Land Assets**

LandAsset (property & ROW) [feature type = polygon]
GBRAID (file or internal reference ID) [type = text]
Type (instrument type) [type=text] (e.g., easement, lease, agreement, deed)
PropertyID (appraisal district parcel ID) [type=text]
OwnerName (name of property owner) [type-=text]
Width (easement width) [type = text]
LegalAcres (total acreage from legal description) [type = double]
GISAcres (calculated acreage from spatial data) [type = double]

CAD DATA

- Digital CAD data must be provided as individual point, line, and polygon drawing files. Acceptable CAD file formats include:
  - Autodesk AutoCAD DWG/DXF (AutoCAD 2000 – 2014, Software Version 15.0 – 19.1, or newer)
  - Microstation DGN (Version 5 – 8, or newer)
- **All CAD files must be exported with an applied spatial reference**. CAD data must include a projection file (.prj) and a world file (.wld or .wld3). Any data submitted without defining the projection or improperly projected (i.e. spatially referenced to the wrong location) **will not be accepted**. Verify that CAD files provided are correctly spatially referenced and aligned with the project location.
- CAD files must be submitted in one of the following projections:
  - *NAD_1983_2011_StatePlane_Texas_South_Central_FIPS_4204_FtUS (WKID: 6588)*
  - *NAD_1983_StatePlane_Texas_South_Central_FIPS_4204_Feet (WKID: 2278)*
- CAD data files must have tabular attribution (fields and values populated in the layer table), including a Layer and/or Reference name field that identifies the feature types within the file.
- Coordinate with your internal engineers, CAD technicians and/or GIS professionals to ensure that the CAD data provided can be opened in GIS desktop software with correct spatial reference location and proper tabular attribution to distinguish linear assets within the project. All data must be accessible in a GIS environment.

For questions or clarification, please contact:
Mysti Downing, GBRA GIS Manager (830-560-3954, mdowning@gbra.org)
Samantha Huykman, GBRA GIS Analyst (830-560-3976, shuykman@gbra.org)

APPENDIX C – GENERIC SPARE PARTS LIST

The engineer shall specify spare parts for the following typical items, as applicable, to be provided by the contractor. Additional spare parts requirements will be evaluated by GBRA during design review based on the equipment proposed. Spare parts requirements shall be listed in each pertinent specification section or in a separate specification section dedicated to spare parts for the entire project.

1. Electrical, Controls & SCADA
   a. One (1) radio of each type and size
   b. One (1) antenna of each type and size
   c. One (1) PLC of each type and size
   d. One (1) I/O module of each type and size
   e. One (1) communication module of each type and size
   f. One (1) OIT/HMI of each type and size
   g. One (1) electronic backup copy of programming (refer to Section 1.4 herein)
   h. One (1) float of each type and size
   i. One (1) circuit breaker of each type and size
   j. Relays (30% of each type and size)
   k. Fuses (30% of each type and size)
   l. Lamps for push-to-test indicator lights (30% of each type and size)
2. Lift Stations
   a. One (1) chain grip eye
   b. Two (2) hatch slam lock keys
   c. One (1) float of each type and size
   d. One (1) submersible level transmitter of each type, size, and range
   e. One (1) PLC of each type and size
   f. One (1) I/O module of each type and size
   g. One (1) communication module of each type and size
   h. One (1) OIT of each type and size
   i. One (1) electronic backup copy of programming (refer to Section 1.4 herein)
   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 and size)
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 and size
   d. One (1) I/O module of each type and size
   e. One (1) communication module of each type and size
   f. One (1) OIT of each type and size
   g. One (1) electronic backup copy of programming (refer to Section 1.4 herein)
   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 and size)

4. Blowers
    a. One (1) pressure transmitter of each type, size, and range
    b. Two (2) sets of belts and/or couplings
    c. Oil and/or grease for one (1) change for each blower
    d. One (1) air inlet filter for each blower
    e. One (1) circuit breaker of each type and size
    f. Relays (30% of each type and size)
    g. Fuses (30% of each type and size)
    h. Lamps for push-to-test indicator lights (30% of each type and size)
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 and size)
6. Peristaltic Pumps
    a. One (1) pump head or five (5) pump tubes, whichever is applicable, of each type and size
7. Digesters
    a. One (1) float of each type and size
8. Chlorination
    a. One (1) Chlorine Institute Emergency Kit
    b. One (1) standard PM kit for each 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 and size
    e. One (1) I/O module of each type and size
    f. One (1) communication module of each type and size
    g. One (1) OIT of each type and size
    h. One (1) electronic backup copy of programming (refer to Section 1.4 herein)
    i. One (1) circuit breaker of each type and size
    j. Relays (30% of each type and size)
    k. Fuses (30% of each type and size)
    l. Lamps for push-to-test indicator lights (30% of each type and size)
10. Air Compressor
    a. One (1) belt
    b. One (1) change of oil
    c. One (1) filter of each type and size
    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 and size)

11. Water Pumping Systems
    a. Oil and/or grease for one (1) change for each pump
    b. One (1) pressure transmitter of each type, size, and range
    c. One (1) PLC of each type and size
    d. One (1) I/O module of each type and size
    e. One (1) communication module of each type and size
    f. One (1) OIT of each type and size
    g. One (1) electronic backup copy of programming (refer to Section 1.4 herein)
    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 and size)
12. Generators
    a. One (1) belt of each type and size
    b. One (1) filter of each type and size
13. Electronic Control Valves
    a. One (1) solenoid valve of each type and size
    b. One (1) position transmitter of each type and size

APPENDIX D – GBRA STANDARD SPECIFICATIONS

Lift Station Demonstration Testing Procedure

The procedure below is typical for triplex stations with mix/flush valves. The contractor shall include testing of any additional equipment and associated control functionality (additional pumps, propeller type mixer, variable frequency drives, etc.). Primary level control shall operate firm pumps only. Backup level control shall operate all pumps (firm and standby).

Pull Pumps

1) Pull each pump. Verify make, model, rotation, mix/flush valves, guide rails, supports, and hoist. Install mix/flush valves after successful draw down testing.

Verify Valves

2) Verify size, make, model, flow direction, and function of plug valves, check valves, and air release valves.

Level Setpoints

3) Verify submersible level transmitter make, model, range, installation height, cord grip, hook, calibration, and PLC pump controller parameters.
4) Verify high float installation height, cord grip, hook.
5) Verify low float installation height, cord grip, hook.

Primary Level Control

6) Turn all HOA switches to off, verify run status and HOA status via SCADA.
7) Adjust setpoints to conserve test water if necessary.
8) Acknowledge/clear all panel, PLC pump controller, and SCADA alarms.
9) Fill wet well above pumps off setpoint, but below lead on setpoint.
10) Turn all HOA switches to auto, verify run status and HOA status via SCADA.
11) 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.
12) 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. Repeat for third pump.
13) 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.
14) Turn all HOA switches to off, verify run status and HOA status via SCADA.
15) Fill wet well above lag on setpoint, but below high float.
16) Turn all HOA switches to auto, verify staggered start of lead and lag pumps, verify standby pump not running, verify run status and HOA status via SCADA, verify pumps off setpoint.

Backup Level Control – Low Float First

17) Turn all HOA switches to off, verify run status and HOA status via SCADA.
18) Fill wet well above lag on setpoint, but below high float.
19) Turn all HOA switches to auto, verify staggered start of lead and lag pumps, verify standby pump not running, verify run status and HOA status via SCADA.

20) Drop low float, verify lead and lag pumps stop, verify standby pump not running, verify transfer to backup controls latched in, verify system in backup alarm latched in local and SCADA, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
21) 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 low alarm cleared local and SCADA, verify run status and HOA status via SCADA.
22) Lift high float, verify staggered start of all pumps (lead, lag, and standby), verify backup controls latched in, verify system in backup alarm latched in local and SCADA, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
23) Drop high float, verify all pumps still running, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify high alarm cleared local and SCADA, verify run status and HOA status via SCADA.
24) Drop low float, verify all pumps stop, verify backup controls latched in, verify system in backup alarm latched in local and SCADA, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
25) 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 low alarm cleared local and SCADA, verify run status and HOA status via SCADA.
26) Reset to primary level control, verify staggered start of lead and lag pumps to complete previous auto cycle, verify standby pump not running, 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.

<u>Backup Level Control – High Float First</u>

27) Fill wet well above pumps off setpoint, but below lead on setpoint.
28) Lift high float, verify staggered start of all pumps (lead, lag, and standby), verify transfer to backup controls latched in, verify system in backup alarm latched in local and SCADA, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
29) Drop high float, verify all pumps still running, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify high alarm cleared local and SCADA, verify run status and HOA status via SCADA.
30) Drop low float, verify all pumps stop, verify backup controls latched in, verify system in backup alarm latched in local and SCADA, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
31) 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 low alarm cleared local and SCADA, verify run status and HOA status via SCADA.
32) Reset to primary level control, wait for start delay timers, 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.

<u>Backup Level Control – High Float Stuck Raised</u>

33) Fill wet well above pumps off setpoint, but below lead on setpoint.
34) Lift high float, verify staggered start of all pumps start (lead, lag, and standby), verify transfer to backup

controls latched in, verify system in backup alarm latched in local and SCADA, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.

35) With high float still lifted drop low float, verify all pumps stop, verify backup controls latched in, verify system in backup alarm latched in local and SCADA, verify high and low alarms horn and beacon and SCADA, verify run status and HOA status via SCADA.

36) Drop high float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in local and SCADA, verify low alarm horn and beacon and SCADA, verify high alarm cleared local and SCADA, verify run status and HOA status via SCADA.

37) 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 low alarm cleared local and SCADA, verify run status and HOA status via SCADA.

38) Reset to primary level control, wait for start delay timers, 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

39) Verify each pump starts and stops in hand.

Draw Down Testing

40) Perform wet well draw down testing for each pump individually and for each combination of pumps. Start and stop within normal operating range shown on construction drawings. Record flanged magnetic flow meter instantaneous and totalizer readings local and SCADA for each run cycle. Record static and dynamic discharge pressures for each run cycle. Record vertical distance from pump discharge flanges to pressure gauge. Verify specified TDH and flow rates for each pump individually and for each combination of pumps. Verify accuracy of flanged magnetic flow meter instantaneous and totalizer readings, verify local and SCADA match. Verify accuracy of PQM readings.

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 start of lead and lag pumps, verify standby pump not 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 supply of emergency power via SCADA. Verify the station automatically returns to primary level control. Verify staggered start of lead and lag pumps, verify standby pump not running, verify run status and HOA status via SCADA.

45) Restore normal power. Verify the station automatically returns to primary level control.

46) Demonstrate power loss in backup level control. Verify the station remains in backup level control.

47) Turn generator HOA to off position. Open the service main disconnect switch. Verify power fail alarm via SCADA.

Other

48) Verify pump control panel intrusion alarm via SCADA.

49) Verify each motor protection relay fault and alarms local and SCADA.

50) Verify all other SCADA points and HMI/OIT features.

Generic Control Narrative

(engineer to customize for each project)

INFLUENT LIFT STATION

EQUIPMENT:

- (3) 20HP 3Ø 480V SUBMERSIBLE PUMPS
- (3) FULL VOLTAGE NON-REVERSING STARTERS
- (3) PUMP START DELAY RELAY TIMERS, OPERATOR ADJUSTABLE, SET AS FOLLOWS:
  - PUMP 1: 15 SECONDS
  - PUMP 2: 30 SECONDS
  - PUMP 3: 45 SECONDS
- (1) SUBMERSIBLE MIXER
- (1) MIXER RUN TIMER, OPERATOR ADJUSTABLE, SET TO 20 SECONDS
- (1) VENDOR SUPPLIED CONTROL PANEL WITH PLC PUMP CONTROLLER AND OIT
- (1) LIFT STATION JUNCTION BOX

INSTRUMENTATION:

- (1) POWER QUALITY METER
- (1) FLANGED MAGNETIC FLOW METER (4-20MA OUTPUT)
- (1) SUBMERSIBLE LEVEL TRANSMITTER IN STILLING WELL (4-20MA OUTPUT)
- (1) LOW LEVEL BACKUP FLOAT
- (1) HIGH LEVEL BACKUP FLOAT
- (1) MOISTURE SENSOR ON EACH PUMP, MFG SUPPLIED NO/NC CONTACT
- (1) TEMPERATURE SENSOR ON EACH PUMP, MFG SUPPLIED NO/NC CONTACT
- (4) ELAPSED TIME METERS (ONE FOR EACH PUMP AND MIXER)

NORMAL SEQUENCE OF OPERATION (VIA LEVEL TRANSMITTER):

- WET WELL BEGINS FILLING.
- WHEN THE SETPOINT FOR LEAD PUMP CALL TO RUN IS REACHED, START THE MIXER AND LEAD PUMP.
- IF THE SETPOINT FOR LAG PUMP CALL TO RUN IS REACHED, START THE LAG PUMP.
- THE STANDBY PUMP SHALL NOT BE ACTIVATED BY THE NORMAL SEQUENCE OF OPERATION.
- OPERATE UNTIL BASIN LEVEL REACHES PUMP SHUTDOWN SETPOINT.
- ALTERNATE LEAD, LAG, AND STANDBY PUMPS.

OPERATION VIA BACKUP FLOATS:

- IF THE WET WELL LEVEL REACHES THE HIGH LEVEL FLOAT, START THE MIXER AND ALL PUMPS INCLUDING STANDBY PUMP.
- ALL PUMPS SHALL OPERATE UNTIL THE WET WELL IS PUMPED DOWN TO THE LOW LEVEL FLOAT.
- ACTIVATION OF EITHER HIGH LEVEL OR LOW LEVEL FLOAT SHALL DISENGAGE LEVEL TRANSMITTER CONTROLS, PROVIDE ALARMS TO SCADA, AND ACTIVATE HORN AND STROBE IN ACCORDANCE WITH GBRA STANDARDS.
- SYSTEM SHALL OPERATE ON FLOATS ONLY UNTIL MANUALLY RESET LOCALLY BY AN OPERATOR.

MANUAL OPERATION:

- WHEN THE LOCAL CONTROL PANEL IS SWITCHED FROM “REMOTE” TO “LOCAL”, LOCAL RUN AND STOP BUTTONS SHALL BE UTILIZED TO START THE PUMPS.
- LOW FLOAT SHALL STOP ALL PUMPS IN BOTH "REMOTE" AND “LOCAL” MODE.

LIFT STATION OIT PROGRAMMING:

- DISPLAY ALL STATUSES, PROCESS VALUES, AND CONTROL VARIABLES ON THE OIT. ALL PARAMETERS AND SETPOINTS SHALL BE OPERATOR ADJUSTABLE ON THE OIT. INCLUDE MINIMUM ONE (1) WEEK ALARM HISTORIAN.

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SETPOINTS
- ALL PUMPS OFF LEVEL SETPOINT (FEET, 2 DECIMAL PLACES)
- LEAD PUMP ON LEVEL SETPOINT (FEET, 2 DECIMAL PLACES)
- LAG PUMP ON LEVEL SETPOINT (FEET, 2 DECIMAL PLACES)

DATA AND ALARMS
- PUMP 1 RUN STATUS
- PUMP 2 RUN STATUS
- PUMP 3 RUN STATUS
- PUMP 1 IN HAND
- PUMP 2 IN HAND
- PUMP 3 IN HAND
- PUMP 1 IN AUTO
- PUMP 2 IN AUTO
- PUMP 3 IN AUTO
- PUMP 1 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 2 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 3 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 1 RUN HOURS (1 DECIMAL PLACE)
- PUMP 2 RUN HOURS (1 DECIMAL PLACE)
- PUMP 3 RUN HOURS (1 DECIMAL PLACE)
- MIXER RUN STATUS
- MIXER IN HAND
- MIXER IN AUTO
- MIXER COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- MIXER RUN HOURS (1 DECIMAL PLACE)
- PHASE FAULT ALARM
- POWER QUALITY METER AMPS (PER PHASE)
- FLOW METER INSTANTANEOUS FLOW RATE (GPM, INTEGER)
- FLOW METER TOTALIZED FLOW (GALLONS, INTEGER)
- FLOW METER 2-HOUR PEAK FLOWS (GPM, INTEGER)
- COMMUNICATIONS FAIL ALARM
- WET WELL LEVEL (FEET, 2 DECIMAL PLACES)
- HIGH LEVEL FLOAT ALARM
- LOW LEVEL FLOAT ALARM
- OPERATING ON BACKUP FLOATS ALARM

GBRA CONTROL ROOM PROGRAMMING:
- PUMP 1 RUN STATUS
- PUMP 2 RUN STATUS
- PUMP 3 RUN STATUS
- PUMP 1 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 2 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 3 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- MIXER RUN STATUS
- MIXER COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PHASE FAULT ALARM

- FLOW METER INSTANTANEOUS FLOW RATE (GPM, INTEGER)
- FLOW METER 2-HOUR PEAK FLOWS (GPM, INTEGER)
- COMMUNICATIONS FAIL ALARM
- WET WELL LEVEL (FEET, 2 DECIMAL PLACES)
- HIGH LEVEL FLOAT ALARM
- LOW LEVEL FLOAT ALARM
- OPERATING ON BACKUP FLOATS ALARM

HEADWORKS

EQUIPMENT:
- 2HP 3Ø 480V DRIVE MOTOR
- VENDOR SUPPLIED CONTROL PANEL WITH OIT
- REVERSING STARTERS
- ELAPSED TIME METER

INSTRUMENTATION:
- SOLENOID VALVES
- FLOAT SWITCHES

NORMAL SEQUENCE OF OPERATION:
- VENDOR SUPPLIED CONTROL PANEL IS SET TO “AUTO”

MANUAL OPERATION:
- VENDOR SUPPLIED CONTROL PANEL IS SET TO “MANUAL”

HEADWORKS OIT PROGRAMMING:
- DISPLAY ALL STATUSES, PROCESS VALUES, AND CONTROL VARIABLES ON THE OIT. ALL PARAMETERS AND SETPOINTS SHALL BE OPERATOR ADJUSTABLE ON THE OIT. INCLUDE MINIMUM ONE (1) WEEK ALARM HISTORIAN.

PLANT HMI PROGRAMMING:
- HEADWORKS DRIVE MOTOR RUN STATUS
- HEADWORKS DRIVE MOTOR RUN HOURS (1 DECIMAL PLACE)
- HEADWORKS AUTO STATUS
- HEADWORKS COMMON FAULT ALARM
- HEADWORKS HIGH LEVEL FLOAT ALARM

GBRA CONTROL ROOM PROGRAMMING:
- HEADWORKS HIGH LEVEL FLOAT ALARM
- HEADWORKS COMMON FAULT ALARM

AERATION

EQUIPMENT:
- (5) 60HP 3Ø 480V BELT DRIVEN BLOWERS
- (5) SOLID STATE REDUCED VOLTAGE STARTERS
- (5) POWER FACTOR CORRECTION CAPACITORS
- (5) DISCONNECT SWITCHES
- (5) LOCAL BLOWER CONTROL PANELS
- (5) START DELAY RELAY TIMERS, OPERATOR ADJUSTABLE, SET AS FOLLOWS:
    - BLOWER 1: 10 SECONDS
    - BLOWER 2: 20 SECONDS
    - BLOWER 3: 30 SECONDS
    - BLOWER 4: 40 SECONDS
    - BLOWER 5: 50 SECONDS

INSTRUMENTATION:
- (1) PRESSURE TRANSMITTER IN AIR MANIFOLD (4-20MA OUTPUT)
- (5) ELAPSED TIME METERS
- (5) CURRENT MONITORS

NORMAL SEQUENCE OF OPERATION:
- OPERATOR WILL MANUALLY START THE REQUIRED NUMBER OF BLOWERS FOR THE DESIRED AMOUNT OF PROCESS AIR.
- BLOWERS CAN BE STARTED LOCALLY OR REMOTELY FROM THE OPERATIONS BUILDING.

MANUAL OPERATION:
- SEE “NORMAL SEQUENCE OF OPERATION”

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SETPOINTS
- BLOWER 1 NO LOAD SETPOINT (AMPS, 1 DECIMAL PLACE)
- BLOWER 2 NO LOAD SETPOINT (AMPS, 1 DECIMAL PLACE)
- BLOWER 3 NO LOAD SETPOINT (AMPS, 1 DECIMAL PLACE)
- BLOWER 4 NO LOAD SETPOINT (AMPS, 1 DECIMAL PLACE)
- BLOWER 5 NO LOAD SETPOINT (AMPS, 1 DECIMAL PLACE)
- BLOWER SYSTEM AIR MANIFOLD LOW PRESSURE ALARM SETPOINT (PSI, 1 DECIMAL PLACE)

DATA AND ALARMS
- BLOWER 1 RUN STATUS
- BLOWER 2 RUN STATUS
- BLOWER 3 RUN STATUS
- BLOWER 4 RUN STATUS
- BLOWER 5 RUN STATUS
- BLOWER 1 COMMON FAULT ALARM
- BLOWER 2 COMMON FAULT ALARM
- BLOWER 3 COMMON FAULT ALARM
- BLOWER 4 COMMON FAULT ALARM
- BLOWER 5 COMMON FAULT ALARM
- BLOWER 1 RUN HOURS (1 DECIMAL PLACE)
- BLOWER 2 RUN HOURS (1 DECIMAL PLACE)
- BLOWER 3 RUN HOURS (1 DECIMAL PLACE)
- BLOWER 4 RUN HOURS (1 DECIMAL PLACE)
- BLOWER 5 RUN HOURS (1 DECIMAL PLACE)
- BLOWER 1 OPERATING AMPS (1 DECIMAL PLACE)
- BLOWER 2 OPERATING AMPS (1 DECIMAL PLACE)
- BLOWER 3 OPERATING AMPS (1 DECIMAL PLACE)
- BLOWER 4 OPERATING AMPS (1 DECIMAL PLACE)

- BLOWER 5 OPERATING AMPS (1 DECIMAL PLACE)
- BLOWER SYSTEM AIR MANIFOLD OPERATING PRESSURE (PSI, 1 DECIMAL PLACE)
- BLOWER SYSTEM AIR MANIFOLD LOW PRESSURE ALARM

GBRA CONTROL ROOM PROGRAMMING:

- BLOWER 1 RUN STATUS
- BLOWER 2 RUN STATUS
- BLOWER 3 RUN STATUS
- BLOWER 4 RUN STATUS
- BLOWER 5 RUN STATUS
- BLOWER 1 COMMON FAULT ALARM
- BLOWER 2 COMMON FAULT ALARM
- BLOWER 3 COMMON FAULT ALARM
- BLOWER 4 COMMON FAULT ALARM
- BLOWER 5 COMMON FAULT ALARM
- BLOWER SYSTEM AIR MANIFOLD LOW PRESSURE ALARM

CLARIFIERS

EQUIPMENT:
- (2) 1/2HP 3Ø 480V DRIVE MOTOR
- (2) VENDOR SUPPLIED CONTROL PANEL

INSTRUMENTATION:
- (2) OVER TORQUE SWITCH
- (2) ELAPSED TIME METER

NORMAL SEQUENCE OF OPERATION:
- CLARIFIER DRIVE RUNS 24/7. ONCE MCP AT LOCAL CONTROL PANEL AND ON/OFF SWITCH AT LOCAL CONTROL PANEL ARE TURNED ON, DRIVE IS ENERGIZED AND OPERATING.

MANUAL OPERATION:
- SEE “NORMAL SEQUENCE OF OPERATION”

PLANT HMI PROGRAMMING:
- CLARIFIER 1 DRIVE RUN STATUS
- CLARIFIER 2 DRIVE RUN STATUS
- CLARIFIER 1 DRIVE NOT RUNNING ALARM
- CLARIFIER 2 DRIVE NOT RUNNING ALARM
- CLARIFIER 1 DRIVE RUN HOURS (1 DECIMAL PLACE)
- CLARIFIER 2 DRIVE RUN HOURS (1 DECIMAL PLACE)

GBRA CONTROL ROOM PROGRAMMING:
- CLARIFIER 1 DRIVE NOT RUNNING ALARM
- CLARIFIER 2 DRIVE NOT RUNNING ALARM

ACH FEED

EQUIPMENT:
- (3) PERISTALTIC METERING PUMPS

INSTRUMENTATION:
- (1) ULTRASONIC LEVEL MEASUREMENT OF ACH TANK WITH LOCAL DISPLAY

NORMAL SEQUENCE OF OPERATION:
- ACH FEED IS ACCOMPLISHED VIA PERISTALTIC METERING PUMPS. METERING PUMPS SHALL RECEIVE FLOW PACING SIGNAL FROM THE ULTRASONIC FLOW METER AT THE CHLORINE CONTACT BASIN WEIR.
- DURING NORMAL OPERATION, EACH METERING PUMP WILL VARY PUMPING RATE BETWEEN TWO OPERATOR DEFINED SETPOINTS.
- PUMP 1 SHALL RECEIVE A FLOW PACING SIGNAL FROM THE ULTRASONIC FLOW METER AT THE CHLORINE CONTACT BASIN 1 WEIR.
- PUMP 2 SHALL BE EQUIPPED WITH A SELECTOR SWITCH TO RECEIVE A FLOW PACING SIGNAL FROM THE ULTRASONIC FLOW METER AT EITHER THE CHLORINE CONTACT BASIN 1 WEIR OR THE CHLORINE CONTACT BASIN 2 WEIR.
- PUMP 3 SHALL RECEIVE A FLOW PACING SIGNAL FROM THE ULTRASONIC FLOW METER AT THE CHLORINE CONTACT BASIN 2 WEIR.

INTERSYSTEM FAULT OPERATION:
- LOSS OF FLOW PACING SIGNAL SHALL RESULT IN MAINTAINING THE CURRENT PUMPING RATE. LOSS OF FLOW PACING SIGNAL SHALL RESULT IN A SCADA ALARM UNLESS THE LOSS OF SIGNAL IS CAUSED BY THE ATS SWITCHING TO GENERATOR POWER OR BACK TO UTILITY POWER.

MANUAL OPERATION:
- LOCAL TO PERISTALTIC PUMP.

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SETPOINTS
- ACH PUMP 1 MINIMUM FLOW RATE SETPOINT (GPD, 2 DECIMAL PLACES)
- ACH PUMP 1 MAXIMUM FLOW RATE SETPOINT (GPD, 2 DECIMAL PLACES)
- ACH PUMP 2 MINIMUM FLOW RATE SETPOINT (GPD, 2 DECIMAL PLACES)
- ACH PUMP 2 MAXIMUM FLOW RATE SETPOINT (GPD, 2 DECIMAL PLACES)
- ACH PUMP 3 MINIMUM FLOW RATE SETPOINT (GPD, 2 DECIMAL PLACES)
- ACH PUMP 3 MAXIMUM FLOW RATE SETPOINT (GPD, 2 DECIMAL PLACES)

DATA AND ALARMS
- ACH PUMP 1 RUN STATUS
- ACH PUMP 2 RUN STATUS
- ACH PUMP 3 RUN STATUS
- ACH PUMP 1 COMMON FAULT ALARM
- ACH PUMP 2 COMMON FAULT ALARM
- ACH PUMP 3 COMMON FAULT ALARM
- ACH PUMP 1 RUN HOURS (1 DECIMAL PLACE)
- ACH PUMP 2 RUN HOURS (1 DECIMAL PLACE)
- ACH PUMP 3 RUN HOURS (1 DECIMAL PLACE)
- ACH PUMP 1 PUMPING RATE (GPD, 2 DECIMAL PLACES)
- ACH PUMP 2 PUMPING RATE (GPD, 2 DECIMAL PLACES)
- ACH PUMP 3 PUMPING RATE (GPD, 2 DECIMAL PLACES)
- ACH PUMP 1 LOSS OF FLOW PACING SIGNAL ALARM
- ACH PUMP 2 LOSS OF FLOW PACING SIGNAL ALARM
- ACH PUMP 3 LOSS OF FLOW PACING SIGNAL ALARM
- ACH TANK LEVEL (FEET, 2 DECIMAL PLACES)

GBRA CONTROL ROOM PROGRAMMING:

- ACH PUMP 1 COMMON FAULT ALARM
- ACH PUMP 2 COMMON FAULT ALARM
- ACH PUMP 3 COMMON FAULT ALARM

DIGESTERS

INSTRUMENTATION:

- (1) HIGH LEVEL FLOAT IN DIGESTER 1
- (1) HIGH LEVEL FLOAT IN DIGESTER 3

PLANT HMI PROGRAMMING:

DATA AND ALARMS

- DIGESTERS 1 & 2 HIGH LEVEL FLOAT ALARM
- DIGESTERS 3 & 4 HIGH LEVEL FLOAT ALARM

GBRA CONTROL ROOM PROGRAMMING:

- DIGESTERS 1 & 2 HIGH LEVEL FLOAT ALARM
- DIGESTERS 3 & 4 HIGH LEVEL FLOAT ALARM

SLUDGE DEWATERING

EQUIPMENT:
- (2) 7.5HP 3Ø 460V PUMPS
- (2) VARIABLE FREQUENCY DRIVES
- (2) PERISTALTIC METERING PUMPS
- (1) VENDOR SUPPLIED CONTROL PANEL

INSTRUMENTATION:
- (1) FLANGED MAGNETIC FLOW METER (4-20MA OUTPUT)

NORMAL SEQUENCE OF OPERATION:
- SLUDGE DEWATERING SYSTEM IS OPERATED VIA LOCAL CONTROL PANEL.
- SPEED REFERENCE FOR BOTH VFDS IS PROVIDED BY AN OPERABLE KNOB ON THE LOCAL CONTROL PANEL.
- DISPLAY FOR THE MAGNETIC FLOW METER IS INTEGRATED INTO THE LOCAL CONTROL PANEL.
- START COMMAND TO BOTH PERISTALTIC METERING PUMPS IS INITIATED WHEN THE OPERATOR MANUALLY STARTS EITHER OF THE SLUDGE PUMPS.
- FLOW RATE FROM THE MAGNETIC FLOW METER IS PROVIDED TO BOTH PERISTALTIC METERING PUMPS THROUGH THE CONTROL SYSTEM FOR CONTROL OF POLYMER INJECTION RATE.
- DURING NORMAL OPERATION, A SINGLE METERING PUMP WILL VARY PUMPING RATE BETWEEN TWO OPERATOR DEFINED SET POINTS. OPERATOR WILL ENABLE THE DESIRED PUMP.

GENERATOR POWER OPERATION:
- SLUDGE PUMPS MAY BE OPERATED ON GENERATOR POWER, HOWEVER IT IS NOT INTENDED THAT SLUDGE PUMPS BE LEFT ON DURING GENERATOR START AND ATS TRANSFER. VFDS WILL BE PROGRAMMED FOR A 60 SECOND WAIT TIME AFTER POWER IS RESTORED TO RESUME OPERATION IF A CALL TO RUN COMMAND IS STILL PRESENT. HALT PERISTALTIC PUMPS UNTIL SLUDGE PUMPS RESUME OPERATION.

MANUAL OPERATION:
- SEE “NORMAL SEQUENCE OF OPERATION”

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SET POINTS

SET POINT # 1:
- FLOW RATE AT ONSET OF PUMPING (GPH, 2 DECIMAL PLACES)

SET POINT # 2:
- FLOW RATE AT MAXIMUM PUMPING (GPH, 2 DECIMAL PLACES)

DATA AND ALARMS
- SLUDGE PUMP 1 RUN STATUS
- SLUDGE PUMP 2 RUN STATUS
- SLUDGE PUMP 1 COMMON FAULT
- SLUDGE PUMP 2 COMMON FAULT
- SLUDGE PUMP 1 RUN HOURS (1 DECIMAL PLACE)
- SLUDGE PUMP 2 RUN HOURS (1 DECIMAL PLACE)
- POLYMER PUMP 1 RUN STATUS
- POLYMER PUMP 2 RUN STATUS
- POLYMER PUMP 1 COMMON FAULT
- POLYMER PUMP 2 COMMON FAULT
- POLYMER PUMP 1 RUN HOURS (1 DECIMAL PLACE)
- POLYMER PUMP 2 RUN HOURS (1 DECIMAL PLACE)
- POLYMER PUMP 1 PUMPING RATE (GPH, 1 DECIMAL PLACE)
- POLYMER PUMP 2 PUMPING RATE (GPH, 1 DECIMAL PLACE)

- FLOW METER INSTANTANEOUS FLOW RATE (GPM, 1 DECIMAL PLACE)
- FLOW METER TOTALIZED FLOW (GALLONS, INTEGER)
- DIGESTER HIGH LEVEL ALARM FLOAT

GBRA CONTROL ROOM PROGRAMMING:

- NONE

CHLORINE CONTACT BASINS

EQUIPMENT:
- (1) V-NOTCH WEIR AT CONTACT BASIN 1
- (1) V-NOTCH WEIR AT CONTACT BASIN 2

INSTRUMENTATION:
- (1) ULTRASONIC FLOW METER AT CHLORINE CONTACT BASIN 1 WEIR (4-20MA OUTPUT)
- (1) ULTRASONIC FLOW METER AT CHLORINE CONTACT BASIN 2 WEIR (4-20MA OUTPUT)

NORMAL SEQUENCE OF OPERATION:
- SEE ACH FEED.
- SEE CHLORINE FEED.

MANUAL OPERATION:
- SEE ACH FEED.
- SEE CHLORINE FEED.

PLANT HMI PROGRAMMING:

DATA AND ALARMS
- CHLORINE CONTACT BASIN 1 WEIR INSTANTANEOUS FLOW RATE (GPM, 1 DECIMAL PLACE)
- CHLORINE CONTACT BASIN 2 WEIR INSTANTANEOUS FLOW RATE (GPM, 1 DECIMAL PLACE)
- CHLORINE CONTACT BASIN 1 WEIR TOTALIZED FLOW (GALLONS, INTEGER)
- CHLORINE CONTACT BASIN 2 WEIR TOTALIZED FLOW (GALLONS, INTEGER)
- CHLORINE CONTACT BASIN 1 WEIR 2-HOUR PEAK FLOWS (GPM, INTEGER)
- CHLORINE CONTACT BASIN 2 WEIR 2-HOUR PEAK FLOWS (GPM, INTEGER)

GBRA CONTROL ROOM PROGRAMMING:
- CHLORINE CONTACT BASIN 1 WEIR INSTANTANEOUS FLOW RATE (GPM, 1 DECIMAL PLACE)
- CHLORINE CONTACT BASIN 2 WEIR INSTANTANEOUS FLOW RATE (GPM, 1 DECIMAL PLACE)
- CHLORINE CONTACT BASIN 1 WEIR 2-HOUR PEAK FLOWS (GPM, INTEGER)
- CHLORINE CONTACT BASIN 2 WEIR 2-HOUR PEAK FLOWS (GPM, INTEGER)

CHLORINE FEED

EQUIPMENT:
- (2) AUTOMATIC CHLORINATORS
- (1) MANUAL CHLORINATOR
- (2) ELECTRIC ACTUATED BALL VALVE WITH AUXILIARY CONTACTS FOR OPEN AND CLOSED STATES
- (1) INTAKE FAN

INSTRUMENTATION:
- (1) CHLORINE GAS LEAK DETECTOR (0-10 PPM) WITH AUDIBLE AND VISUAL ALARMS

NORMAL SEQUENCE OF OPERATION:
- AUTOMATIC CHLORINATOR 1 SERVES CONTACT BASIN 1.
- AUTOMATIC CHLORINATOR 2 SERVES CONTACT BASIN 2.
- WHEN FLOW LEAVING THE CHLORINE CONTACT BASIN EXCEEDS THE ELECTRIC ACTUATED BALL VALVE OPEN SETPOINT, VALVE OPENS.
- WHEN FLOW DROPS BELOW VALVE CLOSE SETPOINT, VALVE CLOSES.
- DEAD BAND EXISTS BETWEEN OPEN AND CLOSE SETPOINTS TO PREVENT VALVE SHORT CYCLING.
- EACH AUTOMATIC CHLORINATOR SHALL RECEIVE FLOW PACING SIGNAL FROM THE ULTRASONIC FLOW METER AT THE RESPECTIVE CHLORINE CONTACT BASIN WEIR.
- DETECTION OF A CHLORINE GAS LEAK SHALL AUTOMATICALLY SHUTDOWN THE INTAKE FAN AND SHALL ACTIVATE AUDIBLE, VISUAL, AND SCADA ALARMS.

INTERSYSTEM FAULT OPERATION:
- LOSS OF FLOW PACING SIGNAL SHALL RESULT IN MAINTAINING THE CURRENT VALVE POSITION AND DOSAGE RATE. LOSS OF FLOW PACING SIGNAL SHALL RESULT IN A SCADA ALARM UNLESS THE LOSS OF SIGNAL IS CAUSED BY THE ATS SWITCHING TO GENERATOR POWER OR BACK TO UTILITY POWER.

MANUAL OPERATION:
- MANUAL BYPASS VALVES AND/OR MANUAL CHLORINATOR.

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SETPOINTS
- ELECTRIC ACTUATED BALL VALVE 1 OPEN SETPOINT (GPM, 1 DECIMAL PLACE)
- ELECTRIC ACTUATED BALL VALVE 2 OPEN SETPOINT (GPM, 1 DECIMAL PLACE)
- ELECTRIC ACTUATED BALL VALVE 1 CLOSE SETPOINT (GPM, 1 DECIMAL PLACE)
- ELECTRIC ACTUATED BALL VALVE 2 CLOSE SETPOINT (GPM, 1 DECIMAL PLACE)
- ELECTRIC ACTUATED BALL VALVE 1 DEAD BAND BETWEEN OPEN AND CLOSE SETPOINTS
- ELECTRIC ACTUATED BALL VALVE 2 DEAD BAND BETWEEN OPEN AND CLOSE SETPOINTS
- AUTOMATIC CHLORINATOR 1 MINIMUM DOSAGE RATE SETPOINT (PPD, 1 DECIMAL PLACE)
- AUTOMATIC CHLORINATOR 2 MINIMUM DOSAGE RATE SETPOINT (PPD, 1 DECIMAL PLACE)
- AUTOMATIC CHLORINATOR 1 MAXIMUM DOSAGE RATE SETPOINT (PPD, 1 DECIMAL PLACE)
- AUTOMATIC CHLORINATOR 2 MAXIMUM DOSAGE RATE SETPOINT (PPD, 1 DECIMAL PLACE)
- ATMOSPHERIC CHLORINE LEVEL ALARM SETPOINT (PPM, 1 DECIMAL PLACE)

DATA AND ALARMS
- ELECTRIC ACTUATED BALL VALVE 1 STATUS (OPEN/CLOSE)
- ELECTRIC ACTUATED BALL VALVE 2 STATUS (OPEN/CLOSE)
- CURRENT ATMOSPHERIC CHLORINE LEVEL (PPM, 1 DECIMAL PLACE)
- CHLORINE GAS LEAK ALARM
- AUTOMATIC CHLORINATOR 1 LOSS OF FLOW PACING SIGNAL ALARM
- AUTOMATIC CHLORINATOR 2 LOSS OF FLOW PACING SIGNAL ALARM
- CHLORINE CYLINDER SCALE 1 WEIGHT (POUNDS, 2 DECIMAL PLACES)

- CHLORINE CYLINDER SCALE 2 WEIGHT (POUNDS, 2 DECIMAL PLACES)
- CHLORINE CYLINDER SCALE 3 WEIGHT (POUNDS, 2 DECIMAL PLACES)
- CHLORINE CYLINDER SCALE 4 WEIGHT (POUNDS, 2 DECIMAL PLACES)

GBRA CONTROL ROOM PROGRAMMING:

- CHLORINE GAS LEAK ALARM

NON-POTABLE WATER

EQUIPMENT:
- (2) 15HP 3Ø 460V PUMPS (1 DUTY, 1 STANDBY)
- (2) FULL VOLTAGE NON-REVERSING STARTERS
- (1) VENDOR SUPPLIED CONTROL PANEL WITH PLC PUMP CONTROLLER AND OIT

INSTRUMENTATION:
- (2) ELAPSED TIME METERS
- (1) SUCTION PRESSURE TRANSMITTER (4-20MA OUTPUT)
- (1) DISCHARGE PRESSURE TRANSMITTER (4-20MA OUTPUT)
- (1) MAGNETIC FLOW METER (4-20MA OUTPUT)

NORMAL SEQUENCE OF OPERATION:
- DUTY PUMP IS OPERATED TO MAINTAIN A SPECIFIC PRESSURE RANGE WITHIN PRESSURE TANKS.
- WHEN PUMP START SETPOINT IS REACHED, START DUTY PUMP.
- OPERATE PUMP UNTIL SHUTDOWN SETPOINT IS REACHED.
- ALTERNATE DUTY PUMP.

INTERSYSTEM FAULT OPERATION:
- IF THE SUCTION PRESSURE TRANSMITTER LOW ALARM SETPOINT IS REACHED, PUMP SHALL SHUTDOWN IMMEDIATELY AND ALARM TO SCADA.
- IF THE DISCHARGE PRESSURE TRANSMITTER LOW ALARM SETPOINT IS REACHED, PUMP SHALL SHUTDOWN IMMEDIATELY AND ALARM TO SCADA.
- IF THE DISCHARGE PRESSURE TRANSMITTER HIGH ALARM SETPOINT IS REACHED, PUMP SHALL SHUTDOWN IMMEDIATELY AND ALARM TO SCADA.

MANUAL OPERATION:
- VIA LOCAL CONTROL PANEL

NON-POTABLE WATER OIT PROGRAMMING:
- DISPLAY ALL STATUSES, PROCESS VALUES, AND CONTROL VARIABLES ON THE OIT. ALL PARAMETERS AND SETPOINTS SHALL BE OPERATOR ADJUSTABLE ON THE OIT. INCLUDE MINIMUM ONE (1) WEEK ALARM HISTORIAN.

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SETPOINTS
- DUTY PUMP OFF PRESSURE SETPOINT (PSI, INTEGER)
- DUTY PUMP ON PRESSURE SETPOINT (PSI, INTEGER)
- SUCTION PRESSURE LOW ALARM SETPOINT (PSI, INTEGER)
- DISCHARGE PRESSURE LOW ALARM SETPOINT (PSI, INTEGER)
- DISCHARGE PRESSURE HIGH ALARM SETPOINT (PSI, INTEGER)

DATA AND ALARMS
- NPW PUMP 1 RUN STATUS
- NPW PUMP 2 RUN STATUS
- NPW PUMP 1 AUTO STATUS
- NPW PUMP 2 AUTO STATUS
- NPW PUMP 1 COMMON FAULT ALARM
- NPW PUMP 2 COMMON FAULT ALARM
- NPW PUMP 1 RUN HOURS (1 DECIMAL PLACE)
- NPW PUMP 2 RUN HOURS (1 DECIMAL PLACE)
- NPW PHASE FAULT ALARM
- NPW SUCTION PRESSURE (PSI, 1 DECIMAL PLACE)
- NPW DISCHARGE PRESSURE (PSI, 1 DECIMAL PLACE)
- NPW LOW SUCTION PRESSURE ALARM
- NPW LOW DISCHARGE PRESSURE ALARM

- NPW HIGH DISCHARGE PRESSURE ALARM
- NPW INSTANTANEOUS FLOW RATE (GPM, INTEGER)
- NPW TOTALIZED FLOW (GALLONS, INTEGER)

GBRA CONTROL ROOM PROGRAMMING:

- NPW LOW SUCTION PRESSURE ALARM
- NPW LOW DISCHARGE PRESSURE ALARM
- NPW HIGH DISCHARGE PRESSURE ALARM

FILTERS

EQUIPMENT:
- (2) FILTER BASINS
- (2) VENDOR SUPPLIED CONTROL PANELS, EACH WITH OIT (ONE PER BASIN)
- (1) 5HP 3Ø 480V AIR COMPRESSOR DRIVE MOTOR

INSTRUMENTATION:
- (2) HIGH LEVEL FLOATS (ONE PER BASIN)
- (2) LOW LEVEL FLOATS (ONE PER BASIN)
- (2) BACKWASH LEVEL FLOATS (ONE PER BASIN)
- (1) PRESSURE SWITCH ON COMPRESSED AIR MANIFOLD

NORMAL SEQUENCE OF OPERATION:
- VENDOR SUPPLIED CONTROL PANEL IS SET TO “AUTO”

MANUAL OPERATION:
- VENDOR SUPPLIED CONTROL PANEL IS SET TO “MANUAL”

FILTER OIT PROGRAMMING:
- DISPLAY ALL STATUSES, PROCESS VALUES, AND CONTROL VARIABLES ON THE OIT. ALL PARAMETERS AND SETPOINTS SHALL BE OPERATOR ADJUSTABLE ON THE OIT. INCLUDE MINIMUM ONE (1) WEEK ALARM HISTORIAN.

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SETPOINTS
- FILTER SYSTEM COMPRESSED AIR LOW PRESSURE ALARM SETPOINT (PSI, INTEGER)

DATA AND ALARMS
- FILTER 1 AUTO STATUS
- FILTER 2 AUTO STATUS
- FILTER 1 MODE (NORMAL/BACKWASH)
- FILTER 2 MODE (NORMAL/BACKWASH)
- FILTER 1 HIGH LEVEL FLOAT ALARM
- FILTER 2 HIGH LEVEL FLOAT ALARM
- FILTER SYSTEM COMPRESSED AIR LOW PRESSURE ALARM

GBRA CONTROL ROOM PROGRAMMING:
- FILTER 1 HIGH LEVEL FLOAT ALARM
- FILTER 2 HIGH LEVEL FLOAT ALARM
- FILTER SYSTEM COMPRESSED AIR LOW PRESSURE ALARM

EFFLUENT BASIN FLOW METER

EQUIPMENT:
- (1) V-NOTCH WEIR

INSTRUMENTATION:
- (1) ULTRASONIC FLOW METER AT EFFLUENT BASIN WEIR (4-20MA OUTPUT)

PLANT HMI PROGRAMMING:

DATA AND ALARMS
- EFFLUENT BASIN WEIR INSTANTANEOUS FLOW RATE (GPM, 1 DECIMAL PLACE)
- EFFLUENT BASIN WEIR TOTALIZED FLOW (GALLONS, INTEGER)
- EFFLUENT BASIN WEIR 2-HOUR PEAK FLOWS (GPM, INTEGER)

GBRA CONTROL ROOM PROGRAMMING:
- EFFLUENT BASIN WEIR INSTANTANEOUS FLOW RATE (GPM, 1 DECIMAL PLACE)
- EFFLUENT BASIN WEIR 2-HOUR PEAK FLOWS (GPM, INTEGER)

EFFLUENT LIFT STATION

EQUIPMENT:

- (3) 15HP 3Ø 480V SUBMERSIBLE PUMPS
- (3) FULL VOLTAGE NON-REVERSING STARTERS
- (3) PUMP START DELAY RELAY TIMERS, OPERATOR ADJUSTABLE, SET AS FOLLOWS:
  - PUMP 1: 15 SECONDS
  - PUMP 2: 30 SECONDS
  - PUMP 3: 45 SECONDS
- (1) VENDOR SUPPLIED CONTROL PANEL WITH PLC PUMP CONTROLLER AND OIT
- (1) LIFT STATION JUNCTION BOX

INSTRUMENTATION:

- (1) POWER QUALITY METER
- (1) FLANGED MAGNETIC FLOW METER (4-20MA OUTPUT)
- (1) SUBMERSIBLE LEVEL TRANSMITTER IN STILLING WELL (4-20MA OUTPUT)
- (1) LOW LEVEL BACKUP FLOAT
- (1) HIGH LEVEL BACKUP FLOAT
- (1) MOISTURE SENSOR ON EACH PUMP, MFG SUPPLIED NO/NC CONTACT
- (1) TEMPERATURE SENSOR ON EACH PUMP, MFG SUPPLIED NO/NC CONTACT
- (3) ELAPSED TIME METERS

NORMAL SEQUENCE OF OPERATION (VIA LEVEL TRANSMITTER):

- WET WELL BEGINS FILLING.
- WHEN THE SETPOINT FOR LEAD PUMP CALL TO RUN IS REACHED, START THE LEAD PUMP.
- IF THE SETPOINT FOR LAG PUMP CALL TO RUN IS REACHED, START THE LAG PUMP.
- THE STANDBY PUMP SHALL NOT BE ACTIVATED BY THE NORMAL SEQUENCE OF OPERATION.
- OPERATE UNTIL BASIN LEVEL REACHES PUMP SHUTDOWN SETPOINT.
- ALTERNATE LEAD, LAG, AND STANDBY PUMPS.

OPERATION VIA BACKUP FLOATS:

- IF THE WET WELL LEVEL REACHES THE HIGH LEVEL FLOAT, START ALL THREE PUMPS.
- ALL PUMPS SHALL OPERATE UNTIL THE WET WELL IS PUMPED DOWN TO THE LOW LEVEL FLOAT.
- ACTIVATION OF EITHER HIGH LEVEL OR LOW LEVEL FLOAT SHALL DISENGAGE LEVEL TRANSMITTER CONTROLS, PROVIDE ALARMS TO SCADA, AND ACTIVATE HORN AND STROBE IN ACCORDANCE WITH GBRA STANDARDS.
- SYSTEM SHALL OPERATE ON FLOATS ONLY UNTIL MANUALLY RESET LOCALLY BY AN OPERATOR.

MANUAL OPERATION:

- WHEN THE LOCAL CONTROL PANEL IS SWITCHED FROM “REMOTE” TO “LOCAL”, LOCAL RUN AND STOP BUTTONS SHALL BE UTILIZED TO START THE PUMPS.
- LOW FLOAT SHALL STOP ALL PUMPS IN BOTH "REMOTE" AND “LOCAL” MODE.

LIFT STATION OIT PROGRAMMING:

- DISPLAY ALL STATUSES, PROCESS VALUES, AND CONTROL VARIABLES ON THE OIT. ALL PARAMETERS AND SETPOINTS SHALL BE OPERATOR ADJUSTABLE ON THE OIT. INCLUDE MINIMUM ONE (1) WEEK ALARM HISTORIAN.

PLANT HMI PROGRAMMING:

OPERATOR ADJUSTABLE SETPOINTS

- ALL PUMPS OFF LEVEL SETPOINT (FEET, 2 DECIMAL PLACES)
- LEAD PUMP ON LEVEL SETPOINT (FEET, 2 DECIMAL PLACES)
- LAG PUMP ON LEVEL SETPOINT (FEET, 2 DECIMAL PLACES)

DATA AND ALARMS

- PUMP 1 RUN STATUS

- PUMP 2 RUN STATUS
- PUMP 3 RUN STATUS
- PUMP 1 IN HAND
- PUMP 2 IN HAND
- PUMP 3 IN HAND
- PUMP 1 IN AUTO
- PUMP 2 IN AUTO
- PUMP 3 IN AUTO
- PUMP 1 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 2 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 3 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 1 RUN HOURS (1 DECIMAL PLACE)
- PUMP 2 RUN HOURS (1 DECIMAL PLACE)
- PUMP 3 RUN HOURS (1 DECIMAL PLACE)
- PHASE FAULT ALARM
- POWER QUALITY METER AMPS (PER PHASE)
- FLOW METER INSTANTANEOUS FLOW RATE (GPM, INTEGER)
- FLOW METER TOTALIZED FLOW (GALLONS, INTEGER)
- FLOW METER 2-HOUR PEAK FLOWS (GPM, INTEGER)
- COMMUNICATIONS FAIL ALARM
- WET WELL LEVEL (FEET, 2 DECIMAL PLACES)
- HIGH LEVEL FLOAT ALARM
- LOW LEVEL FLOAT ALARM
- OPERATING ON BACKUP FLOATS ALARM

GBRA CONTROL ROOM PROGRAMMING:

- PUMP 1 RUN STATUS
- PUMP 2 RUN STATUS
- PUMP 3 RUN STATUS
- PUMP 1 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 2 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PUMP 3 COMMON FAULT ALARM (SEAL FAIL, OVER TEMP, FAIL TO START, MOTOR OVERLOAD)
- PHASE FAULT ALARM
- FLOW METER INSTANTANEOUS FLOW RATE (GPM, INTEGER)
- FLOW METER 2-HOUR PEAK FLOWS (GPM, INTEGER)
- COMMUNICATIONS FAIL ALARM
- WET WELL LEVEL (FEET, 2 DECIMAL PLACES)
- HIGH LEVEL FLOAT ALARM
- LOW LEVEL FLOAT ALARM
- OPERATING ON BACKUP FLOATS ALARM

GENERATOR POWER OPERATION

- ALL EQUIPMENT SHALL BE CONFIGURED TO AUTOMATICALLY RESET AFTER POWER OUTAGES. WWTP SHALL IMMEDIATELY RESUME NORMAL OPERATION WHEN ATS TRANSFERS TO GENERATOR POWER.

ADDITIONAL PLANT HMI PROGRAMMING

- WWTP COMMUNICATIONS FAILURE
- PLANT POWER FAILURE (FROM LOAD SIDE OF ATS)
- ATS IN EMERGENCY POSITION
- GENERATOR COMMON FAULT
- MAIN POWER QUALITY METER STATISTICS (PER PHASE) AMPS, KW, KVA, KVAR, PF, THD
- RTU BATTERY SYSTEM LOW VOLTAGE

ADDITIONAL GBRA CONTROL ROOM PROGRAMMING

- WWTP COMMUNICATIONS FAILURE
- PLANT POWER FAILURE (FROM LOAD SIDE OF ATS)
- ATS IN EMERGENCY POSITION
- GENERATOR RUNNING
- GENERATOR COMMON FAULT
- OPERATIONS BUILDING HIGH TEMPERATURE ALARM
- OPERATIONS BUILDING SMOKE ALARM
- MCC MAIN POWER FAULT
- RTU BATTERY SYSTEM LOW VOLTAGE

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, process piping, air release valves, pressure transmitters, flow control valves, electrical, SCADA, and/or flow meters; equipment shall be furnished by the contractor and installed onsite by the contractor (not by building manufacturer).

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 (5) years’ experience designing and fabricating structures of the type specified.

1.3 SYSTEM DESCRIPTION

A. Building shall be one-piece insulated fiberglass shell-type enclosure with walls, roof, doors, fans, louvers, and other miscellaneous components.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
    a. Product data for all materials and components.
    b. Manufacturer color charts.
    c. Manufacturer's installation instructions.
2. Fabrication drawings:
    a. Drawings showing layout, dimensions, anchorages, and accessories.
    b. Details of anchor bolts, base plates, and all other components fastened to the foundation.
    c. Details of roof panels, wall panels, wall penetrations and escutcheons, reinforcement panels at equipment mounting locations, doors, fans, louvers, and any other components.

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. Jacobs Manufacturing Co.
2. Warminster Fiberglass Co.
3. Or approved equal.

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. As shown on drawings.
2. The building size shall be as required to achieve NEC required clearances for all electrical and SCADA components and enclosures and other clearances shown on the contract drawings and GBRA standard details.
3. Wall height shall be 8’-0” minimum.

C. Building foundation/floor, steps/stairs, perimeter curbs, and entrance/exit ramps shall be cast-in-place reinforced concrete in accordance with GBRA Standards and Design Guidelines.

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: 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: 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. Construct buildings using prefabricated molded composite wall and roof panels. Provide factory assembled buildings if panel construction is employed.

B. All joints and seams shall be sealed and weatherproof.

C. Roof shall be gable style with 3:12 pitch.

D. Structurally reinforce wall and roof panels to meet loading conditions and to maintain flatness and straightness. Provide reinforcement panels at equipment mounting locations. Reinforcements shall be encapsulated. Assembly bolts shall not penetrate the exterior of the structure.

E. Wall panels shall have an integral 4" wide internal mounting flange pre-drilled on 12" centers with 5/8" diameter holes for attaching to a concrete foundation.

F. Furnish walls, roof, doors, fans, louvers, escutcheon plates, and other miscellaneous components with interior and exterior beige color finish.

2.5 ACCESSORIES

A. Doors and Door Frames: 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 gel coat, fiberglass reinforcement, polyester resin, insulating core, and internal reinforcements with all mortises, openings, recesses, and pockets molded in place. Finish color shall match building.

1. Single door minimum size: 3'-0" wide, 7'-0" high, 1 ¾" thick.
2. Double door minimum size: Pair of 2'-6" wide, 7'-0" high, 1 ¾" thick.
3. Doors shall open to exterior.
4. Mount each door with three stainless steel NRP butt hinges 4 ½" long.
5. All other hardware and accessories shall be aluminum and/or stainless steel.
6. All fasteners for all items shall be stainless steel.
7. Provide 18" wide x 12" tall safety wired glass in each door.
8. Provide panic hardware with keyed external lever, and Best Access key system Model SSS-1C6D1626 including control keys.
9. Provide hydraulic closers, Dorma STA8900FMC or equal.
10. Provide door stops and door holders.
11. Provide 12" tall kick plates.
12. Provide natural sponge rubber bulb type door gaskets with flexible lock to retain permanent grip.
13. Provide single flap insert type neoprene sweeps.
14. Provide 4" wide seamless black vinyl thresholds, Home Depot GFTHRESH10MB or equal, attach with adhesive and evenly spaced drive pin anchors, 6 anchors for single doors, 10 anchors for double doors.
15. 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.
16. Install "Danger" signs indicating any type of chemicals or hazards present.

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.

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 Aerovent Model FDP or equal, with gravity shutter, canopy, and removable aluminum insect screen, wall mount in upper portion of building near corner,

secure to building with aluminum rivets. All components shall be constructed of PVC, FRP, stainless steel, and/or aluminum. Finish color shall match building. Provide one (1) complete air exchange every three (3) minutes.

F. Exhaust Louver: Rectangular, with gravity shutter and removable aluminum insect screen, wall mount in lower portion of building near corner opposite from intake fan, secure to building with aluminum rivets. All components shall be constructed of PVC, FRP, stainless steel, and/or aluminum. Finish color shall match building. Size to accommodate one (1) complete air exchange every three (3) minutes.

G. Split Escutcheon Plates: Round, FRP plate, 1/8" minimum thickness, field install interior and exterior at wall pipe penetrations, secure to building with aluminum rivets. Finish color shall match building.

H. Other Equipment and Appurtenances: Any other equipment or appurtenances identified in the contract documents shall not be furnished or installed by the building manufacturer; such items shall be furnished by the contractor and installed onsite by the contractor and shall be in accordance with GBRA Standards and Design Guidelines. The contractor shall mount these items on strut, unless noted otherwise, and secure the strut to the building with aluminum rivets. The contractor shall coordinate wall penetrations and reinforcement panel sizes and locations for equipment mounting with the building manufacturer (reference Part 2.4.D herein). Equipment and appurtenances by contractor include the following items, and any other items identified in the contract documents:

1. Electrical enclosures, raceways, conductors, and strut.
2. Interior Light Fixtures: Minimum two per building.
3. Exterior Light Fixtures: Minimum one light fixture centered above each door frame.
4. Fan and Light Switches: Weatherproof, outdoor rated, mount on building exterior adjacent to entry door(s).
5. Intake Fan Controls: Provide thermostat control.
6. Receptacles: Minimum three 110V 20A receptacles, one of which shall be a dedicated circuit for a portable heater.

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. All joints and seams shall be sealed and weatherproof.

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 13410: Water Delivery Point Process Control Descriptions

REFERENCE DWG(S)	(per design engineer)
DESCRIPTION:	The in-district customer sites deliver water to the customers on a daily rate basis. This daily rate shall be utilized as the setpoint to adjust the control valve to maintain the flow rate.
GENERAL MONITORING:	Remote control room(s) monitor the following for in-district customer sites: control valve position, fail alarm, and statuses; pipeline pressure and low/high alarms; flow rate and high/low alarms, flow total for the day and yesterday; tank level and customer enable status; facility alarms for power fail and PLC intrusion. Valve fail alarm shall be generated when the valve position disagrees with the command position while in the remote mode. The fail shall have a time delay and dead band adjustment. The daily flow total shall be generated from flow rate reading. The total shall be from midnight to midnight, and shall be stored at the remote control room(s). PLC shall store the previous day total as the yesterday total.
LOCAL MANUAL CONTROL MODE:	When the control valve L/O/R switch is in the local position, the valve shall be opened and closed at the local operator station.
LOCAL AUTOMATIC CONTROL MODE:	None
REMOTE MANUAL CONTROL MODE:	When the control valve L/O/R switch is in the remote position, the remote control room(s) HMI operator shall be able to select an AUTO/MANUAL mode. In the MANUAL mode the valve shall be opened and closed by adjusting percent open setpoint.
REMOTE AUTOMATIC CONTROL MODE:	When the control valve L/O/R switch is in remote position and the mode is set to AUTO the valve shall modulate to control the flow rate. The flow rate setpoint shall be the customer daily rate set at the remote control room(s). The modulation shall use a PID control algorithm. There shall be two shutdown control points to close the valve in AUTO mode: 1. If the customer enable is off the control valve shall be closed. The customer enable shall be a local control function. 2. If a system shutdown occurs the control valve shall be closed. The system shutdown for the individual customer site shall be generated from pumping station(s) information by the remote control room(s).

Shutdown Rate: When a shutdown occurs, the valve shall ramp closed on an adjustable rate. This “time to close” setpoint shall be operator adjustable from 1.0 to 3.0 minutes on the remote control room(s) HMI.

NEW SITES: Contractor shall integrate new sites into the applicable existing GBRA control system PLC(s) and HMI(s). New sites must be added to the system flow controls including distribution setpoints.

END OF SECTION

Section 13428: Supervisory Control and Data Acquisition (SCADA)

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Design Phase:

1. Design engineer must obtain GBRA design approval prior to advertising for bids.
2. Design engineer shall perform site investigations and field radio path studies with portable masts and radios; submit the radio path studies, elevation profiles, and proposed system design for GBRA review, comment, and approval including model numbers of antennas used to obtain results. Evaluate terrain, interference, and potential obstructions.
3. The installation details required for the radio telemetry equipment may 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.
4. Provide radio(s) appropriate for the applicable service area. Depending on service area, radio(s) may be cellular, FreeWave ZumLink Z9-PE2-Grey, Banner Engineering DX80DR9M-H1C, or other as designated by GBRA. Design engineer must coordinate with GBRA to determine service area, site specific requirements, and appropriate equipment.
5. The topography of the radio system service area may not permit direct line of sight radio paths. The system must be designed with towers of appropriate height along with any necessary repeaters required to maintain a minimum radio receive signal level of -80 dBm for FreeWave radios and minimum 25% green packets for Banner radios.
6. A tower is required for antenna height greater that 34’ AGL that cannot be accomplished with a mast. Reference Detail 180 for additional requirements and for mast and utility pole options.
7. 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 with GBRA repeater(s) if necessary.
8. Reference GBRA Standards and Design Guidelines for RTU and additional requirements.

B. Construction Phase:

1. In order to centralize responsibility, all work described in this Section shall be self-performed by a single system subcontractor except where noted otherwise. Contractor shall coordinate and guarantee all work performed by the subcontractor.
2. All work shall be in accordance with this section, the contract documents, and GBRA Standards and Design Guidelines.
3. Subcontractor shall provide all labor, materials, equipment and incidentals necessary to furnish, install, calibrate, test, startup and place in operation a complete and functional SCADA system.

4. Subcontractor shall furnish and install all wiring for the SCADA system.
5. Subcontractor shall perform RTU/PLC programming, HMI/OIT development, and system integration at the project site(s) and at the applicable GBRA control room(s). The program for each PLC must be set to load on uninitialized memory. Include alarm historian at each HMI/OIT. Comply with GBRA revision management policy.
6. Subcontractor shall obtain the services of a tower manufacturer to design and furnish the antenna tower(s) including foundation design.
7. Subcontractor shall obtain the services of a tower erector to construct and erect in place the antenna tower(s).

1.2 QUALIFICATIONS AND QUALITY ASSURANCE

A. SCADA subcontractors must be listed as Certified or better by Inductive Automation for Ignition HMI Software; integration must be performed by personnel who are Gold Level Certified or better, experienced, and competent in the implementation of Ignition HMI Software. Submit applicable certifications, experience, and references.

B. PLC programming must be performed by personnel with a minimum of five (5) years' experience of similar scope and magnitude. Submit applicable certifications, experience, and references.

C. Antenna installation shall be performed by personnel with a minimum of two (2) years' experience. Submit applicable certifications and experience.

D. Tower manufacturer shall retain the services of a professional engineer licensed in the State of Texas to design the antenna tower and foundation. Design calculations, design drawings, and shop drawings shall be sealed, signed, and dated by this engineer. Submit the calculations and drawings accordingly.

E. Tower erector must be approved by the manufacturer, and must have erected at least two antenna tower structures fabricated by the manufacturer. Submit experience and manufacturer approval.

1.3 SUBMITTALS

A. Reference GBRA Standards and Design Guidelines - Section 1.3 for submittal requirements.

B. Submit all applicable shop drawings, diagrams, and schematics.

C. Submit all items described in Paragraph 1.2 above.

D. Submit all proposed HMI/OIT development. Obtain GBRA approval prior to installation.

1. A mandatory coordination meeting is required prior to preparing submittals for HMI/OIT development. Contractor shall coordinate schedule with GBRA at least ten (10) business days in advance.

E. Reference GBRA Standards and Design Guidelines - Section 1.4 for final completion requirements.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials and equipment shall be stored in accordance with published manufacturer recommendations.

1.5 RADIO NETWORK FUNCTIONAL REQUIREMENTS

A. Radio receive signal level must be -80 dBm or better for FreeWave radios, and minimum 25% green packets for Banner radios.

1.6 SPARE PARTS

A. Reference GBRA Standards and Design Guidelines - Appendix C for spare parts requirements.

PART 2 - PRODUCTS

2.1 RADIOS

A. Provide radio(s) appropriate for the applicable service area. Depending on service area, radio(s) may be cellular, FreeWave ZumLink Z9-PE2-Grey, Banner Engineering DX80DR9M-H1C, or other as designated by GBRA. Design engineer must coordinate with GBRA to determine service area, site specific requirements, and appropriate equipment.

2.2 OMNIDIRECTIONAL ANTENNAS

A. Omnidirectional remote mount antennas and RF coaxial surge protectors shall be furnished and installed as indicated on the contract drawings.

B. Antenna mounting shall be in accordance with the radio path studies.

C. Omnidirectional antennas shall meet the following requirements:

1. Frequency Range: Center tuned for 902-928 MHz
2. Gain: as indicated by radio path studies, and as 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. RF Coaxial Surge Protector: provide with each antenna

D. Acceptable manufacturers are limited to the following: Andrew, Citel, Decibel, Kathrein, Laird, Larsen, Maxrad, PCTEL, PolyPhaser, and Telewave.

2.3 YAGI DIRECTIONAL ANTENNAS

A. Yagi directional remote mount antennas and RF coaxial surge protectors shall be furnished and installed as indicated on the contract drawings.

B. Antenna mounting shall be in accordance with the radio path studies.

C. Yagi directional antennas shall meet the following requirements:

1. Frequency Range: Center tuned for 902-928 MHz
2. Gain: as indicated by radio path studies, and as required to offset coax losses
3. Power Input: 50 watts minimum
4. VSWR: less than 1.5
5. Lightning Protection: dedicated direct ground
6. Ground: DC grounded type
7. Wind Rating: 150 mph survival without ice
8. Wind Rating: 100 mph survival with .5” radial ice
9. Connector: Type N female direct connection, no factory jumper or whip
10. Mounting Hardware: stainless steel clamps and standoff hardware as recommended by the antenna manufacturer
11. RF Coaxial Surge Protector: provide with each antenna

D. Acceptable manufacturers are limited to the following: Andrew, Citel, Decibel, Kathrein, Laird, Larsen, Maxrad, PCTEL, PolyPhaser, and Telewave.

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. A single continuous piece of coaxial cable shall be installed for each radio, splices are not allowed. For coax runs 100 feet in length or less, cable shall be 1/2” diameter (Andrew LDF4-50A, or equal). For coax runs exceeding 100 feet in length, cable shall be 7/8" diameter (Andrew LDF5-50A, or equal). Provide loss calculations for coax runs exceeding 200 feet in length. System shall be designed to provide the full EIRP of 36dB at antenna as allowed by FCC for 900 MHz ISM systems.

B. Install stainless steel hanger kits and clamping hardware (Andrew, or equal) to secure coaxial cable and ground conductor to antenna tower at 3-foot intervals.

C. Utilize N-type connectors to terminate each end of each transmission cable.

D. Install an in-line RF coaxial surge protector (Citel, or equal) for each cable, with N-type connectors.

E. Install a flexible coaxial jumper of necessary length between the RF coaxial surge protector and the radio, with appropriate connector type and gender. Type and gender adapters are not allowed. This must be a single piece jumper, splices are not allowed.

F. Install a coaxial cable grounding kit (Andrew, or equal) for each radio.

G. Seal all outdoor coaxial connectors with vapor wrap.

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 hot dip galvanized steel with stainless steel or hot dip galvanized hardware, fasteners, and anchor bolts. Provide an external ladder with fall protection and anti-climb devices on all towers. Towers shall be designed for TIA-222 Risk Category III and the appropriate exposure category and 3 second peak gust wind rating based on the ultimate effective projected area and wind speed data for the proposed site location with the external ladder assembly, antennas, and all appurtenances.

B. 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 code requirements for minimum factors of safety for stability of antenna tower type structures. Consider the most critical combination of loads utilizing code requirements as the basis for the load combination.

2.6 SPLINE BALLS

A. Furnish and install spline balls with stainless steel mounting hardware in accordance with Detail 180.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Subcontractor shall be responsible for the installation, programming, and documentation of all SCADA equipment.

B. Reference GBRA Standards and Design Guidelines for additional requirements.

3.2 CONFIGURATION AND PROGRAMMING

A. Subcontractor shall provide documentation of all parameters for each radio including IP or node addresses, login credentials, encryption keys, etc. This documentation shall be included in the O&M manual.

B. Subcontractor shall perform RTU/PLC programming, HMI/OIT development, and system integration at the project site(s) and at the applicable GBRA control room(s). The program for each PLC must be set to load on uninitialized memory. Include alarm historian at each HMI/OIT. Comply with GBRA revision management policy.

C. A mandatory coordination meeting is required prior to performing any work at the applicable GBRA control room(s). Contractor shall coordinate schedule with GBRA at least ten (10) business days in advance.

3.3 FIELD TESTING AND DEMONSTRATION

A. The contractor and subcontractor shall perform operational demonstration testing and operator training in accordance with GBRA Standards and Design Guidelines prior to placing the facility into service. The entire SCADA system shall be tested, including but not limited to all HMI/OIT features and all signals/points from field equipment/devices to the applicable HMI(s) and OIT(s) at the project site(s) and at the applicable GBRA control room(s). Schedule GBRA to witness the demonstration testing. The contractor and subcontractor shall test and verify complete functionality prior to demonstration testing. Contractor shall coordinate schedule with GBRA at least ten (10) business days in advance.

END OF SECTION

Section 13442: Flanged Magnetic Flow Meters

A. Acceptable manufacturers:

1. Badger
2. Endress + Hauser
3. Foxboro
4. Krohne
5. McCrometer
6. Rosemount
7. Substitutions are not allowed.

B. Design and fabrication requirements:

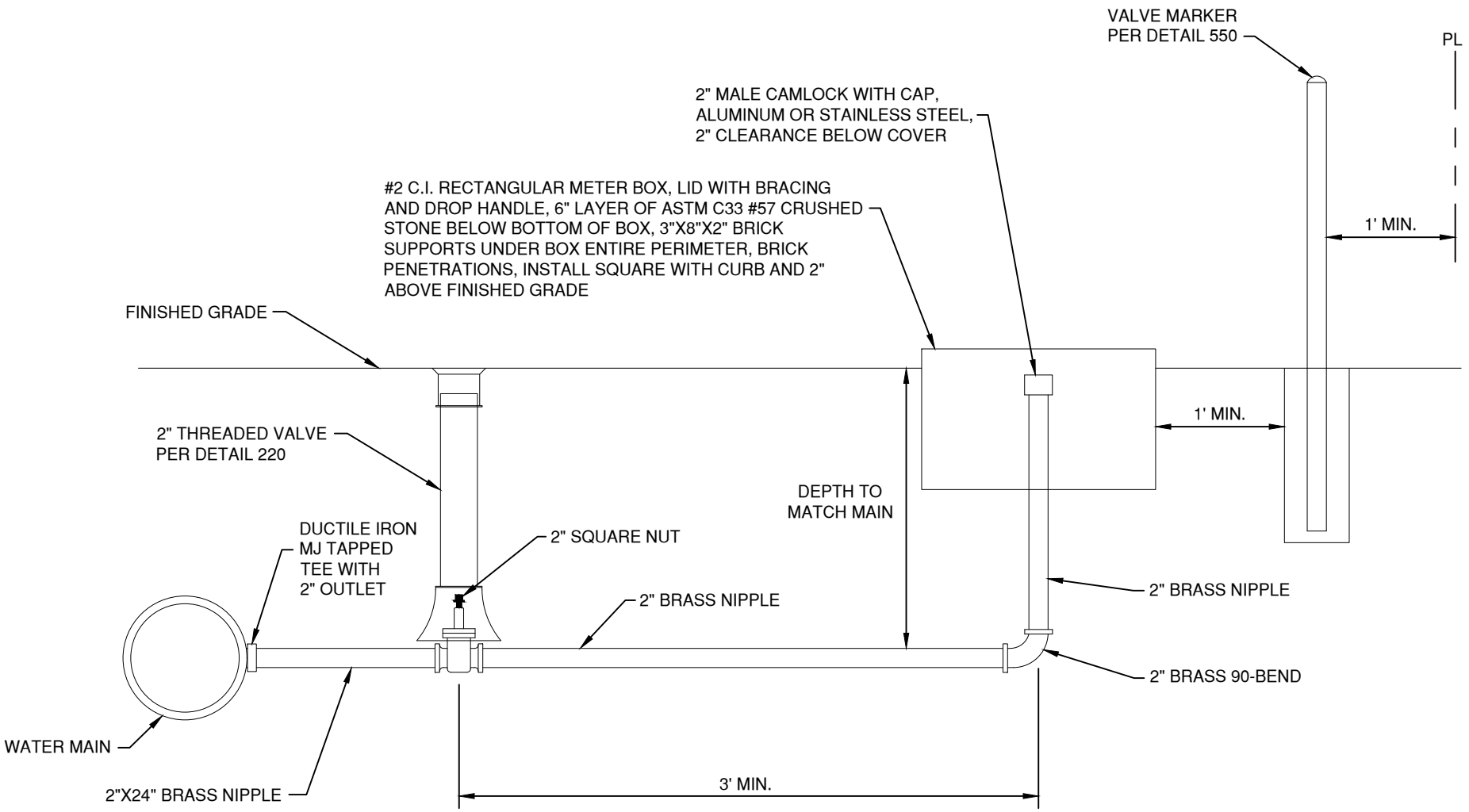
1. All materials and components shall be chemical resistant and compatible with the intended process fluid in accordance with published manufacturer recommendations.
2. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
3. High input impedance pre-amplifiers, minimum impedance shall be 10^{10} ohms.
4. Provide flanged end connections per ANSI/ASME B16.5 to match rating of piping system.
5. Grounding: Provide inlet and outlet grounding rings of same material as electrode.
6. 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 allowed.
7. The signal converter shall be remotely mounted using a remote-mount kit provided by the manufacturer. The transmitter shall be FM approved. Rating shall be at least NEMA 4X with separate electronics and termination areas.
8. Submergence: The sensor shall be sealed and rated for permanent submergence to 30 feet.
9. Pulsed DC magnetic field excitation.
10. Automatic zero.
11. Adjustable low flow cutoff.
12. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
13. Inaccuracy:
    a. Above 10 percent of range: +/-1.0 percent of rate.
    b. Below 10 percent of range: +/-0.1 percent of range setting.
    c. Add +0.1 percent of range to above inaccuracies for analog outputs.
14. Communication with PLC shall be Ethernet IP or Modbus RTU.
15. Power Supply: 120 V +/-10 percent, 60 Hz.
16. Provide surge protection.
17. Provide local operator interface display with indication of flow rate and totalized flow at transmitter.

18. Meter operable as specified in liquids with 5.0 micro mho/cm or more conductivity.
19. Transmitter electronics shall utilize microprocessor based architecture and be configured using parameters.
20. Repeatability: +/- 0.1% of reading or better.
21. The meter shall be capable of automatically indicating zero flow under empty pipe conditions.
22. Flow meter performance shall be verified on a NIST traceable test facility. Contractor shall submit factory and field calibration certificates for all flow meters.
23. Instruments shall be designed and manufactured under the ISO 9001 series of quality standards.
24. Menu or programming changes shall be capable of being performed without removing covers.
25. Instruments shall be capable of storing data in non-volatile memory for a minimum of ten (10) years.
26. The instrument shall have password protection to prevent unauthorized personnel from making settings and programming changes.

C. Installation: Provide unobstructed upstream and downstream straight pipe diameters in accordance with published manufacturer recommendations.

END OF SECTION

APPENDIX E – GBRA STANDARD DETAILS

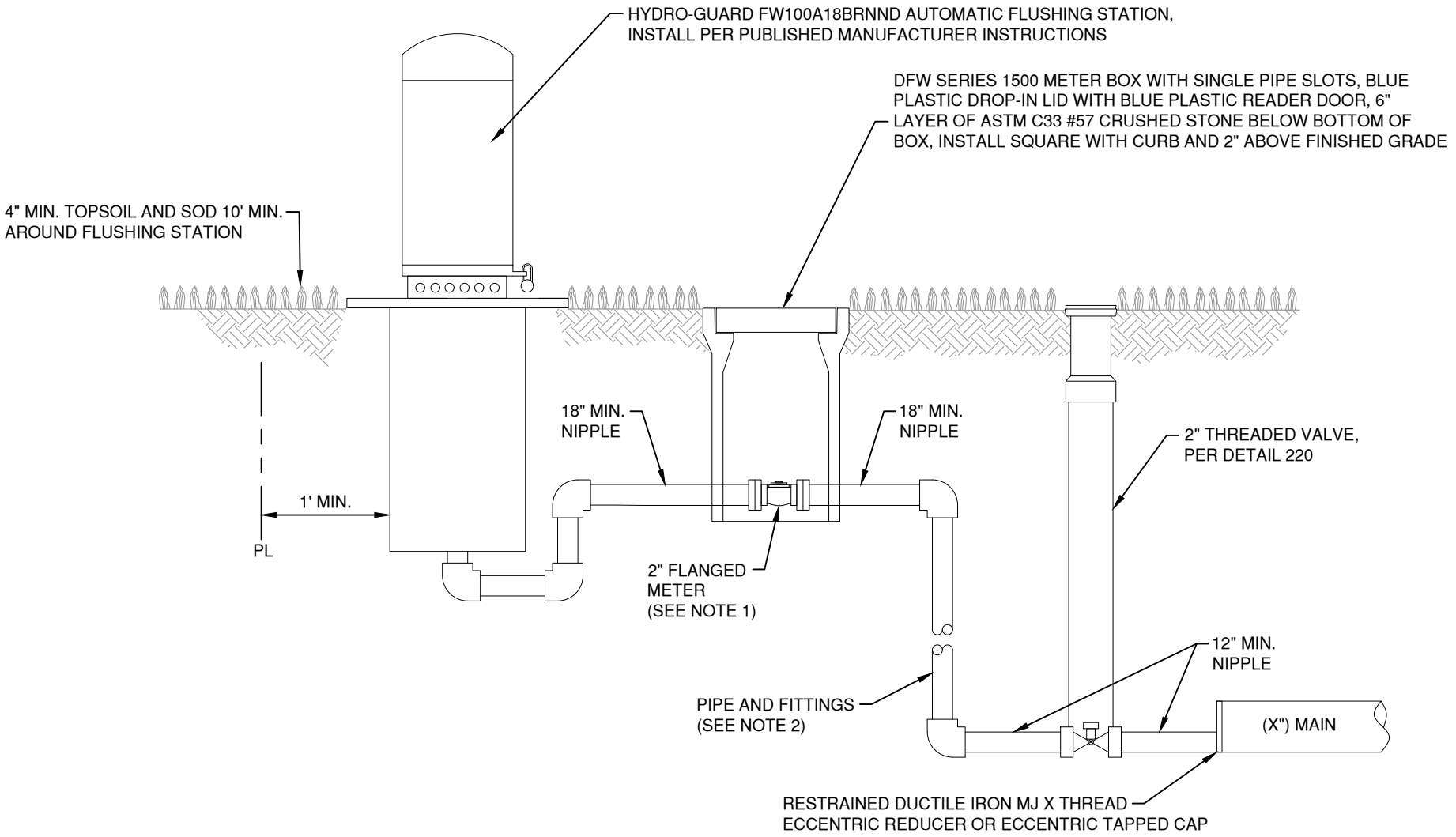


NOTES:
1. INSTALL COMPONENTS PLUMB/LEVEL.

Guadalupe-Blanco River Authority

2" DRAIN VALVE

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 100	

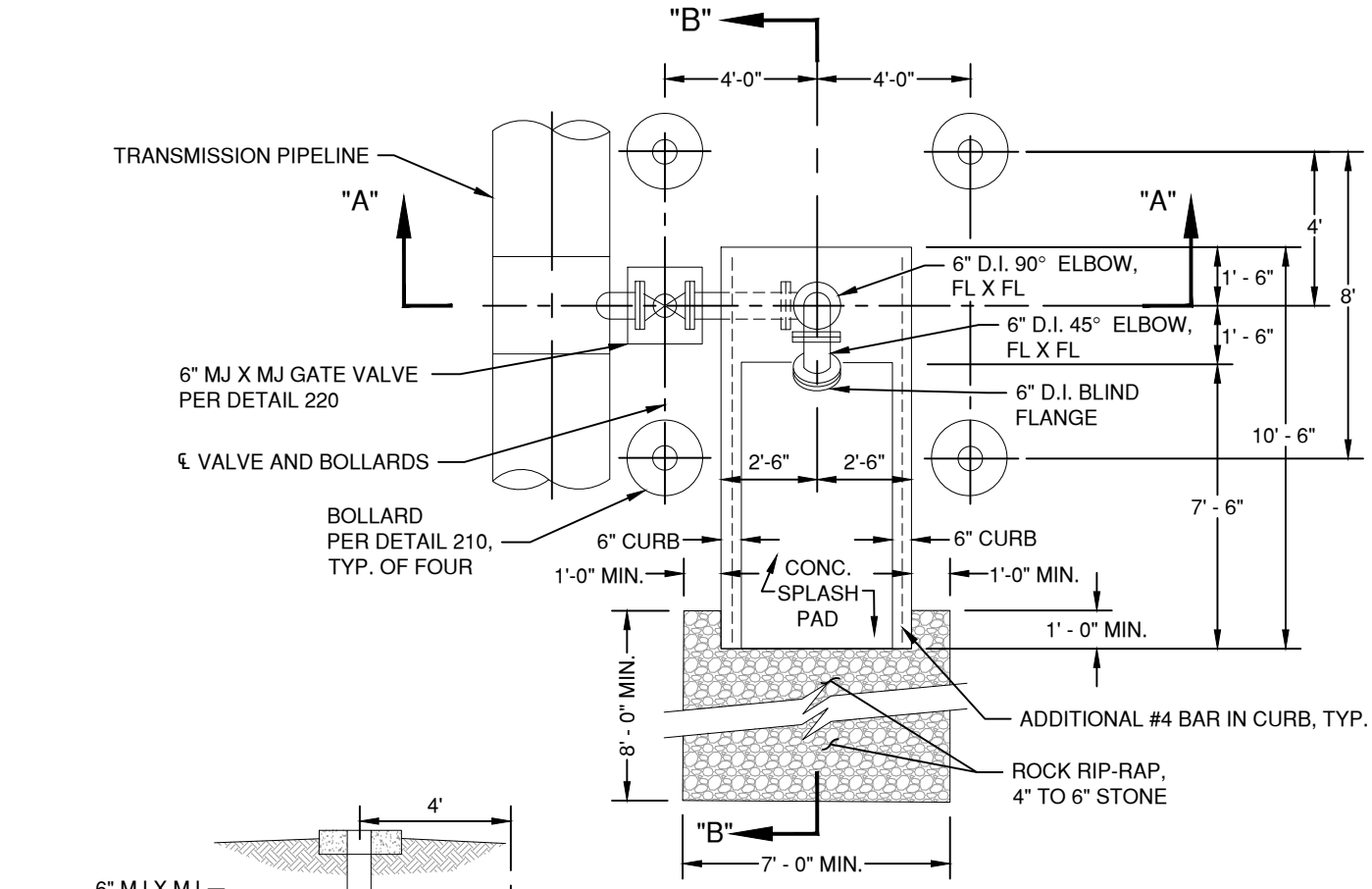


NOTES:
1. METER ONLY FURNISHED BY GBRA, TO BE INSTALLED BY CONTRACTOR.
2. ALL PIPE AND FITTINGS SHALL BE 2" BRASS.
3. INSTALL COMPONENTS PLUMB/LEVEL.

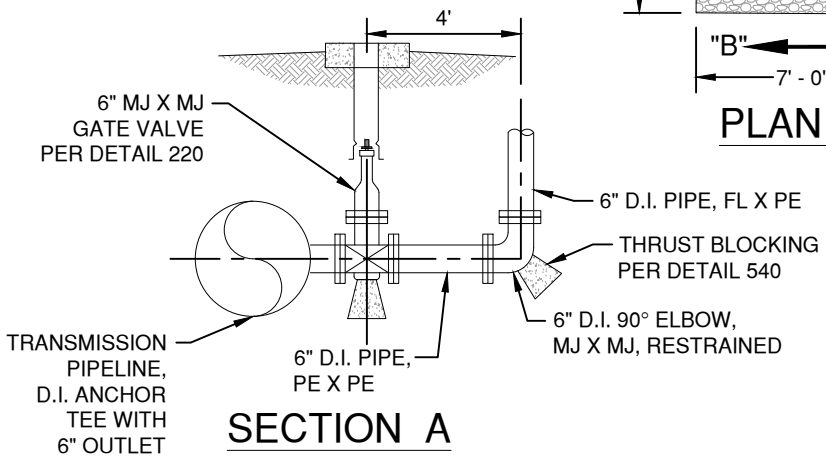
Guadalupe-Blanco River Authority

2" FLUSH VALVE

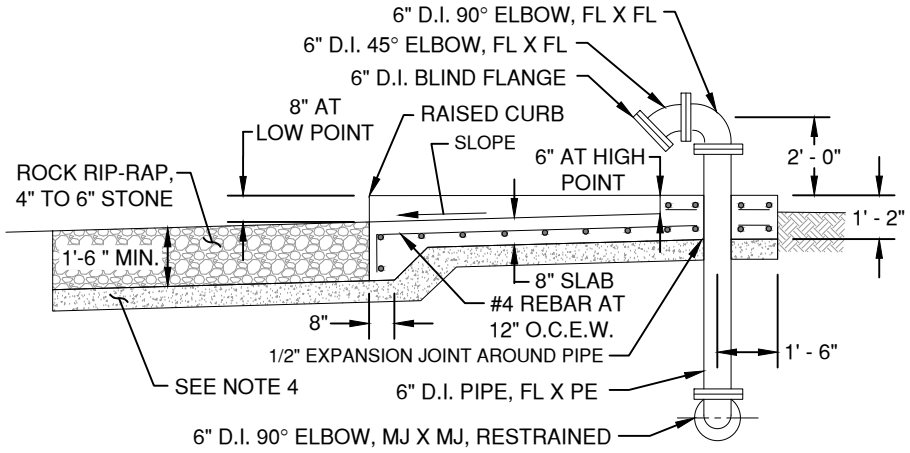
REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 110	



PLAN VIEW



SECTION A



SECTION B

NOTES:

1. ORIENTATION OF ASSEMBLY SHALL BE AS SHOWN ON PIPELINE PLAN AND PROFILE SHEETS, OR AS DIRECTED BY GBRA INSPECTOR IF NOT SHOWN.
2. PIPE, FITTINGS, AND VALVES SHALL BE THE SAME AS OR GREATER WORKING PRESSURE CLASS THAN THE TRANSMISSION PIPE.
3. TOPS OF BOLLARDS SHALL BE INSTALLED AT MATCHING ELEVATION UNLESS APPROVED OTHERWISE BY GBRA INSPECTOR.
4. MINIMUM 6" COMPACTED FLEXIBLE BASE UNLESS INDICATED MORE STRINGENT IN GEOTECH REPORT.
5. EXPOSED VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE FORMED WITH 3/4" CHAMFER STRIPS.
6. CONCRETE SHALL BE READY-MIX 3,000 PSI MINIMUM.
7. PAINT EXPOSED PIPE AND FITTINGS (REFERENCE GBRA STANDARDS FOR PAINTING REQUIREMENTS).
8. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

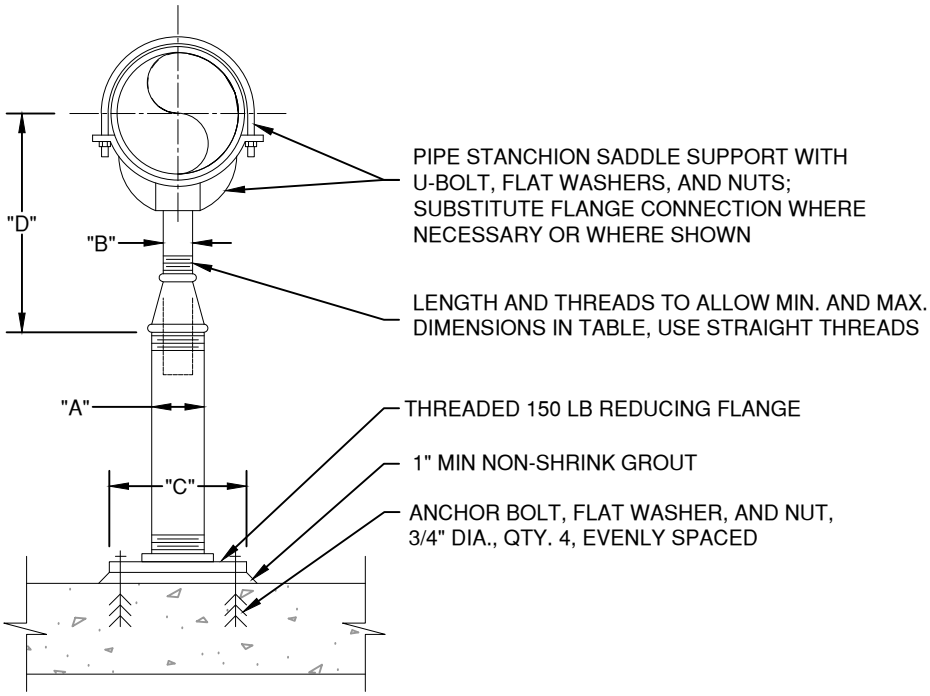
Guadalupe-Blanco River Authority

6" DRAIN VALVE

REVISED	SCALE
JUL. 28, 2025	NONE

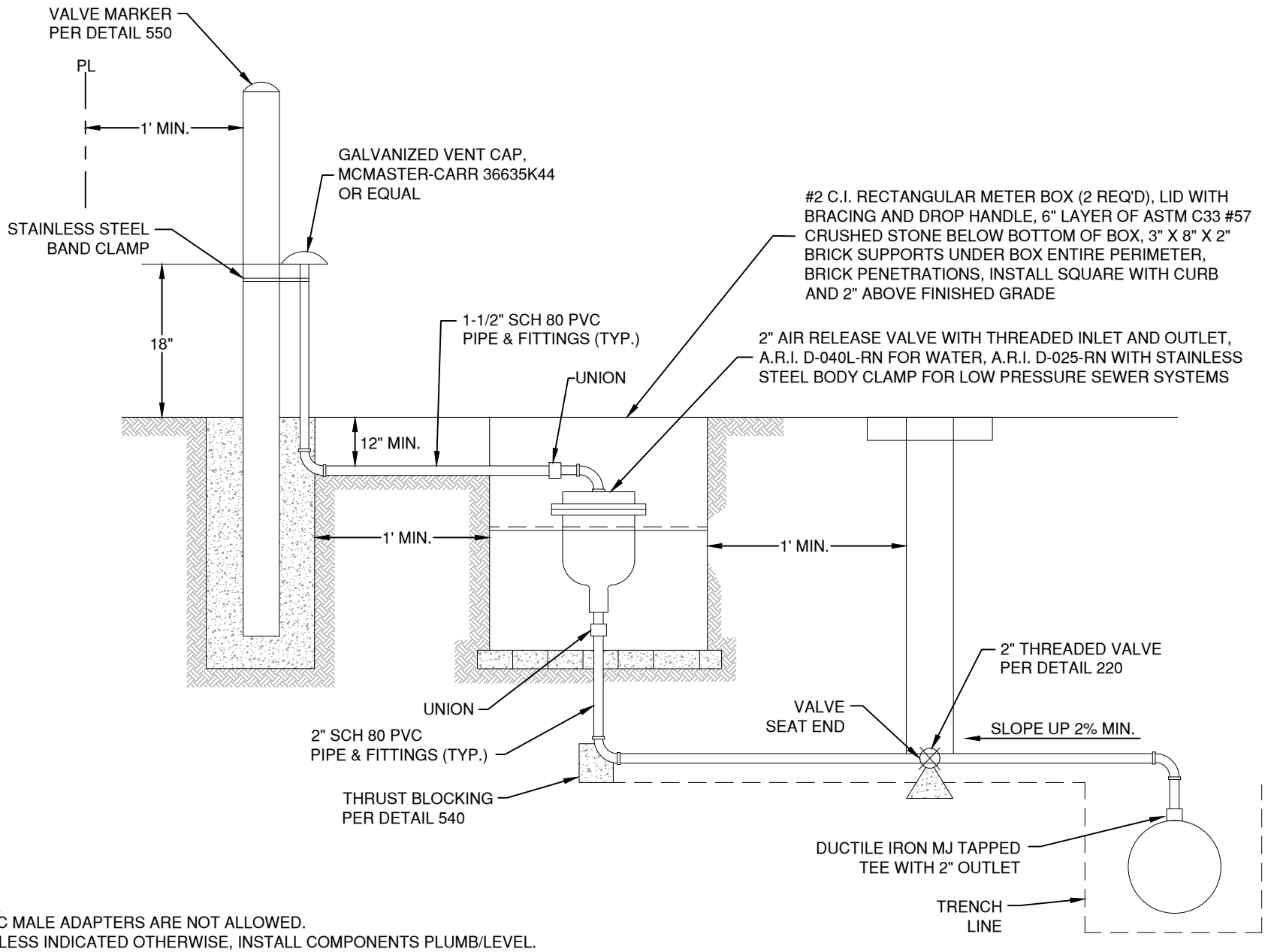
DETAIL NO. 120

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. ASSEMBLY SHALL BE MANUFACTURED BY B-LINE OR EQUAL.
3. PIPE SHALL BE SCHEDULE 40.
4. INSTALL ASSEMBLY PLUMB/LEVEL.

GBRA Guadalupe-Blanco River Authority	ADJUSTABLE STANCHION PIPE SUPPORT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 130	



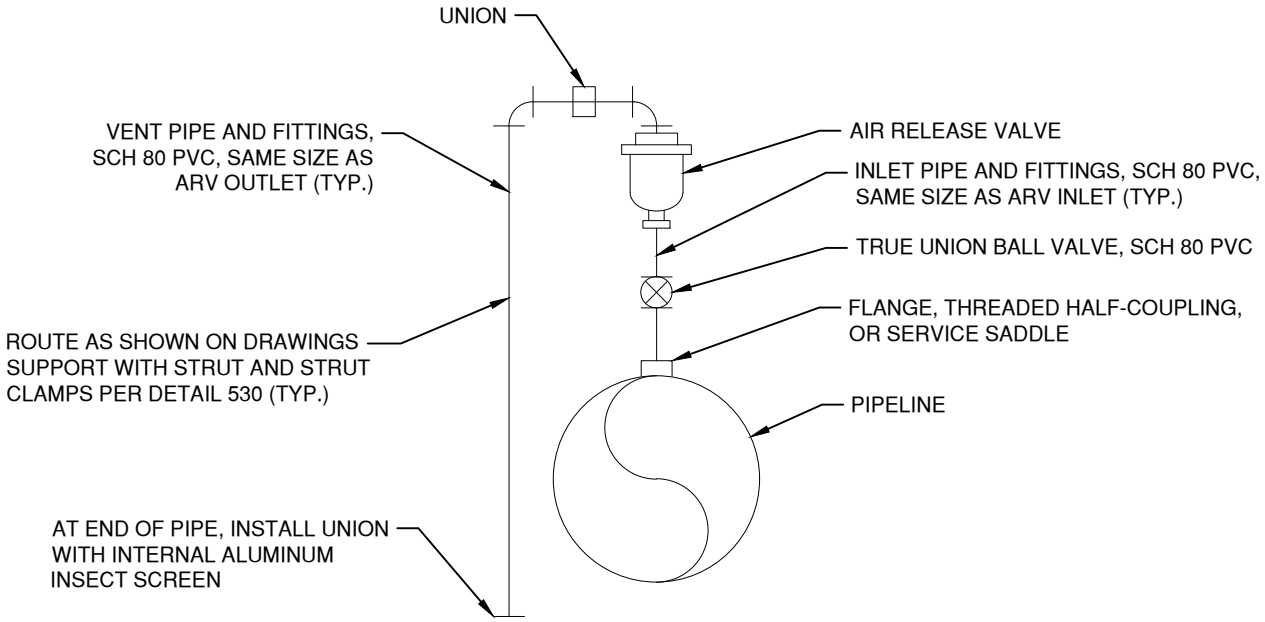
NOTES:
1. PVC MALE ADAPTERS ARE NOT ALLOWED.
2. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

GBRA
Guadalupe-Blanco River Authority

AIR RELEASE VALVE TYPE 1

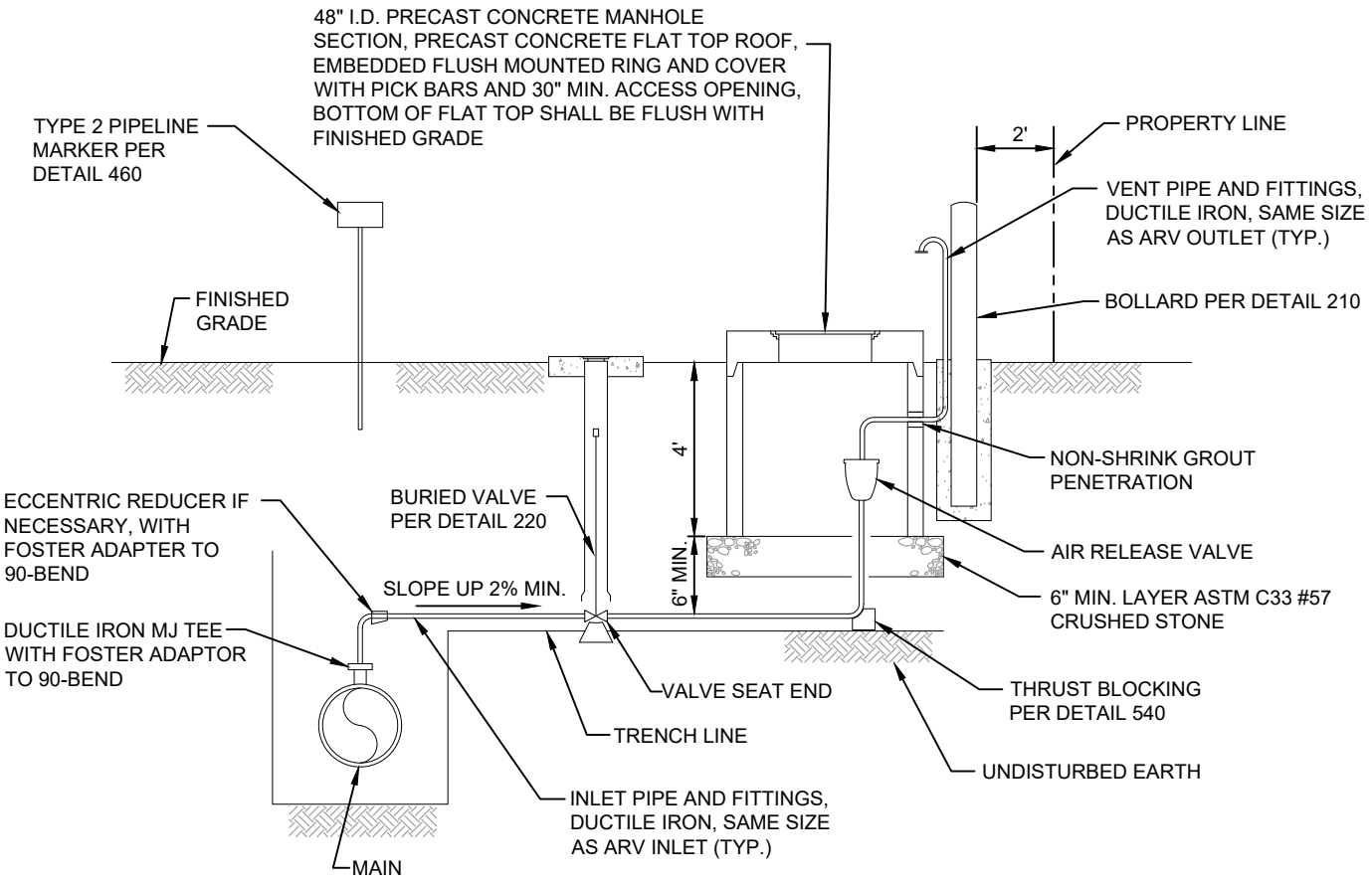
REVISED	SCALE
JUL. 28, 2025	NONE

DETAIL NO. 140



NOTES:
1. FOR WATER, AIR RELEASE VALVE SHALL BE 2" A.R.I. MODEL D-040L-RN WITH THREADED INLET AND OUTLET.
2. FOR WASTEWATER, AIR RELEASE VALVE SHALL BE 2" A.R.I. MODEL D-025-RN WITH THREADED INLET AND OUTLET, AND STAINLESS STEEL BODY CLAMP.
3. PVC MALE ADAPTER ARE NOT ALLOWED.
4. SERVICE SADDLE SHALL BE SMITH BLAIR 317 OR EQUAL.
5. TRUE UNION BALL VALVE SHALL BE GF, HAYWARD, NIBCO, OR SPEARS.
6. UNLESS INDICATED OTHERWISE, INSTALL ASSEMBLY PLUMB/LEVEL.

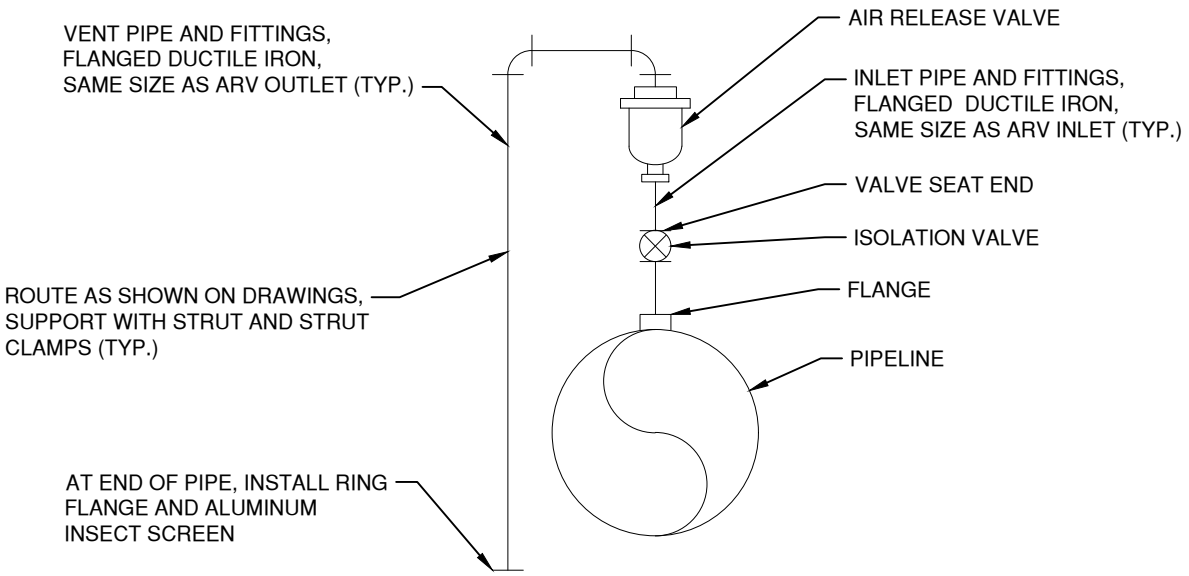
GBRA Guadalupe-Blanco River Authority	AIR RELEASE VALVE TYPE 2	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 150	



NOTES:

1. FOR WATER, AIR RELEASE VALVE SHALL BE 4" MINIMUM VAL-MATIC MODEL 204C.15 OR LARGER AS INDICATED ON DRAWINGS, WITH FLANGED INLET AND OUTLET, AND FUSION BONDED EPOXY INTERNAL AND EXTERNAL.
2. FOR WASTEWATER FORCE MAINS, AIR RELEASE VALVE SHALL BE 3" MINIMUM A.R.I. MODEL D-026 OR LARGER AS INDICATED ON DRAWINGS, WITH FLANGED INLET AND OUTLET.
3. USE RESTRAINED MECHANICAL JOINTS IN BURIED LOCATIONS. USE FLANGED JOINTS INSIDE MANHOLE AND ABOVE GRADE.
4. VENT PIPING SHALL TERMINATE WITH RING FLANGE AND ALUMINUM INSECT SCREEN 24" ABOVE FINISHED GRADE.
5. PAINT PIPING, FITTINGS, AND VALVES WITHIN MANHOLE AND ABOVE GRADE (REFERENCE GBRA STANDARDS FOR PAINTING REQUIREMENTS).
6. EXPOSED VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE FORMED WITH 3/4" CHAMFER STRIPS.
7. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

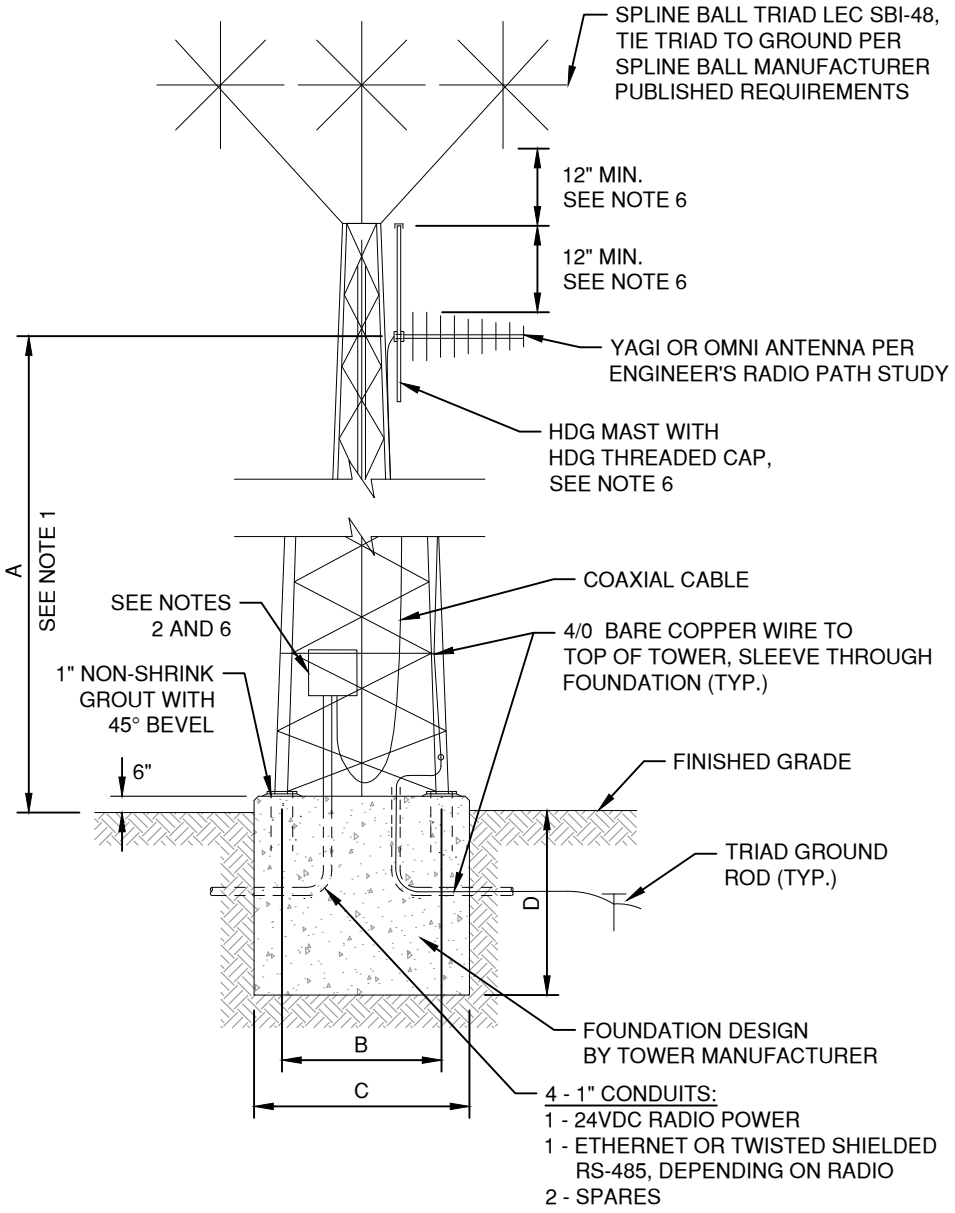
GBRA Guadalupe-Blanco River Authority	AIR RELEASE VALVE TYPE 3	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 160	



NOTES:

1. FOR WATER, AIR RELEASE VALVE SHALL BE 4" MINIMUM VAL-MATIC MODEL 204C.15 OR LARGER AS INDICATED ON DRAWINGS, WITH FLANGED INLET AND OUTLET, AND FUSION BONDED EPOXY INTERNAL AND EXTERNAL.
2. FOR WASTEWATER, AIR RELEASE VALVE SHALL BE 3" MINIMUM A.R.I. MODEL D-026 OR LARGER AS INDICATED ON DRAWINGS, WITH FLANGED INLET AND OUTLET.
3. FOR WATER, ISOLATION VALVE SHALL BE A FLANGED GATE VALVE.
4. FOR WASTEWATER, ISOLATION VALVE SHALL BE A FLANGED PLUG VALVE.
5. PAINT PIPING, FITTINGS, AND VALVES (REFERENCE GBRA STANDARDS FOR PAINTING REQUIREMENTS).
6. UNLESS INDICATED OTHERWISE, INSTALL ASSEMBLY PLUMB/LEVEL.

GBRA Guadalupe-Blanco River Authority	AIR RELEASE VALVE TYPE 4	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 170	



NOTES:

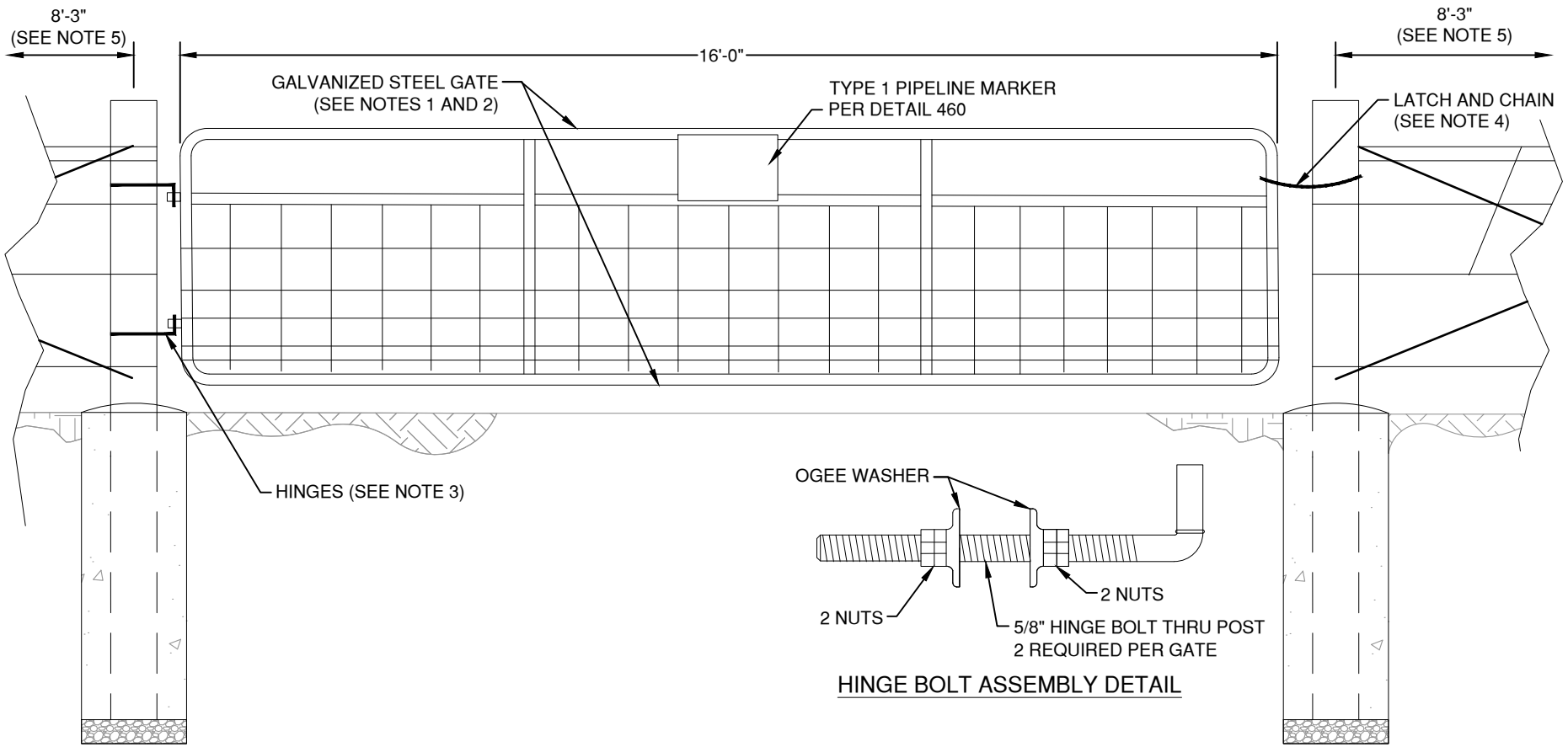
1. A TOWER IS REQUIRED FOR ANTENNA HEIGHT GREATER THAN 34' AGL THAT CANNOT BE ACCOMPLISHED WITH A MAST AS DESCRIBED HEREIN (SEE NOTES 3, 4, AND 5 BELOW).
2. RADIO AND RF COAXIAL SURGE PROTECTOR SHALL BE INSTALLED IN A LOCKABLE 24"W X 24"H X 8"D ENCLOSURE WITH BACKPLANE. ALL EQUIPMENT INSTALLED INSIDE THE ENCLOSURE SHALL BE MOUNTED ON THE BACKPLANE. MOUNT THE ENCLOSURE ON A STRUT RACK AT GROUND LEVEL BELOW THE ANTENNA SUCH THAT THE BOTTOM OF THE ENCLOSURE IS 48" ABOVE FINISHED GRADE OR SLAB-ON-GRADE, WHICHEVER IS APPLICABLE. GROUND THE ENCLOSURE TO THE TOWER/MAST/POLE. ALL ENCLOSURE PENETRATIONS SHALL BE THROUGH THE BOTTOM OF THE ENCLOSURE. ROUTE THE COAXIAL CABLE FROM THE ANTENNA INTO THE BOTTOM OF THE ENCLOSURE WITH AN ALUMINUM CGB CONNECTOR. ROUTE ALL FOUR DUCT BANK CONDUITS INTO THE BOTTOM OF THE ENCLOSURE AND SEAL THE CONDUITS WITH DUCT SEAL.
3. WHERE FEASIBLE, ANTENNA MASTS MAY BE MOUNTED ON TOP OF STORAGE TANKS OR ATTACHED TO ELECTRICAL SHELTERS OR OTHER STRUCTURES. HANDRAIL SUPPORTED MASTS SHALL BE LIMITED TO 10' MAXIMUM LENGTH. STRUCTURE SUPPORTED MASTS SHALL BE LIMITED TO 20' MAXIMUM LENGTH. ROUTE COAXIAL CABLE INSIDE CONDUIT FROM ORIGINATION TO MAST. MAST SHALL BE 2" MINIMUM GRS CONDUIT THREADED ONTO COAXIAL CONDUIT. MAST SPLICES OR COUPLINGS ARE NOT ALLOWED. INSTALL TYPE T CONDULET WITH CGB CONNECTOR THREADED ONTO TOP OF MAST. INSTALL ANTENNA ON A CAPPED CONDUIT NIPPLE THREADED INTO TOP OF TYPE T CONDULET SUCH THAT CAP IS 12" MINIMUM ABOVE TOP OF ANTENNA. ROUTE COAXIAL CABLE INSIDE MAST TO TYPE T CONDULET CGB CONNECTOR AND ANTENNA. ATTACH 4/0 BARE COPPER GROUND WIRE TO BOTTOM OF MAST AND ROUTE TO A DEDICATED GROUND ROD. ROUTE #6 BARE SOLID COPPER GROUND WIRE FROM 4/0 MAST CONNECTION TO SPLINE BALL. ONLY ONE (1) SPLINE BALL REQUIRED. SECURE #6 WIRE TO MAST WITH STAINLESS STEEL BAND CLAMPS.
4. LIFT STATION ELECTRICAL SHELTER SUPPORTED MASTS SHALL BE INSTALLED AT THE END OF THE SHELTER (SEE NOTE 3). RADIO AND RF COAXIAL SURGE PROTECTOR SHALL BE INSTALLED IN THE PUMP CONTROL PANEL OR IN A SEPARATE ENCLOSURE (SEE NOTE 2). COAXIAL CABLE SHALL BE ROUTED IN DUCT BANK TO MAST. SECURE MAST TO ELECTRICAL SHELTER STRUCTURAL STEEL WITH STRUT AND STRUT CLAMPS. DO NOT PENETRATE ROOF.
5. A CLASS 2 HOT DIP GALVANIZED STEEL UTILITY POLE (40' MAXIMUM) MAY BE UTILIZED FOR ANTENNA HEIGHT OF 34' AGL OR LESS. POLE BURY DEPTH SHALL BE 10% OF OVERALL POLE HEIGHT PLUS 6" (E.G. 40' POLE WOULD BE 4.5' BURY AND 35.5' EXPOSED). BURY DEPTH SHALL BE TOTALLY ENCASED WITH POLECRETE SUCH THAT NO PORTION OF THE POLE WILL BE IN CONTACT WITH EARTH. ATTACH 4/0 BARE COPPER GROUND WIRE TO BOTTOM OF POLE AND ROUTE TO A DEDICATED GROUND ROD. ROUTE #6 BARE SOLID COPPER GROUND WIRE FROM 4/0 POLE CONNECTION TO SPLINE BALL. ONLY ONE (1) SPLINE BALL REQUIRED. ALL CABLES AND CONDUCTORS SHALL BE ROUTED IN CONDUIT TO TOP OF POLE. INSTALL TYPE T CONDULET, CGB CONNECTOR, CAPPED NIPPLE, AND ANTENNA AT TOP OF COAXIAL CONDUIT AS DESCRIBED IN NOTE 3. CONDUIT HANGERS SHALL BE SECURED TO THE POLE WITH STAINLESS STEEL BAND CLAMPS.
6. TYPICAL FOR ALL INSTALLATIONS (I.E. TOWERS, MASTS, POLES, ETC.).
7. CONDUIT FOR COAXIAL CABLE SHALL BE 2" MINIMUM.
8. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.
9. REFERENCE GBRA STANDARD SPECIFICATION 13428 FOR ADDITIONAL REQUIREMENTS.

Guadalupe-Blanco River Authority

ANTENNA TOWER

REVISED	SCALE
JUL. 28, 2025	NONE

DETAIL NO. 180



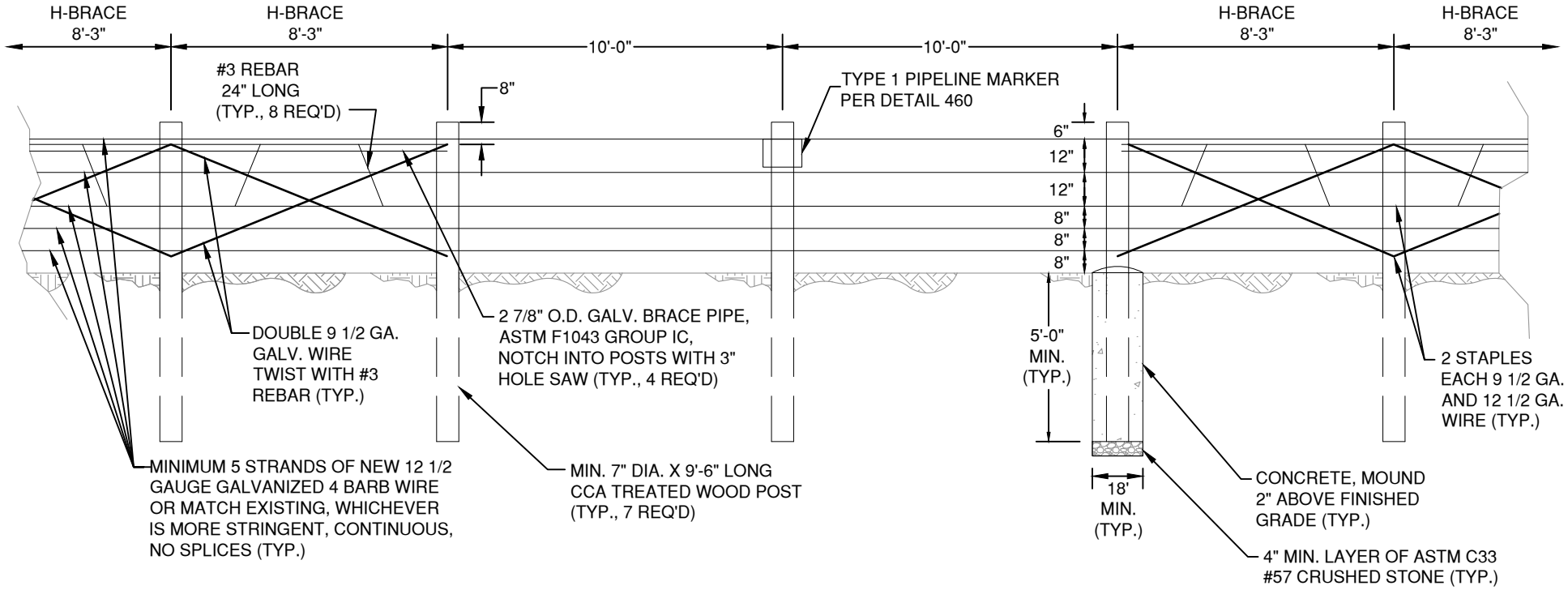
NOTES:

1. INSTALL GATE IN CENTER OF PERMANENT EASEMENT OR CENTERED ON PIPELINE AS DIRECTED BY GBRA INSPECTOR.
2. GATES SHALL BE CONSTRUCTED OF 16 GAUGE GALVANIZED STEEL 1 5/8" O.D. TUBING WITH WELDED SADDLE CONNECTIONS AND 4 GAUGE GALVANIZED HOG WIRE. CRIMPED CONNECTIONS ARE NOT ACCEPTABLE.
3. HINGE ASSEMBLIES SHALL BE HOT DIP GALVANIZED, THRU BOLT TYPE AT POST, WITH RECEIVERS WELDED TO GATE.
4. LATCH SHALL BE 3 1/2" BRASS DOUBLE BOLT SNAP HOOK WITH 1/4" DIAMETER HOT DIP GALVANIZED CHAIN AROUND POST. SECURE CHAIN TO POST WITH FENCE STAPLES.
5. INSTALL DUAL H-BRACES ON EACH SIDE OF GATE PER DETAIL 200.
6. FASTEN EXISTING FENCE WIRES TO NEW BRACE POSTS BEFORE CUTTING THE EXISTING WIRES.
7. ALL MATERIAL SHALL BE NEW AND UNUSED.
8. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

GBRA
Guadalupe-Blanco River Authority

BARBED WIRE FENCE GATE

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 190	

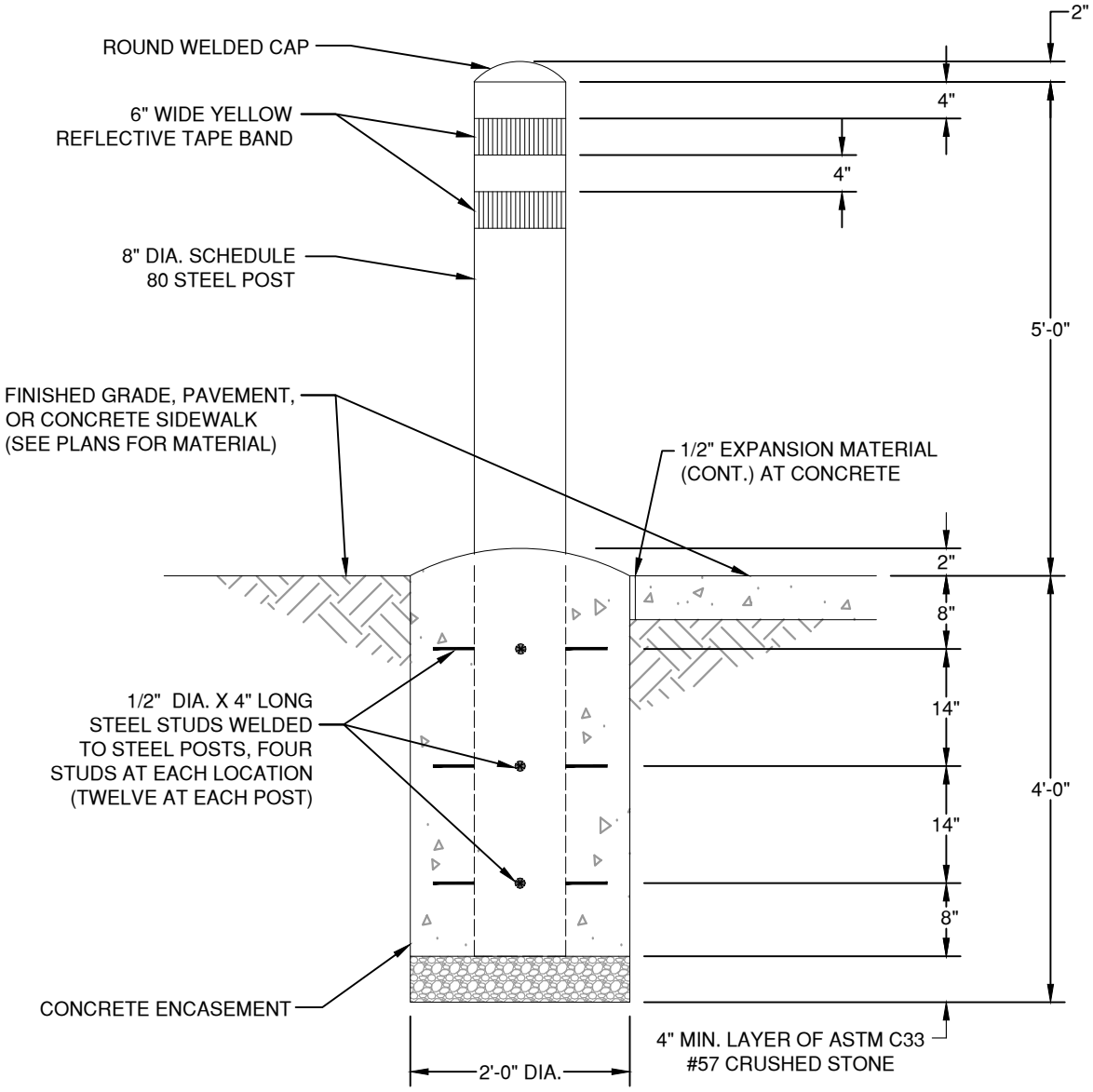


NOTES:
1. ALL MATERIAL SHALL BE NEW AND UNUSED.
2. FASTEN EXISTING FENCE WIRES TO NEW BRACE POSTS BEFORE CUTTING THE EXISTING WIRES.
3. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

GBRA
Guadalupe-Blanco River Authority

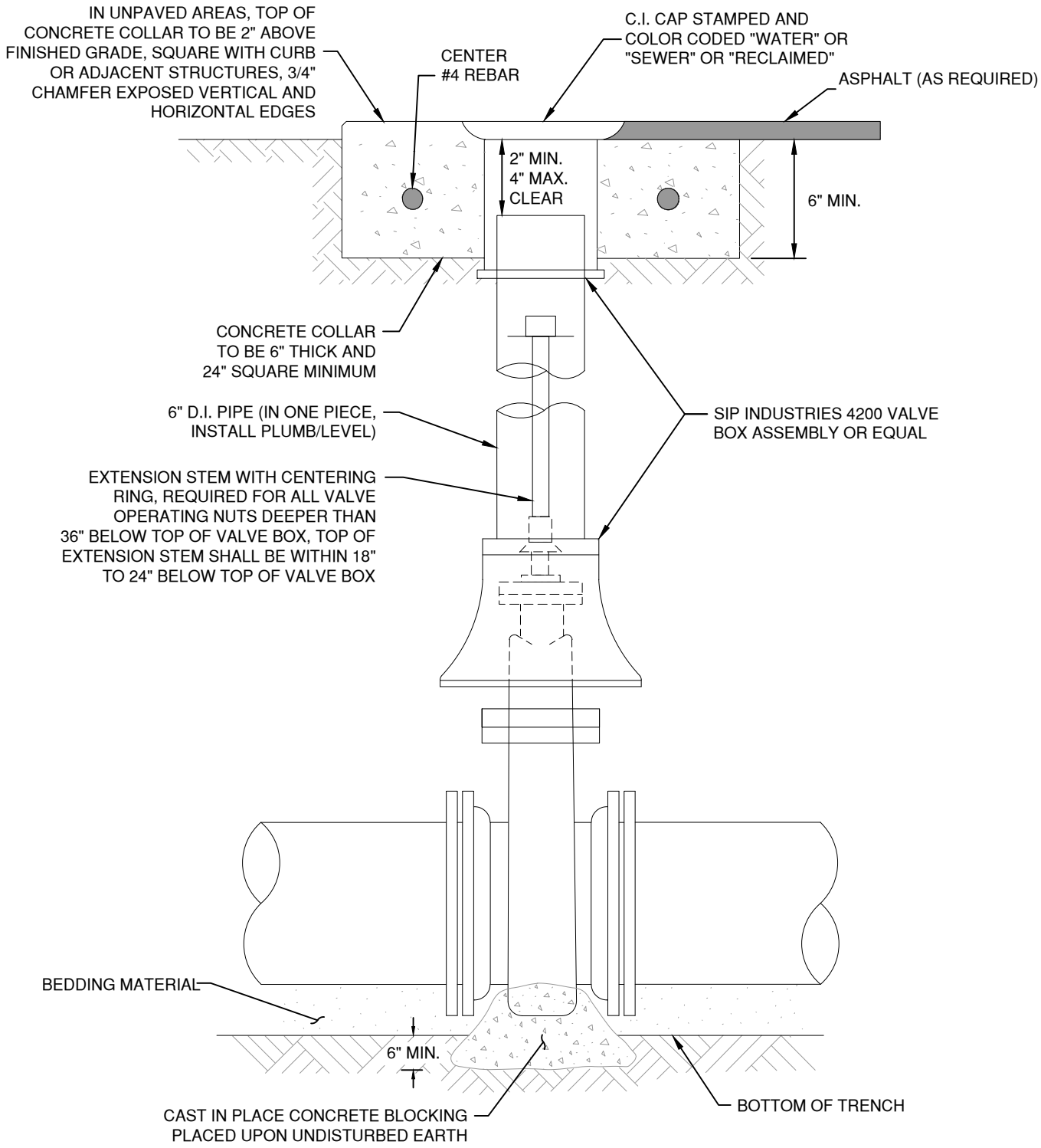
BARBED WIRE FENCE REPAIR

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 200	



NOTES:
1. BOLLARDS ARE REQUIRED FOR ALL BURIED VALVES IN UNPAVED AREAS AND AT OTHER LOCATIONS WHERE SHOWN ON DRAWINGS.
2. ASSEMBLY SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
3. INSTALL ASSEMBLY PLUMB/LEVEL.

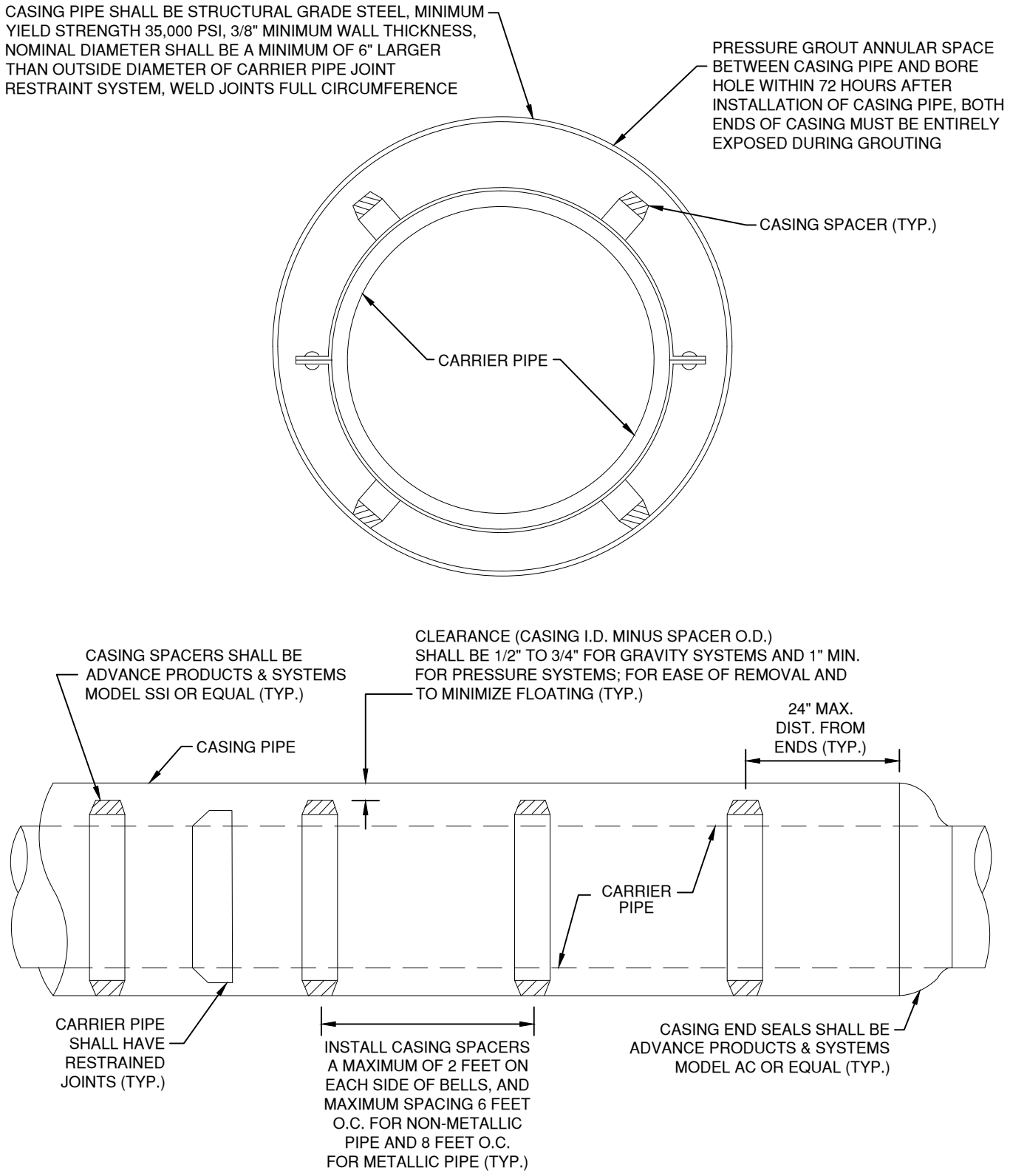
GBRA Guadalupe-Blanco River Authority	BOLLARD	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 210	



NOTES:

1. ALL VALVES SHALL OPEN COUNTER-CLOCKWISE, EXCEPT RECLAIMED SHALL OPEN CLOCKWISE.
2. ALL VALVES SHALL HAVE RESTRAINED MECHANICAL JOINT END CONNECTIONS UNLESS NOTED OTHERWISE.
3. FOR WATER, PROVIDE RESILIENT WEDGE GATE VALVES, AMERICAN FLOW CONTROL SERIES 2500 OR EQUAL.
4. FOR WASTEWATER, PROVIDE EPOXY LINED AND COATED ROUND PORT PLUG VALVES BY CRISPIN, GA, MILLIKEN, OR PRATT. PLUG VALVES SHALL BE HORIZONTAL SHAFT CLOSING DOWNWARD. INSTALL ORIENTATION OF SEAT END ("SE") AS SHOWN ON DRAWINGS OR AS DIRECTED BY GBRA INSPECTOR.
5. INSTALL ASSEMBLY PLUMB/LEVEL.

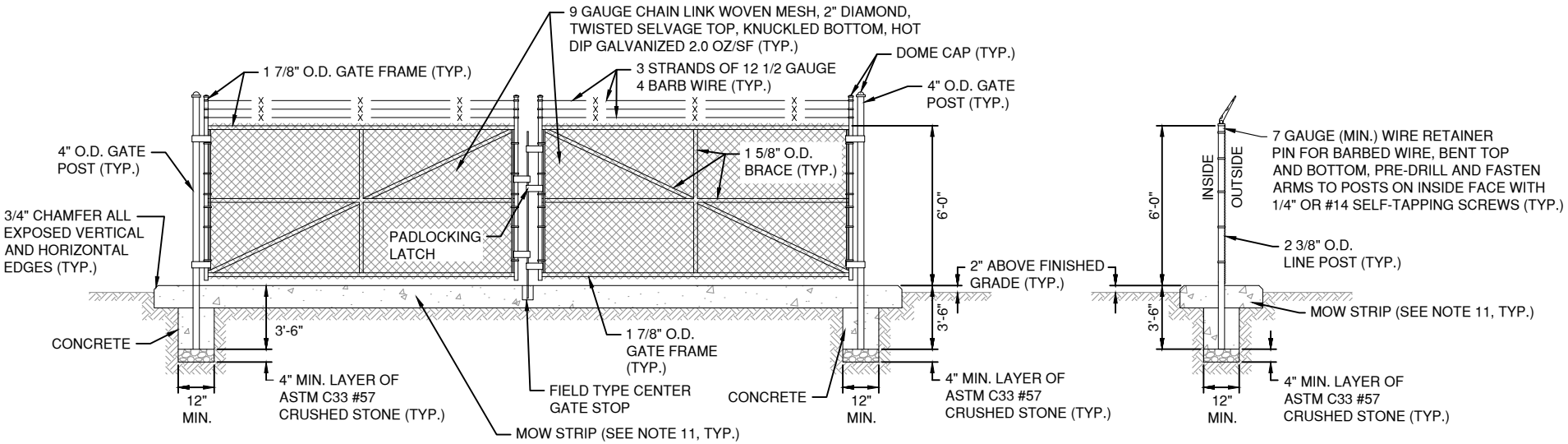
GBRA Guadalupe-Blanco River Authority	BURIED VALVE	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 220	

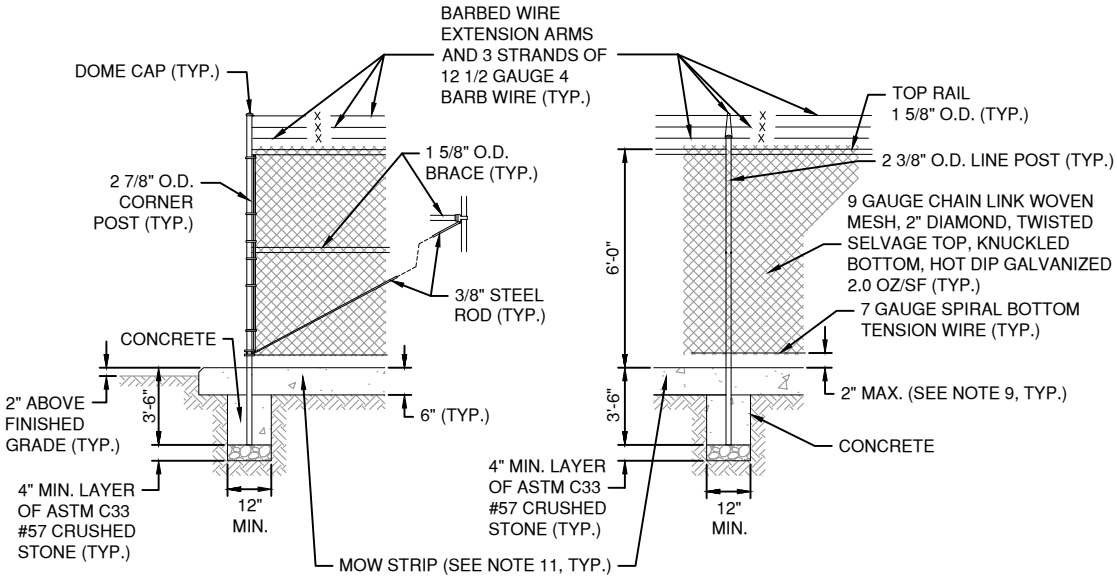


NOTES:

THE MATERIALS SHOWN APPLY TO JACK AND BORE INSTALLATIONS AND STREAM/RIVER CROSSING. FOR ROAD CROSSINGS, CASING SHALL EXTEND 5 FEET MINIMUM BEYOND ROW ON EACH END. OPEN CUT SLEEVING OF SUBDIVISION UTILITIES UNDER STORM SEWER MAY BE C900 DR18 CASING (COLOR TO MATCH CARRIER PIPE) AND ADVANCE PRODUCTS & SYSTEMS MODEL CI SPACERS, OR EQUAL, WITH STAINLESS STEEL HARDWARE. REFERENCE GBRA STANDARDS AND DESIGN GUIDELINES FOR ADDITIONAL SLEEVE REQUIREMENTS. THE CLEARANCE AND DIMENSIONS SHOWN APPLY TO ALL INSTALLATIONS.

GBRA Guadalupe-Blanco River Authority	CASING AND SPACERS	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 230	





NOTES:

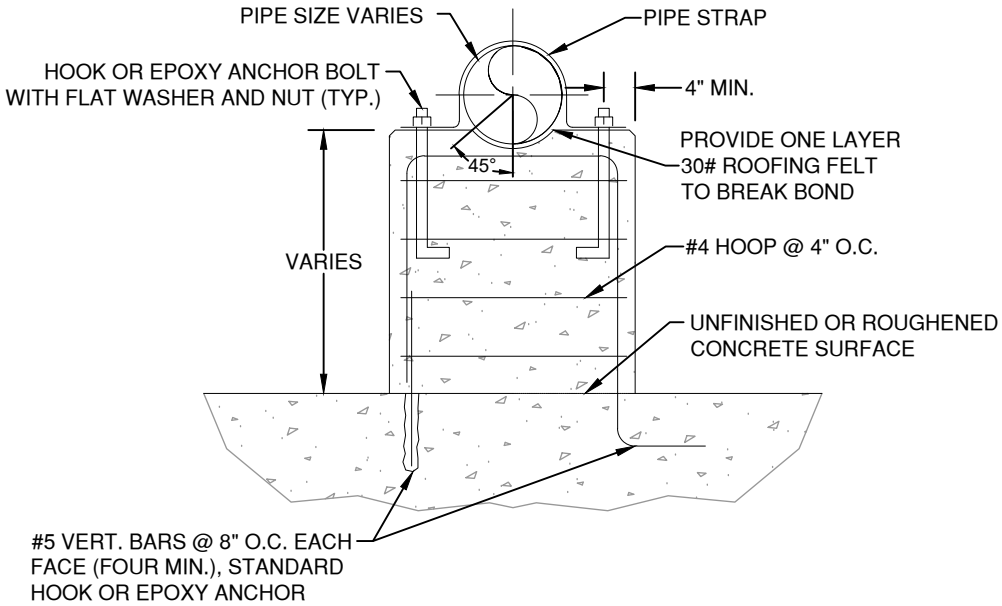
1. SPLICING OF MATERIAL IS NOT ALLOWED.
2. ALL PIPE SHALL BE ASTM F1043 GROUP IC. ALL OTHER MATERIAL SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. GALVANIZING REPAIRS SHALL BE MINIMUM TWO (2) BRUSH COATS OF ZRC GALVILITE.
3. INSTALL A DUCK BILL HOLD BACK FOR EACH GATE LEAF WITH 12" MINIMUM POST DEPTH.
4. TENSION BARS SHALL BE 3/16 " X 3/4".
5. TENSION BANDS SHALL BE MINIMUM 14 GAUGE AND 3/4" WIDTH.
6. BRACE BANDS SHALL BE MINIMUM 12 GAUGE AND 3/4" WIDTH.
7. POST BURY DEPTH MAY BE REDUCED IF 24" MINIMUM IN SOLID ROCK BELOW BOTTOM OF MOW STRIP.
8. MAXIMUM 10' POST SPACING.
9. MAXIMUM 2" GAP AT BOTTOM OF FENCE AND GATES.
10. INSTALL POSTS AND GATES PLUMB/LEVEL IN STRAIGHT ALIGNMENT BETWEEN CORNER POSTS.
11. MOW STRIP SHALL BE 6"D X 24"W REINFORCED CONCRETE CENTERED ON POSTS 2" ABOVE FINISHED GRADE, #4 REBAR @ 18" O.C.E.W., TOOL JOINTS CENTERED BETWEEN POSTS, BROOM FINISH (TYP.). INSTALL 1 1/2" PVC PIPE WEEPS BELOW REBAR AT 12" O.C. THRU MOW STRIP AT LOW POINTS; INSTALL 6" MIN. LAYER OF ASTM C33 #57 CRUSHED STONE OUTSIDE FENCE AND PERFORM GRADING OUTSIDE FENCE TO PROMOTE SITE DRAINAGE.

GBRA
Guadalupe-Blanco River Authority

CHAIN LINK FENCE AND GATES

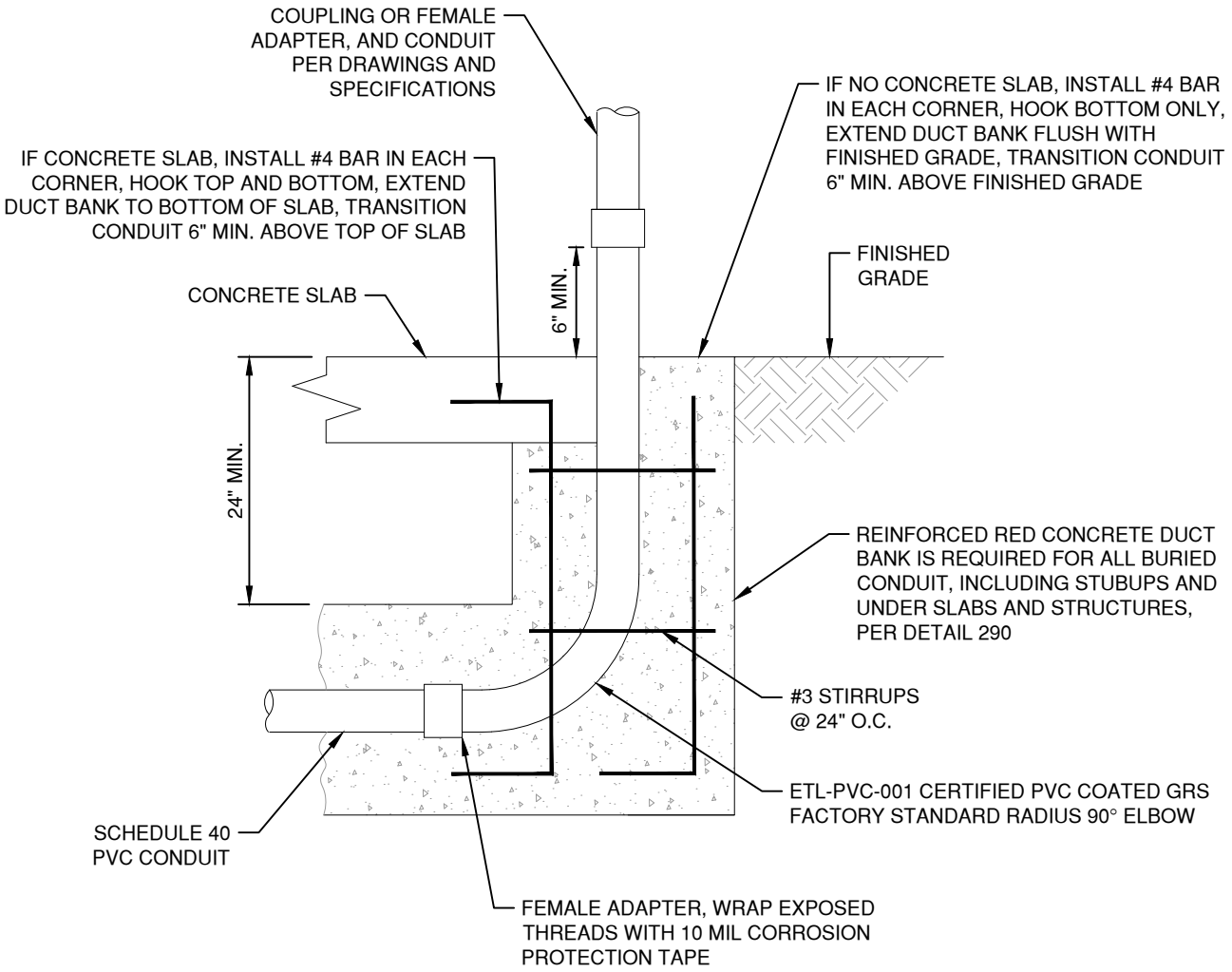
REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 240	

CONCRETE PEDESTAL SUPPORT SCHEDULE DIMENSIONS IN INCHES			
PIPE SIZE NOM. DIA.	STRAP WIDTH	ANCHOR BOLTS DIA.	PEDESTAL THICKNESS
6"–12" 14"–24" 30"–36"	3" 4" 6"	3/4" 1" 1 1/4"	8" 10" 12"



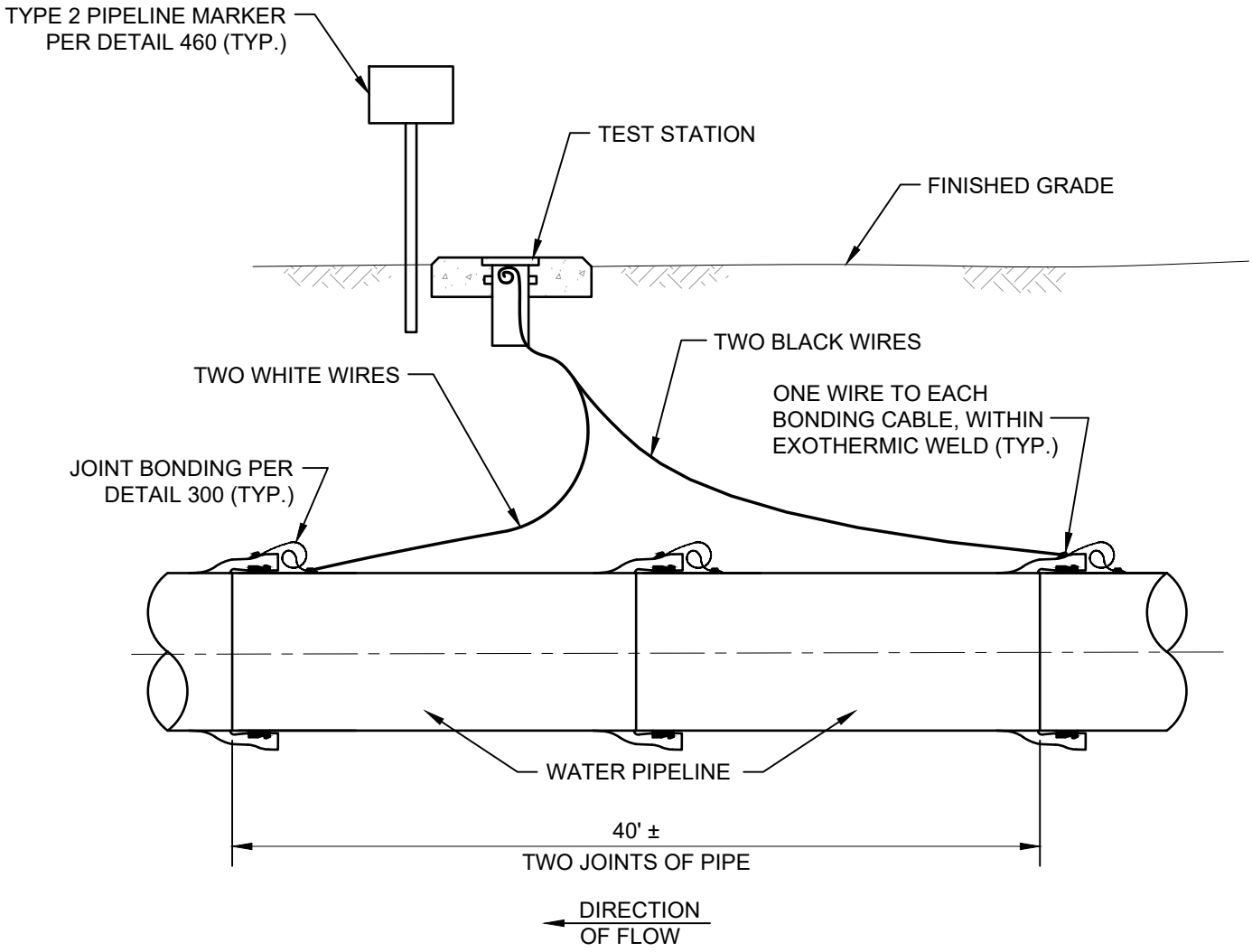
NOTES:
1. INSTALL WHERE SHOWN ON DRAWINGS.
2. ALL EXPOSED VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE FORMED WITH 3/4" CHAMFER STRIPS.
3. INSTALL ASSEMBLY PLUMB/LEVEL.

GBRA Guadalupe-Blanco River Authority	CONCRETE PEDESTAL PIPE SUPPORT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 250	



NOTES:
1. INSTALL STUBUPS PLUMB/LEVEL.

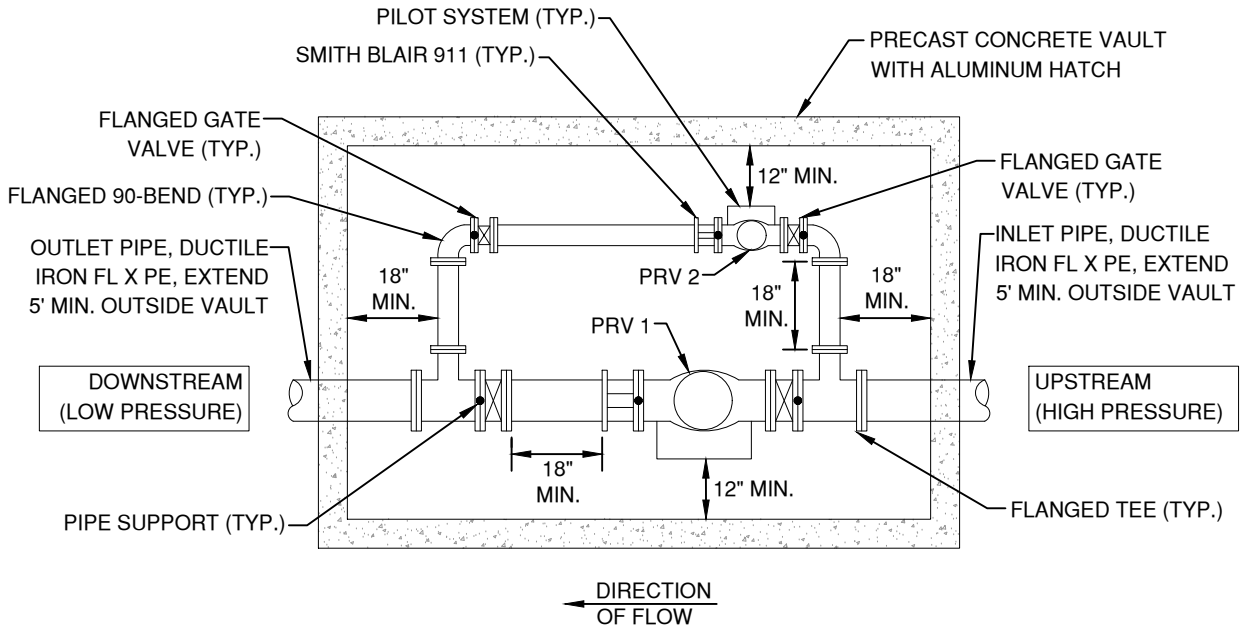
GBRA Guadalupe-Blanco River Authority	CONDUIT STUBUP	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 260	



NOTES:

1. TEST STATIONS SHALL BE COLOR CODED COPPERHEAD RB14TP. INSTALL TEST STATIONS AT ISOLATION VALVES, OR OTHERWISE TO ACHIEVE 2,000 LF MAXIMUM SPACING, WITHIN VALVE BOX CONCRETE COLLARS WITH 6" MINIMUM CONCRETE ENCASEMENT HORIZONTALLY ON ALL SIDES. LEAVE 12" SLACK IN ALL WIRES INSIDE TEST STATION. BUNDLE WIRES WITH ELECTRICAL TAPE 6" FROM END. SECURE ONLY ONE WIRE OF EACH COLOR TO TERMINAL POST.
2. WIRES SHALL BE 12 GA COPPER CLAD STEEL WITH 30 MIL HDPE JACKET. SPLICES ARE NOT ALLOWED. TAPE WIRES TO TOP OF PIPE AT 4 FT MAXIMUM INTERVALS. BUNDLE WIRES WITH ELECTRICAL TAPE AT 2 FT MAXIMUM INTERVALS FROM TOP OF PIPE TO TEST STATION.
3. INSTALL TEST STATIONS PLUMB/LEVEL.

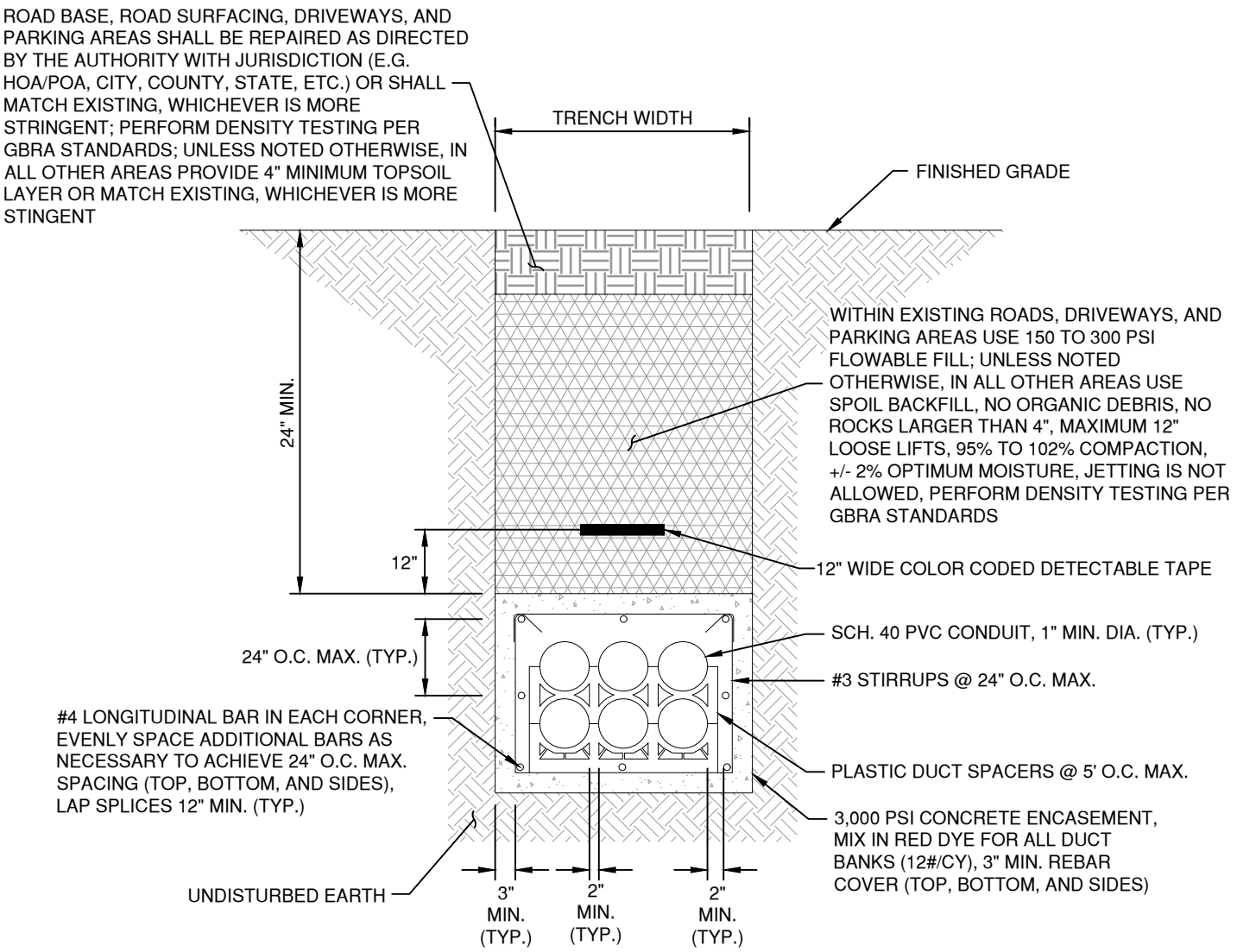
GBRA Guadalupe-Blanco River Authority	CORROSION TEST STATION	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 270	



NOTES:

1. SUBMIT PRODUCT DATA FOR ALL MATERIALS AND A DIMENSIONED VAULT AND PIPING LAYOUT DRAWING DEMONSTRATING ALL REQUIRED CLEARANCES AND OBTAIN GBRA APPROVAL PRIOR TO ORDERING ANY MATERIALS.
2. ALL EXPOSED VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE FORMED WITH 3/4" CHAMFER STRIPS.
3. PRECAST CONCRETE VAULT AND ALUMINUM HATCH SHALL BE H-20 TRAFFIC RATED. HATCH SHALL BE PER CITY OF AUSTIN SPL-614A WITH PADLOCK STAPLE. INSTALL HATCH LENGTHWISE IN CENTER OF VAULT.
4. TOP OF VAULT SHALL BE 4" ABOVE FINISHED GRADE.
5. VAULT SHALL BE OPEN BOTTOM INSTALLED ON 6" MINIMUM LAYER OF ASTM C33 #57 CRUSHED STONE.
6. PROVIDE 24" CLEARANCE FROM BOTTOM OF PIPE TO BOTTOM OF VAULT. DEPTH OF PIPE SHALL BE IN ACCORDANCE WITH DESIGN PROFILES AND MINIMUM COVER REQUIREMENTS.
7. PROVIDE PRECAST BLOCKOUTS WITH KEYWAY AT WALL PIPE PENETRATIONS. FORM AND FILL WITH NON-SHRINK GROUT.
8. PIPING OUTSIDE VAULT SHALL BE RESTRAINED IN ACCORDANCE WITH GBRA STANDARDS.
9. ALL PIPING INSIDE VAULT SHALL BE FLANGED DUCTILE IRON.
10. FLANGE COUPLING ADAPTERS SHALL BE INSTALLED ON LOW PRESSURE SIDE ONLY, SMITH BLAIR MODEL 911 OR EQUAL.
11. GATE VALVES SHALL BE FLANGED AMERICAN FLOW CONTROL SERIES 2500 RISING STEM OR EQUAL.
12. PRESSURE REDUCING VALVES (PRV) SHALL BE CLA-VAL MODEL 90-01G (OR EQUAL BY SINGER, WATTS, OR ZURN WILKINS) WITH ANTI-CAVITATION TRIM AND STAINLESS STEEL PILOT SYSTEMS. INSTALL PILOT SYSTEMS AND GAUGES ON SIDE OF PRV ADJACENT TO NEAREST WALL. STRAINERS ARE REQUIRED IF PROCESS FLUID IS NOT POTABLE.
13. PRV 1 SHALL BE SAME NOMINAL SIZE AS MAIN PIPELINE. PRV 2 SHALL BE HALF NOMINAL SIZE OF MAIN PIPELINE.
14. INSTALL A PRESSURE GAUGE ON EACH PRV INLET AND OUTLET PER DETAIL 470 (TRANSMITTER IS NOT REQUIRED). INSTALL A 45-BEND FITTING BELOW EACH GAUGE SUCH THAT GAUGES ARE LEGIBLE FROM THE HATCH OPENING.
15. INSTALL AN ADJUSTABLE PIPE SUPPORT WITH FLANGE CONNECTION AT EACH LOCATION SHOWN. INSTALL A SQUARE CAST-IN-PLACE REINFORCED CONCRETE BEARING PAD UPON UNDISTURBED EARTH CENTERED UNDER EACH SUPPORT. BEARING PADS SHALL BE SQUARE WITH WALLS AND SHALL EXTEND 6" BEYOND BASE PLATES ON ALL SIDES. TOP OF BEARING PADS SHALL BE 2" ABOVE CRUSHED STONE LAYER. REFERENCE DETAIL 130 FOR ADDITIONAL REQUIREMENTS.
16. PAINT PIPING, FITTINGS, AND VALVES WITHIN VAULT (REFERENCE GBRA STANDARDS FOR PAINTING REQUIREMENTS).

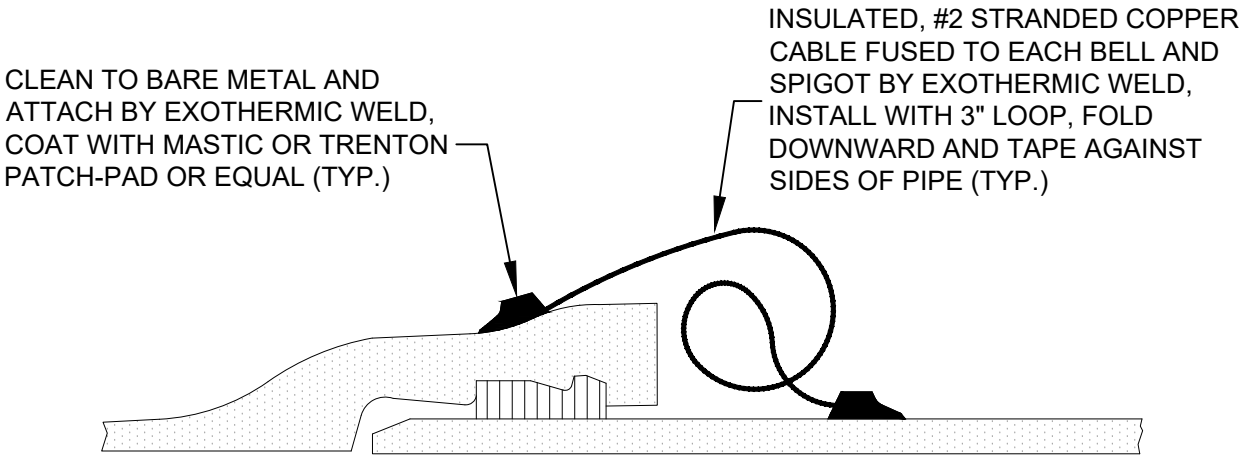
GBRA Guadalupe-Blanco River Authority	DUAL PRV VAULT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 280	



NOTES:

1. REBAR AND RED-DYED CONCRETE ARE REQUIRED FOR ALL DUCT BANKS, INCLUDING STUBUPS AND UNDER SLABS AND STRUCTURES.
2. DUCT BANK REBAR SHALL BE DOWELED INTO SLABS AND STRUCTURES WITH CAST-IN-PLACE OR EPOXY BARS (REQUIRED FOR EACH LONGITUDINAL BAR, HOOK EACH CAST-IN-PLACE END).
3. SIGNALS, COMMUNICATIONS, POWER, AND CONTROLS SHALL BE ROUTED IN SEPARATE DUCTS.
4. DO NOT MIX VOLTAGES IN THE SAME CONDUIT.
5. PROVIDE ONE SPARE CONDUIT OF EACH SIZE AND TYPE IN ALL DUCT BANKS.
6. MINIMUM 12" CLEARANCE BETWEEN SIGNAL OR COMMUNICATION DUCTS AND POWER OR CONTROL DUCTS. FIBER OPTICS ARE EXEMPT FROM THIS REQUIREMENT.
7. MINIMUM 2" CLEARANCE BETWEEN DUCTS FOR LIKE SERVICES.
8. MINIMUM 2" CLEARANCE BETWEEN REBAR AND CONDUIT.
9. MINIMUM 3" CONCRETE COVER AROUND REBAR.
10. MAINTAIN 12" MINIMUM VERTICAL CLEARANCE BETWEEN DUCT BANK CONCRETE AND OTHER UTILITIES.
11. SHARED TRENCHES WITH OTHER UTILITIES ARE NOT ALLOWED.
12. DUCT BANKS SHALL BE SLOPED TO PROMOTE DRAINAGE.
13. THE CONTRACTOR'S MEANS AND METHODS SHALL PREVENT FLOATING OF CONDUIT AND REBAR DURING CONCRETE PLACEMENT. METAL TO METAL CONTACT IS NOT ALLOWED BETWEEN THE REBAR CAGE AND SUPPORTS/BRACING.
14. SLOPE CONCRETE AT CONSTRUCTION JOINTS SUCH THAT THE NEXT PLACEMENT OVERLAPS THE PREVIOUS PLACEMENT. JOINTS SHALL BE CLEAN AND FREE OF WOOD, SOIL, ROCKS, DISTURBED/DAMAGED CONCRETE, OR ANY OTHER DEBRIS.
15. REMOVE ALL FORMS PRIOR TO BACKFILLING.
16. ALL CONDUITS INSIDE HANDHOLES, INCLUDING SPARES, SHALL BE SEALED WITH 3M SCOTCHCAST 2123 RE-ENTERABLE RESIN.

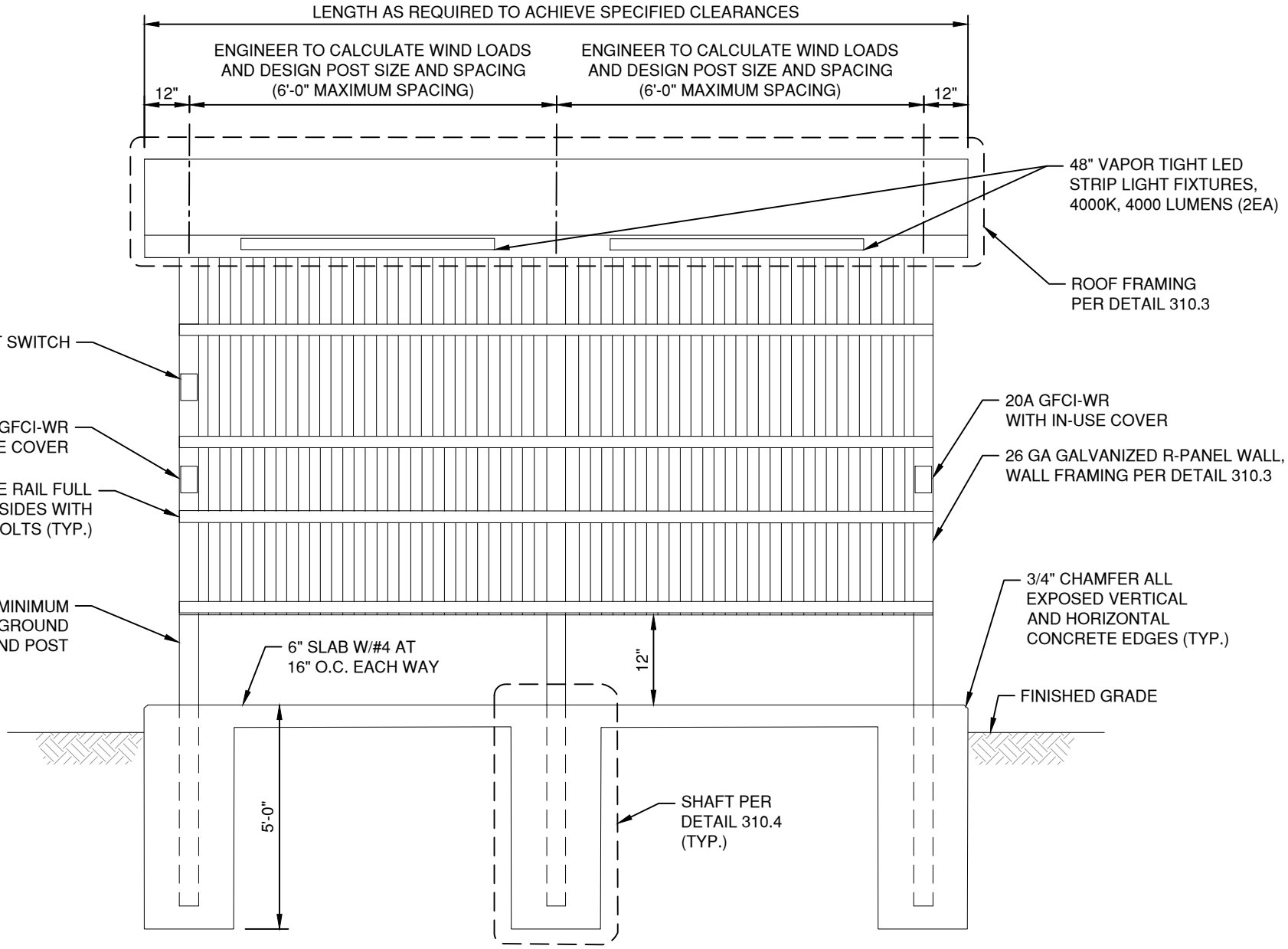
GBRA Guadalupe-Blanco River Authority	DUCT BANK	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 290	



NOTES:

1. BOND ALL JOINTS INCLUDING PIPE, FITTINGS, VALVES, ETC. USE CHARGE SIZES AS RECOMMENDED BY PIPE, FITTING, AND VALVE MANUFACTURERS.
2. TWO BONDING CABLES REQUIRED AT EACH BELL, ONE ON EACH SIDE OF PIPELINE AT 45 DEGREES ABOVE SPRINGLINE, WITH SEPARATE WELDS FOR EACH CABLE.

GBRA Guadalupe-Blanco River Authority	DUCTILE IRON PIPELINE JOINT BONDING	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 300	



NOTES:

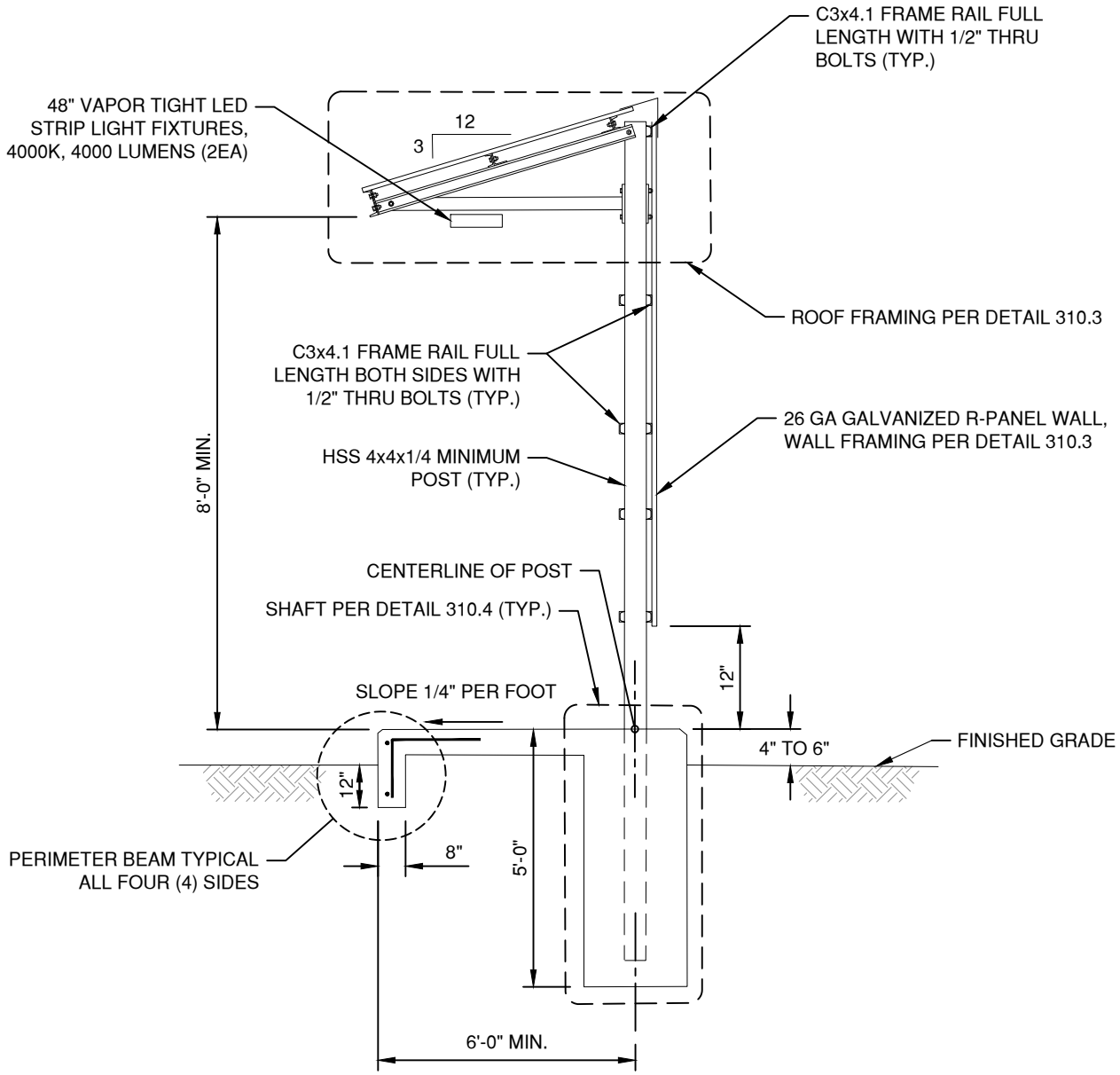
1. SEE DETAIL 310.4 FOR ELECTRICAL SHELTER NOTES.

GBRA
Guadalupe-Blanco River Authority

ELECTRICAL SHELTER FRONT VIEW

REVISED	SCALE
JUL. 28, 2025	NONE

DETAIL NO. 310.1



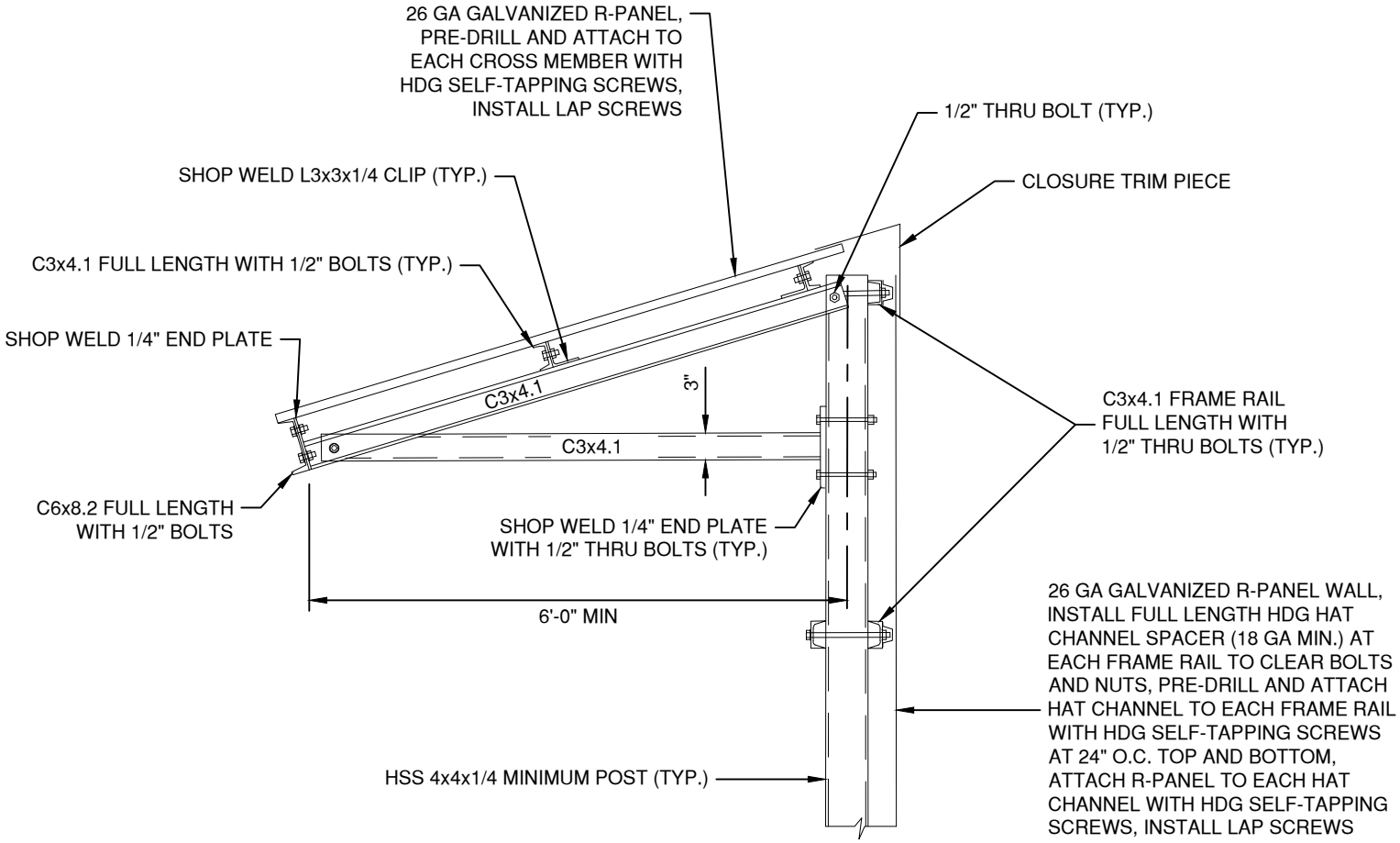
NOTES:

1. SEE DETAIL 310.4 FOR ELECTRICAL SHELTER NOTES.

Guadalupe-Blanco River Authority

ELECTRICAL SHELTER END VIEW

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 310.2	

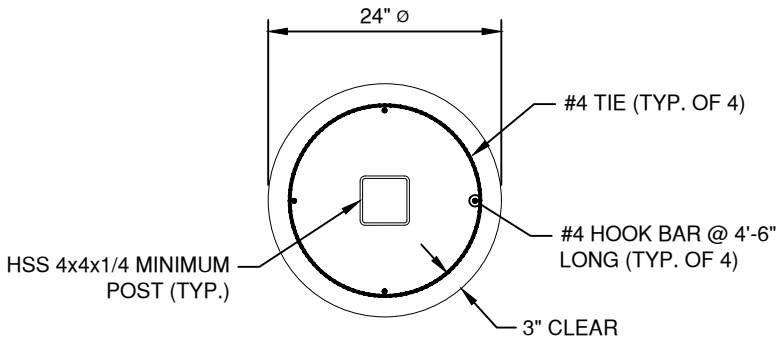


NOTES:
1. THIS DETAIL IS TYPICAL FOR EACH POST.
2. SEE DETAIL 310.4 FOR ELECTRICAL SHELTER NOTES.

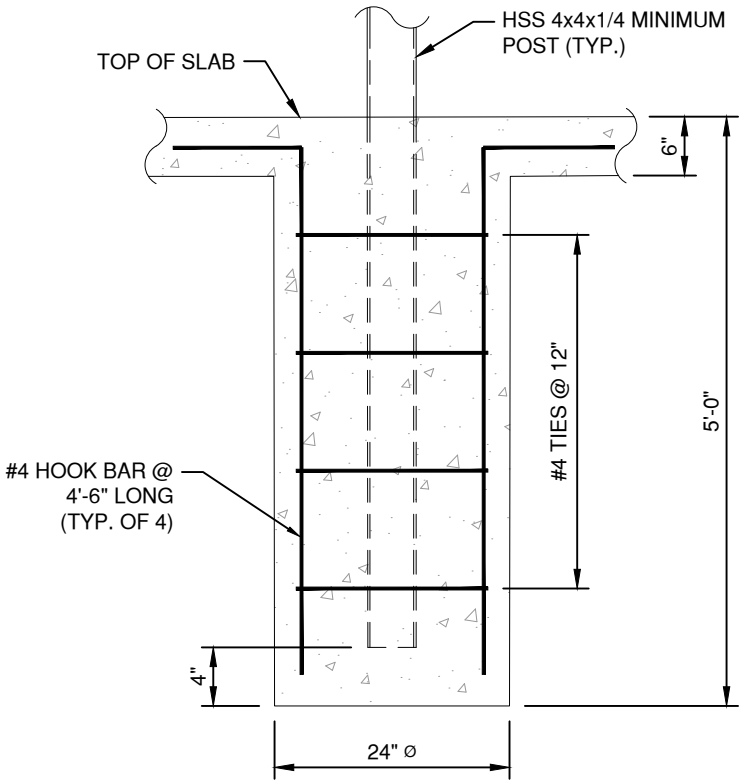
GBRA
Guadalupe-Blanco River Authority

ELECTRICAL SHELTER ROOF & WALL DETAIL

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 310.3	



PLAN



SECTION

NOTES:

1. ORIENTATION OF SHELTER SHALL BE SUCH THAT ELECTRICAL PANELS FACE EAST OR NORTH WITH SHELTER WALL ON WEST OR SOUTH SIDE SIDE. EQUIPMENT MUST BE WITHIN DIRECT LINE OF SIGHT FROM PANEL FRONT.
2. VERTICAL STACKING OF ELECTRICAL ENCLOSURES IS NOT ALLOWED. PROVIDE 6" MINIMUM CLEARANCE BETWEEN ENCLOSURES. PROVIDE 12" MINIMUM CLEARANCE FROM CENTER OF END POSTS TO NEAREST EDGE OF ENCLOSURES. CONTRACTOR SHALL SUBMIT A DIMENSIONED ELECTRICAL LAYOUT DRAWING DEMONSTRATING ALL REQUIRED CLEARANCES PRIOR TO FABRICATION OF SHELTER.
3. ATTACH ALL ELECTRICAL ENCLOSURES AND DEVICES TO STRUCTURE WITH VERTICAL STRUT.
4. ALARM BEACON SHALL BE MOUNTED 12" ABOVE ROOF PEAK AT END OF STRUCTURE. DO NOT PENETRATE ROOF OR WALL.
5. STRUCTURE SHALL BE HOT DIP GALVANIZED (HDG) AFTER FABRICATION.
6. FLAT WASHERS AND LOCK WASHERS ARE REQUIRED FOR ALL BOLTS AND NUTS.
7. ALL FASTENERS SHALL BE HOT DIP GALVANIZED (HDG) OR STAINLESS STEEL.
8. SPLICING OF MATERIALS IN NOT ALLOWED.
9. INSTALL ASSEMBLY PLUMB/LEVEL.

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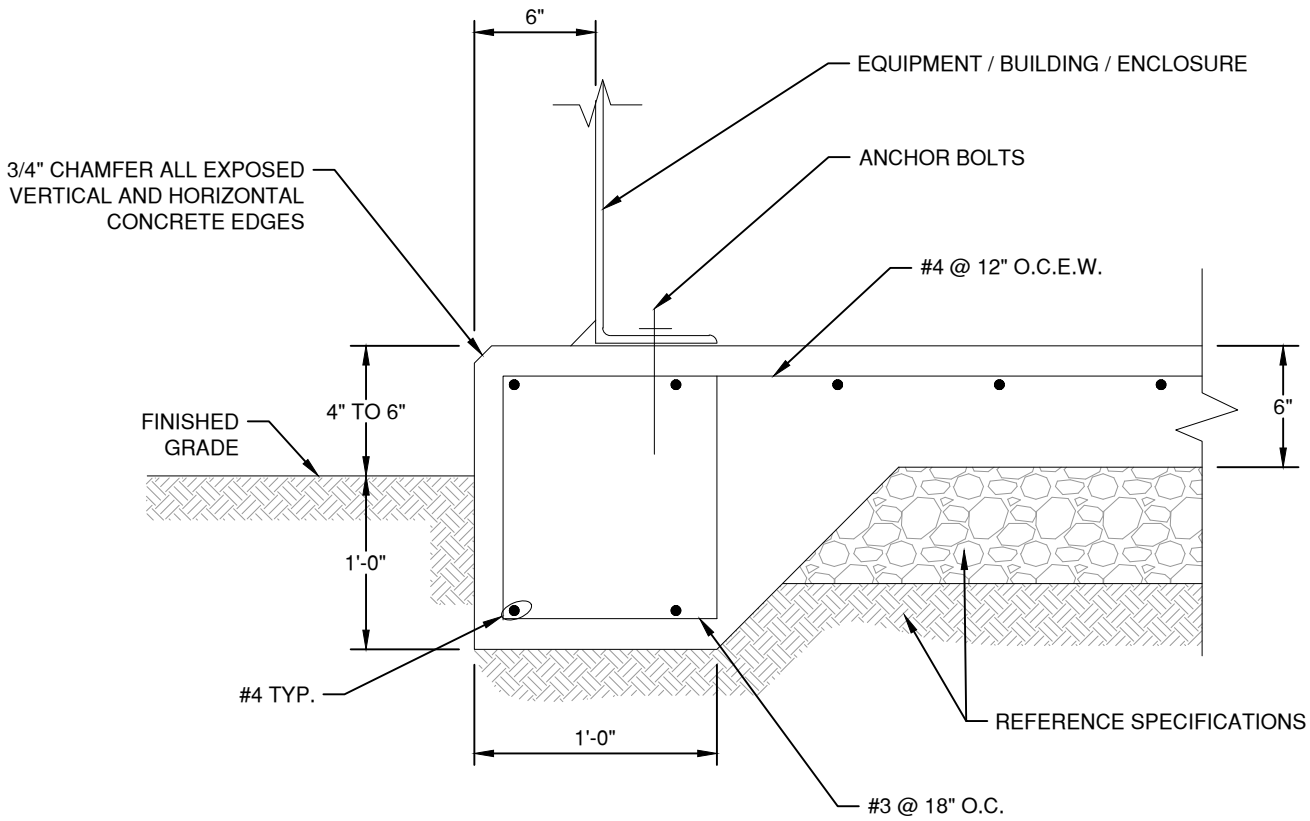
Guadalupe-Blanco River Authority

ELECTRICAL SHELTER NOTES & SHAFT DETAILS

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 310.4	



NOTES:

1. THIS DETAIL SHALL BE UTILIZED FOR FIBERGLASS BUILDINGS, GENERATORS, TRANSFORMERS, BLOWERS, PUMP SKIDS, RPZ ENCLOSURES, AND OTHER MISCELLANEOUS EQUIPMENT EXCEPT WHERE SPECIFIED MORE STRINGENT BY THE DESIGN ENGINEER.
2. UNLESS INDICATED OTHERWISE, INSTALL ASSEMBLY PLUMB/LEVEL.
3. FOR SLOPED FLOORS, CLEARANCE BELOW SLAB REBAR MAY BE REDUCED TO 2" MINIMUM.

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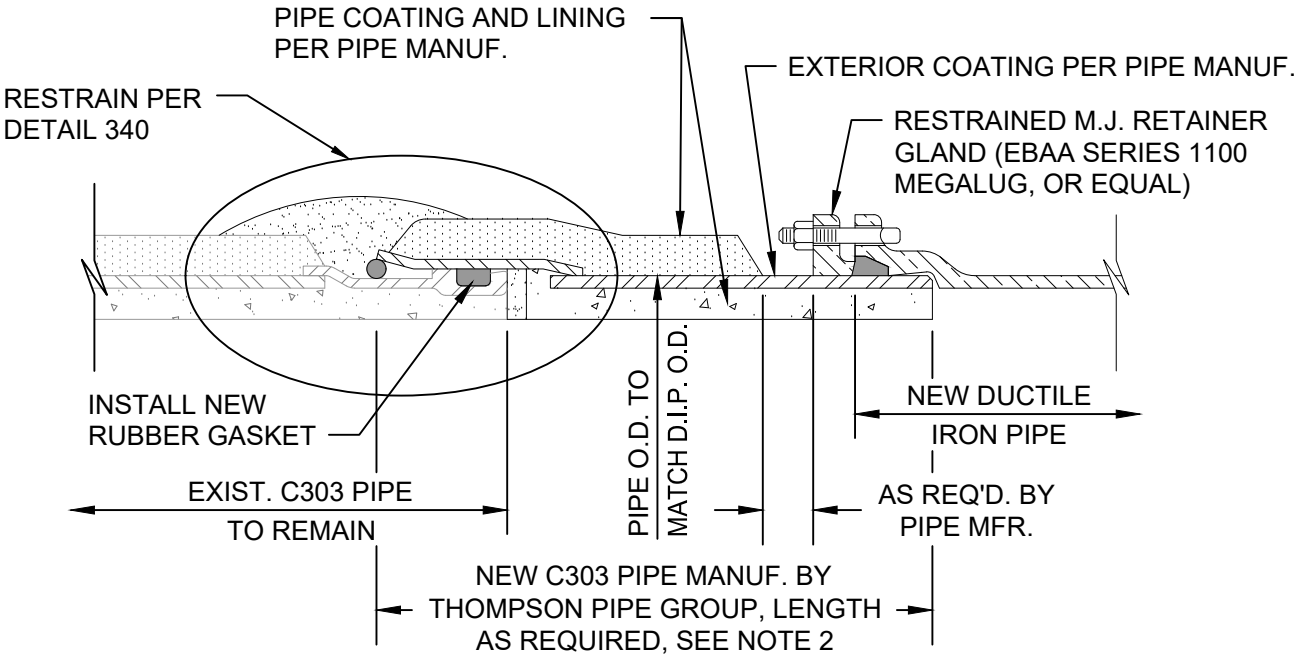
Guadalupe-Blanco River Authority

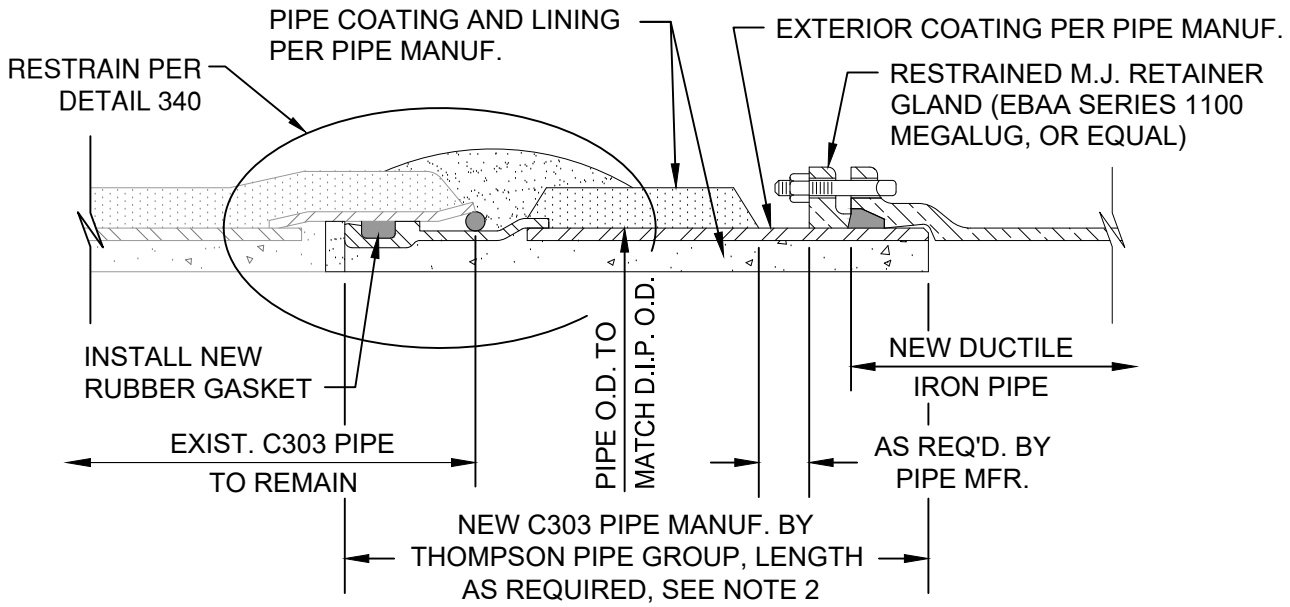
EQUIPMENT PAD

REVISED	SCALE
JUL. 28, 2025	NONE

DETAIL NO. 320



EXISTING C303 SPIGOT

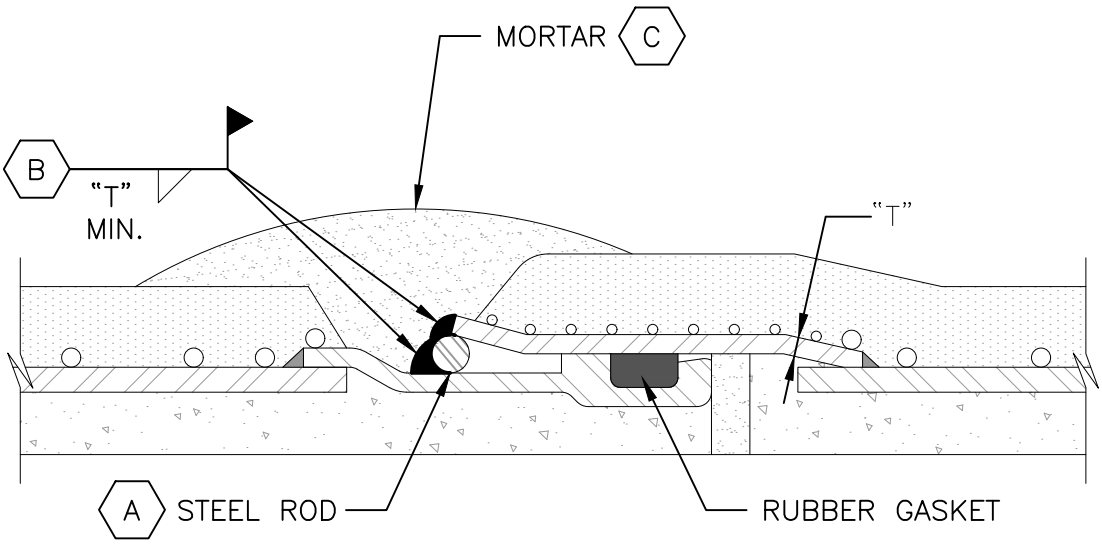


EXISTING C303 BELL

NOTES:

1. CONTRACTOR SHALL RETAIN THE SERVICES OF THOMPSON PIPE GROUP TO PERFORM ALL WELDING. WELDING PERSONNEL AND EQUIPMENT MUST REMAIN ONSITE UNTIL THE PIPELINE IS BACK IN SERVICE AND FULLY PRESSURIZED WITH NO VISIBLE LEAKS; THIS MUST BE INSPECTED AND APPROVED BY GBRA PRIOR TO DEPARTURE OF WELDING PERSONNEL AND EQUIPMENT.
2. WHERE FEASIBLE, A MECHANICAL JOINT PLAIN END ADAPTER AND SPLIT BUTT STRAP BY THOMPSON PIPE GROUP MAY BE UTILIZED IN LIEU OF THE BELL/SPIGOT ADAPTERS SHOWN. ALL ADAPTERS MUST MEET OR EXCEED THE PRESSURE RATING OF THE EXISTING C303 PIPE AND EBAA MINIMUM THICKNESS REQUIREMENTS.

GBRA Guadalupe-Blanco River Authority	EXISTING C303 PIPE CONNECTION TO NEW DUCTILE IRON PIPE	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 330	



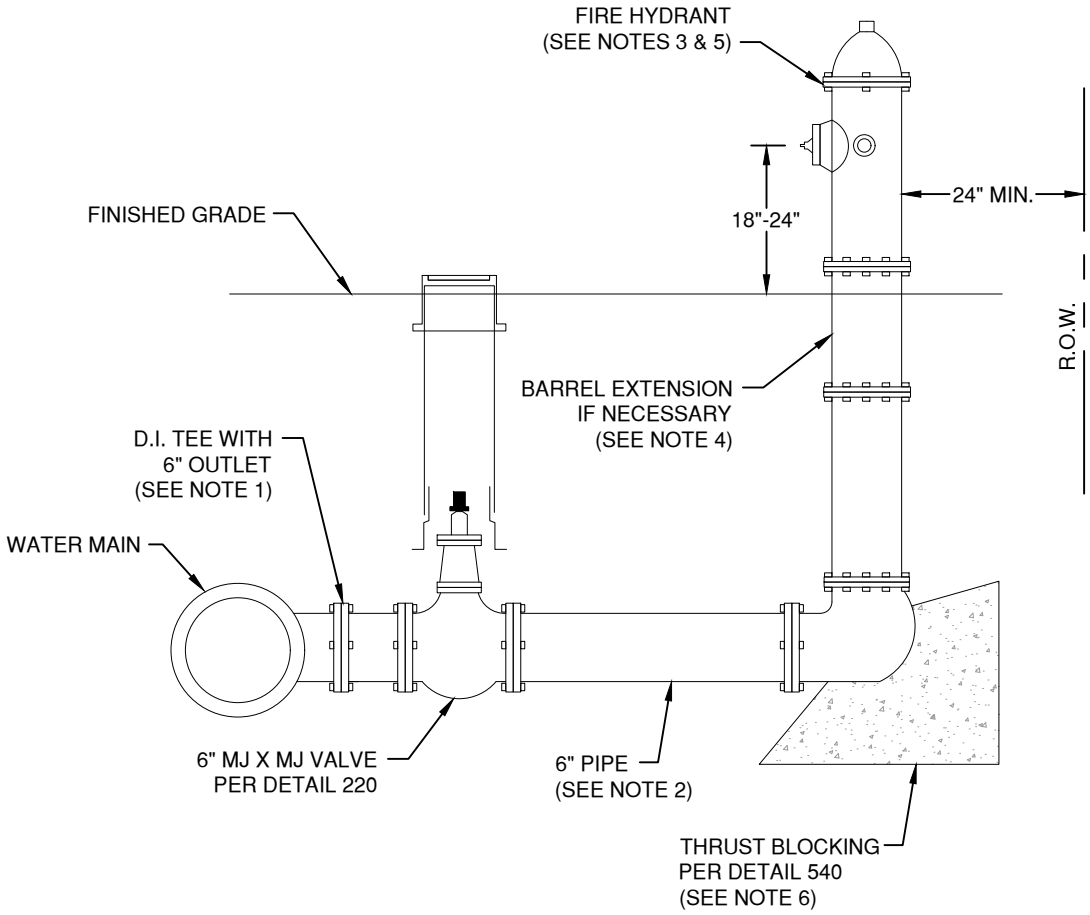
NOTES:

A. INSTALL 3/8" DIA. STEEL ROD SNUGLY INTO THE RECESS BETWEEN THE BELL AND SPIGOT, ALONG THE ENTIRE PIPE CIRCUMFERENCE, AND WELD INTO PLACE USING A TWO-PASS CONTINUOUS WELD.

B. CONTRACTOR SHALL RETAIN THE SERVICES OF THOMPSON PIPE GROUP TO PERFORM ALL WELDING. FILLET WELD ON EACH SIDE OF STEEL ROD, SIZE = "T" MIN., COMPLETE FUSION REQUIRED BETWEEN PIPE BELL/SPIGOT AND STEEL ROD, ENTIRE PIPE CIRCUMFERENCE.

C. AT ALL REQUIRED LOCATIONS: REMOVE OUTSIDE BAND AND MORTAR FROM PIPE JOINT, CLEAN ALL MORTAR RESIDUE FROM SURFACES, AND WELD JOINT PER THE DETAIL AND NOTES. ONCE WELDING OPERATIONS ARE COMPLETE AND PIPE JOINTS HAVE BEEN INSPECTED AND APPROVED BY GBRA, INSTALL NEW OUTSIDE MORTAR.

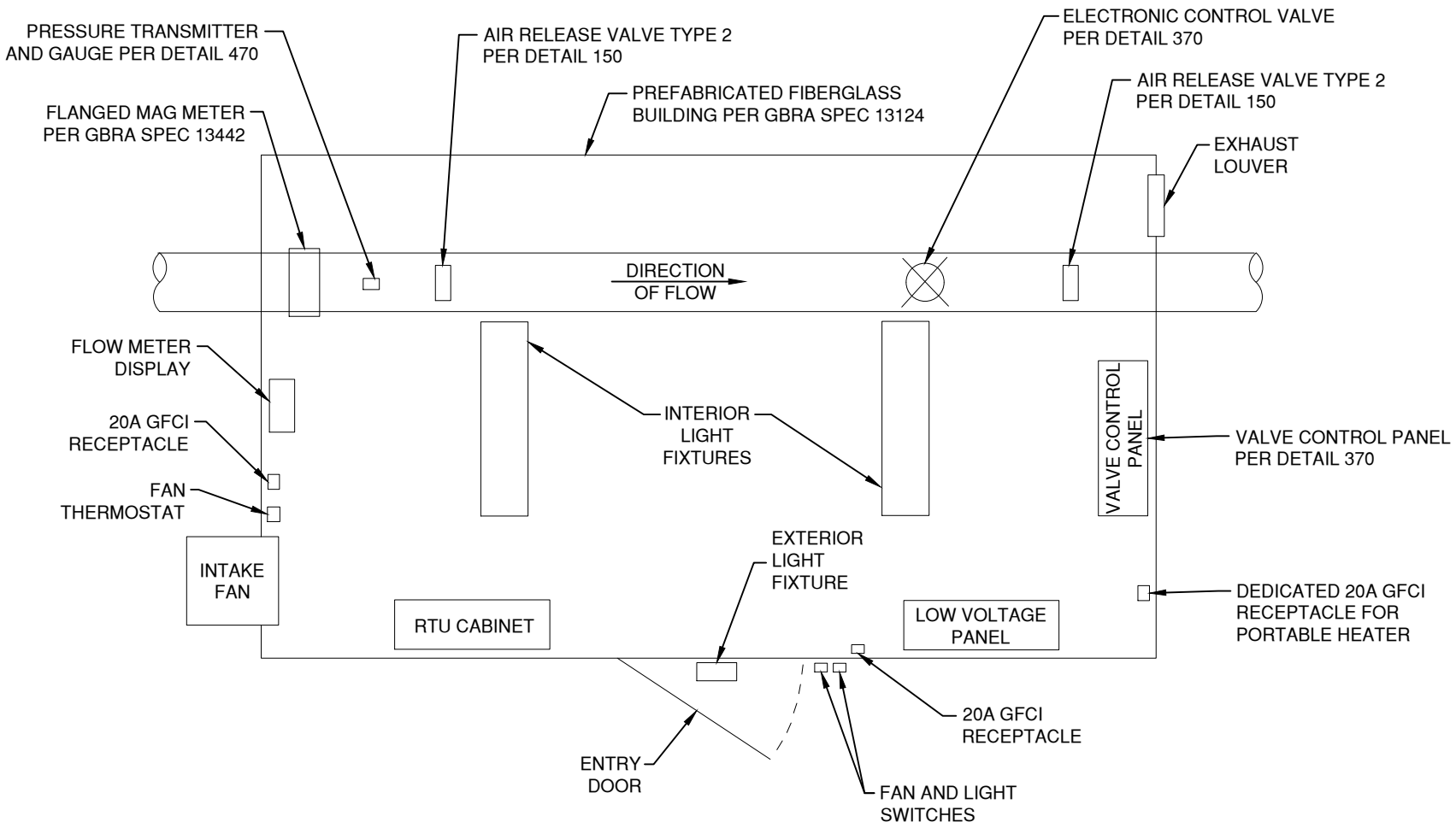
GBRA Guadalupe-Blanco River Authority	EXISTING C303 PIPE WELDED RESTRAINT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 340	



NOTES:

1. UTILIZE ANCHOR TEE FOR DIRECT CONNECTION TO VALVE OR MJ TEE WITH ANCHOR NIPPLE/PIPE EXTENSION AS NECESSARY TO POSITION VALVE PLUMB/LEVEL OUTSIDE OF SIDEWALK.
2. PIPE MATERIAL SHALL BE SAME AS MAIN. FIRE LINE SHALL BE MECHANICALLY RESTRAINED FROM MAIN TO FIRE HYDRANT.
3. FIRE HYDRANT SHALL BE MJ, RED COLOR, AMERICAN-DARLING B-84-B-5, OR EQUAL; WITH 1 EA 5" STORZ PUMPER NOZZLE AND 2 EA 2 1/2" HOSE NOZZLES, EACH WITH PRESSURE RATED CAP AND CHAIN OR CABLE. STORZ NOZZLE SHALL BE A FACTORY INSTALLED INTEGRAL PART OF THE HYDRANT, ADAPTERS ARE NOT ALLOWED.
4. MAXIMUM OF ONE (1) BARREL EXTENSION ALLOWED.
5. HYDRANTS SHALL BE INSTALLED PLUMB/LEVEL.
6. DO NOT BLOCK DRAIN HOLES. TRENCH BEDDING ENVELOPE SHALL EXTEND AROUND THRUST BLOCKING TO 12" MINIMUM ABOVE DRAIN HOLES.

GBRA Guadalupe-Blanco River Authority	FIRE HYDRANT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 350	



NOTES:

1. CONDUITS SHALL STUBUP THRU FLOOR. WALL PENETRATIONS ARE NOT ALLOWED.
2. TOP OF ENCLOSURES SHALL BE 72" ABOVE FLOOR.
3. LOW VOLTAGE PANEL SHALL BE 120/240V, 18 CIRCUIT MINIMUM PANELBOARD WITH 2P-60A MINIMUM MAIN BREAKER AND 20A MINIMUM BRANCH BREAKERS AS REQUIRED FOR LOADS. FILL ALL UNUSED SPACES WITH 1P-20A CIRCUIT BREAKERS. PANELBOARD NEUTRAL SHALL NOT BE BONDED TO GROUND INSIDE PANEL AND SHALL REMAIN SEPARATE. PROVIDE SPD EXTERNAL TO PANEL WITH 2-POLE BREAKER INSIDE PANEL FOR OVERCURRENT PROTECTION.

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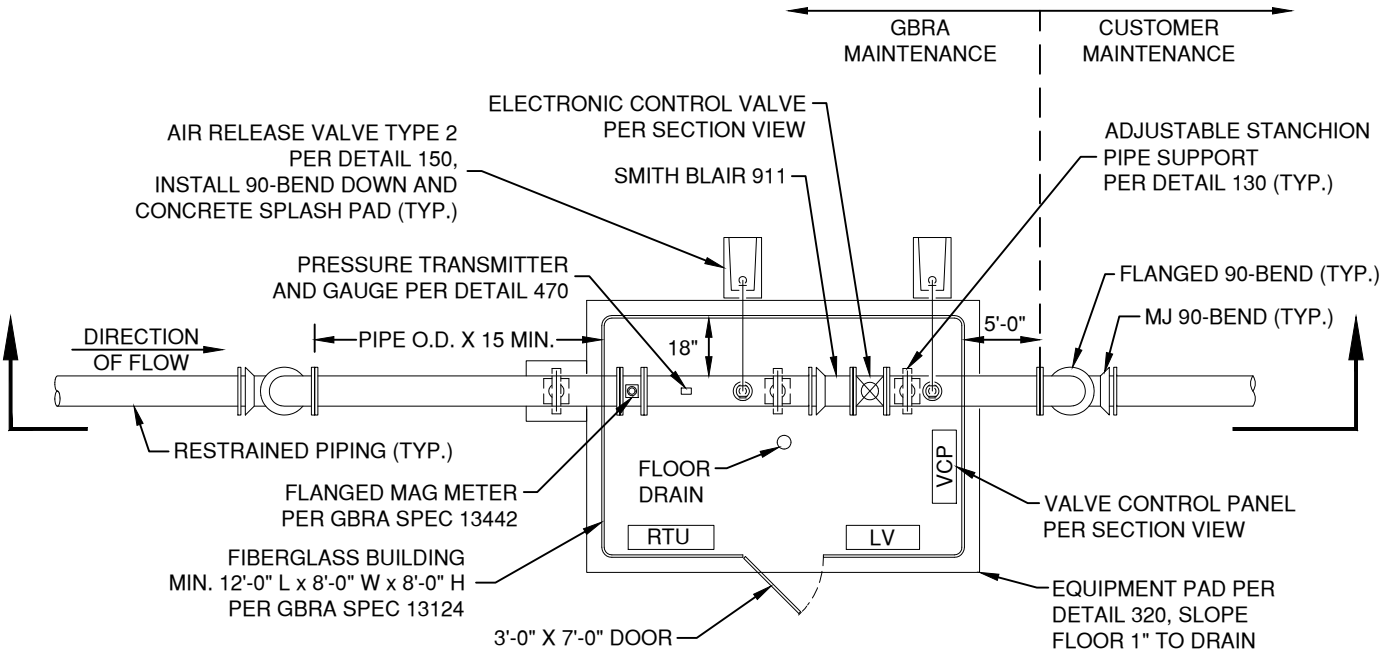
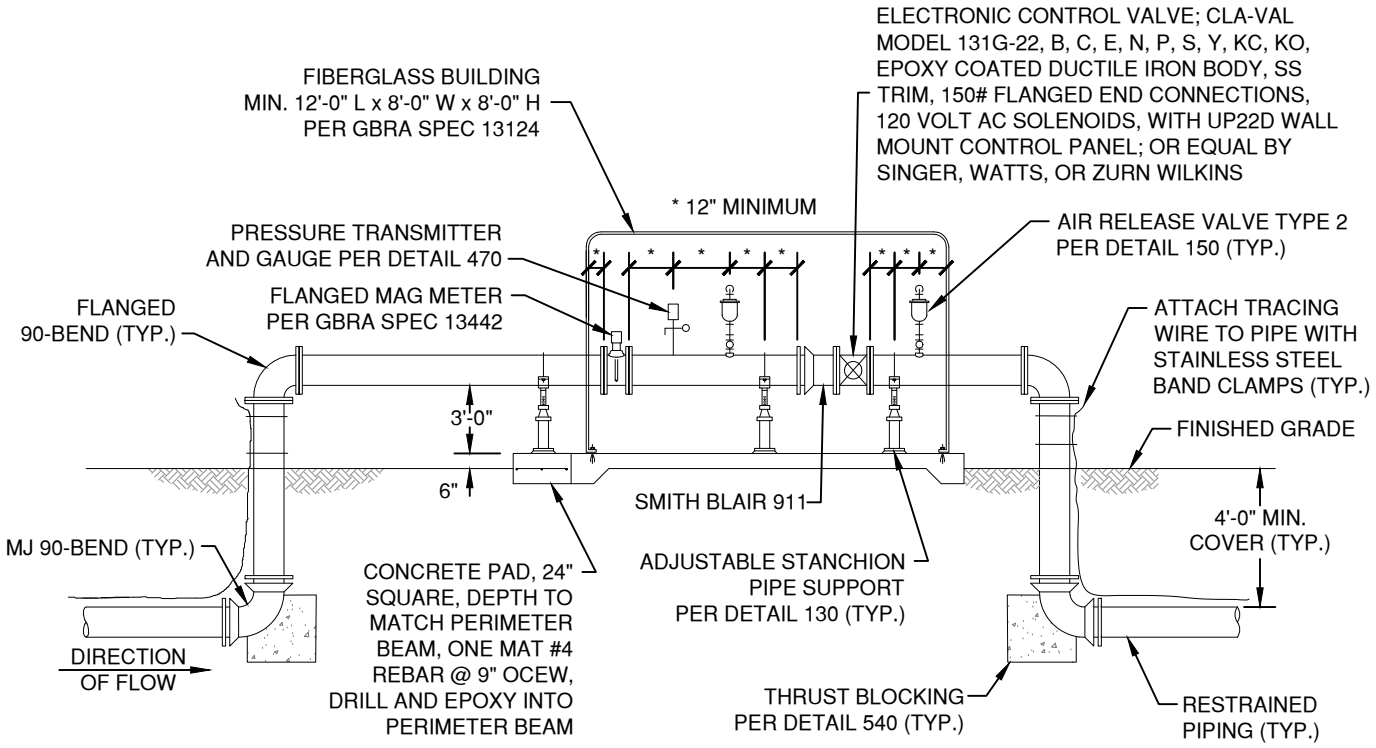
FLOW METER BUILDING ELECTRICAL AND HVAC

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 360	



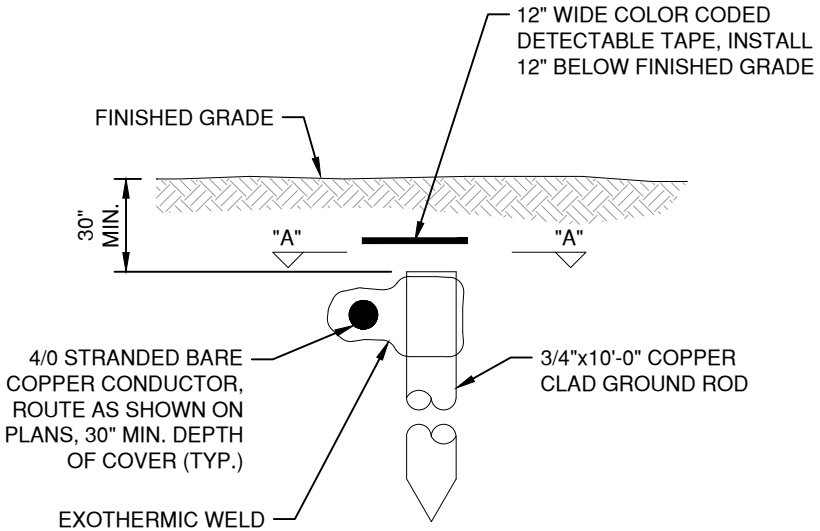
PLAN VIEW



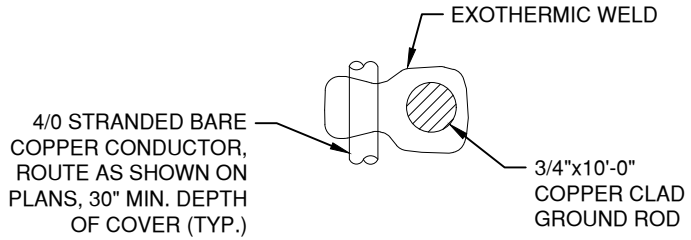
SECTION VIEW

NOTES:
1. INSTALL COMPONENTS PLUMB/LEVEL.
2. PROVIDE UNOBSTRUCTED UPSTREAM AND DOWNSTREAM STRAIGHT PIPE DIAMETERS AT FLANGED MAG METER IN ACCORDANCE WITH PUBLISHED MANUFACTURER RECOMMENDATIONS.

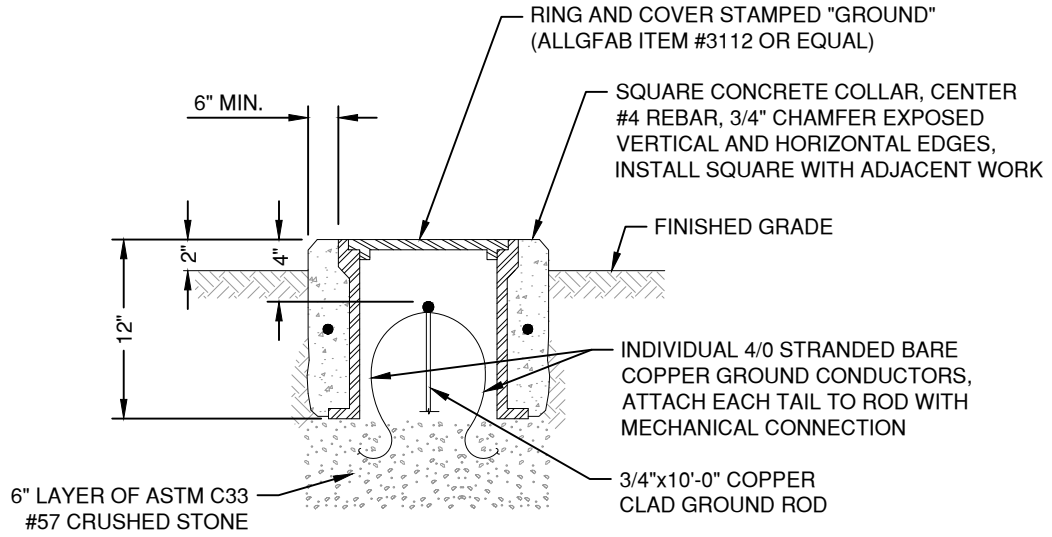
GBRA Guadalupe-Blanco River Authority	FLOW METER BUILDING PIPING	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 370	



GROUND ROD



SECTION "A"



GROUND TEST WELL

NOTES:
1. ANY EXPOSED OR ABOVE GRADE CONNECTIONS SHALL BE MECHANICAL TYPE WITH CRIMP LUGS.
2. BURIED CONNECTIONS SHALL BE EXOTHERMIC WELD.
3. INSTALL COMPONENTS PLUMB/LEVEL.
4. REFERENCE DETAIL 290 FOR TRENCH BACKFILL, COMPACTION, AND SURFACING REQUIREMENTS.

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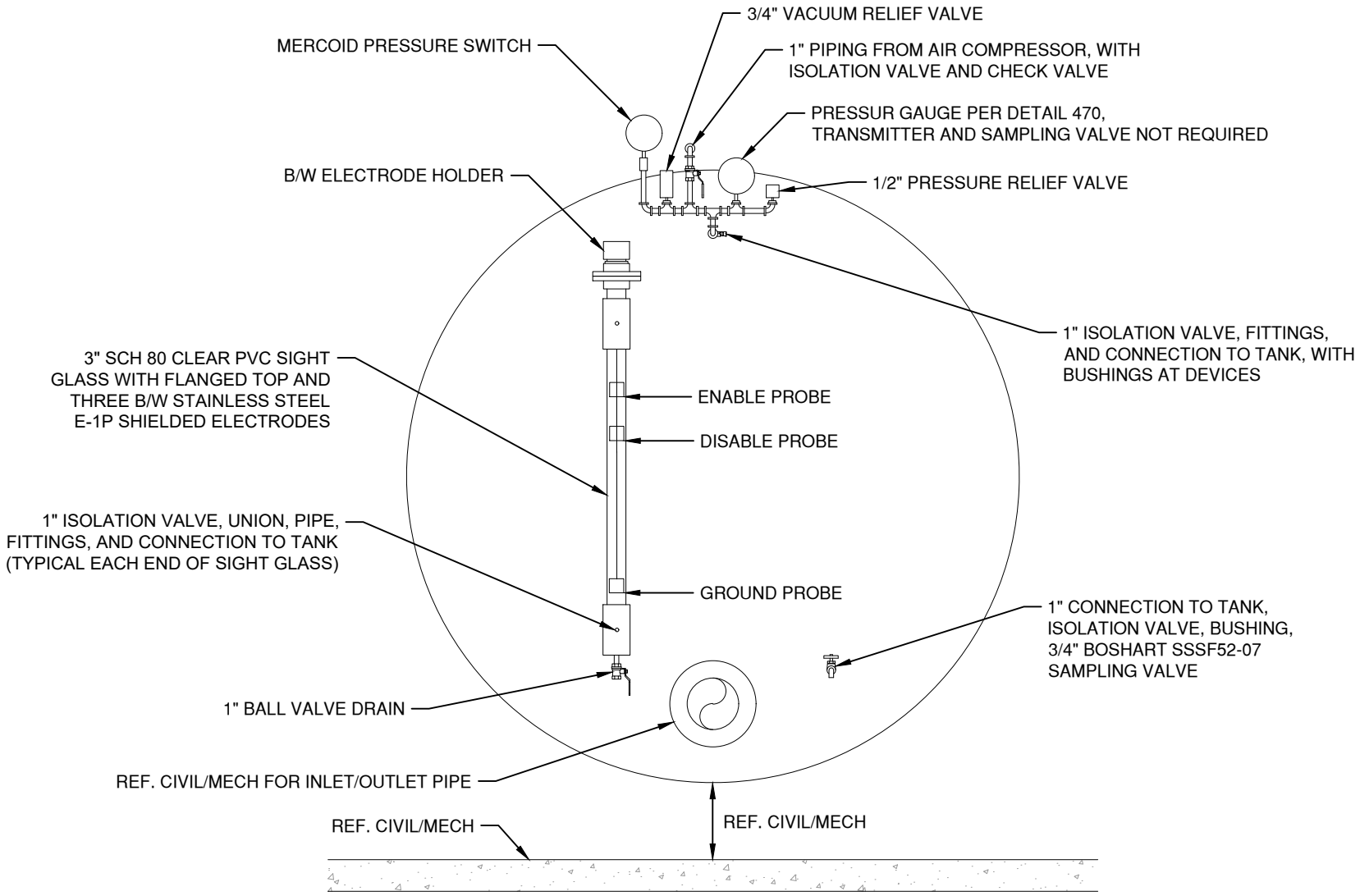
Guadalupe-Blanco River Authority

GROUNDING

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 380	



NOTES:

1. ALL PIPE, FITTINGS, AND VALVES SHALL BE STAINLESS STEEL WITH NICKEL PTFE THREAD SEALANT TAPE. PIPING SHALL BE SCH 40. ISOLATION/BALL VALVES SHALL BE LEVER OPERATED FULL PORT BALL VALVES.
2. INSTALL COMPONENTS PLUMB/LEVEL.
3. REFERENCE DETAIL 390.2 FOR ADDITIONAL REQUIREMENTS.

GBRA
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HYDROPNEUMATIC TANK APPURTENANCES

REVISED	SCALE
JUL. 28, 2025	NONE

DETAIL NO. 390.1

DESIGN CAPACITY:

1. HYDROPNEUMATIC TANK VOLUME SHALL BE MINIMUM 20 GALLONS PER LUE
2. WATER VOLUME SHALL BE 2/3 OF HYDROPNEUMATIC TANK VOLUME
3. AIR COMPRESSOR SHALL BE CAPABLE OF PRESSURIZING THE HYDROPNEUMATIC TANK FROM ZERO TO SYSTEM PRESSURE FOR ALL PUMPS OFF WITHIN 30 MINUTES
4. AIR COMPRESSOR TANK CAPACITY SHALL BE MINIMUM 4 GALLONS PER CFM

PROBES (3EA):

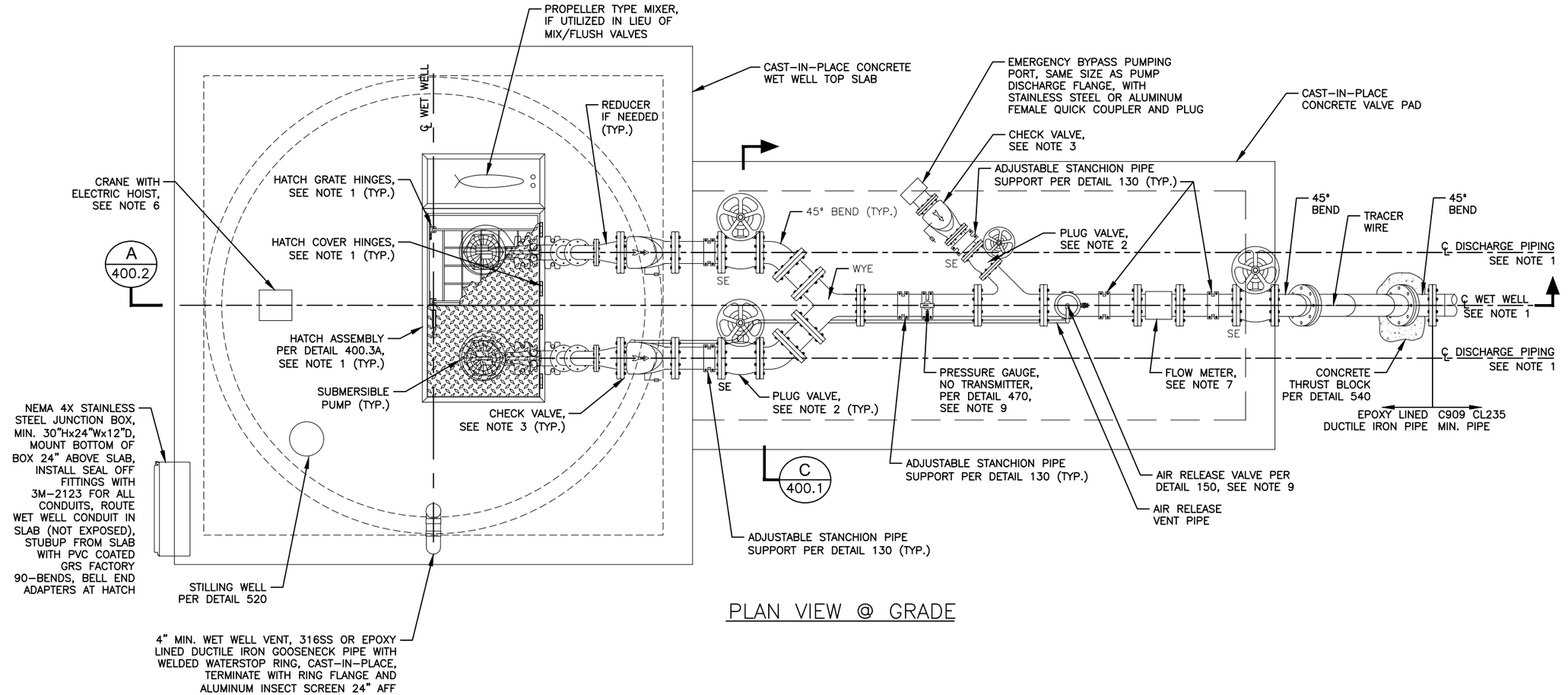
1. THE PROBES SHALL CONTROL THE ADD AIR SOLENOID VALVE ONLY (NOT THE PUMPS)
2. THE PUMPS SHALL BE CONTROLLED BY A PRESSURE TRANSMITTER ON PUMP DISCHARGE HEADER
3. THE ADD AIR SOLENOID VALVE SHALL NOT BE ALLOWED TO BE OPEN WHILE PUMPS ARE RUNNING
4. TOP PROBE ENABLES THE ADD AIR SOLENOID VALVE TO OPEN, INSTALL BOTTOM OF PROBE AT 2/3 OF TANK VOLUME (63% OF TANK INSIDE DIAMETER)
5. MIDDLE PROBE CLOSES/DISABLES THE ADD AIR SOLENOID VALVE, INSTALL BOTTOM OF PROBE 6" BELOW 2/3 OF TANK VOLUME
6. BOTTOM PROBE IS ALWAYS SUBMERGED, IT IS A COMMON/GROUND

MERCOID SWITCH:

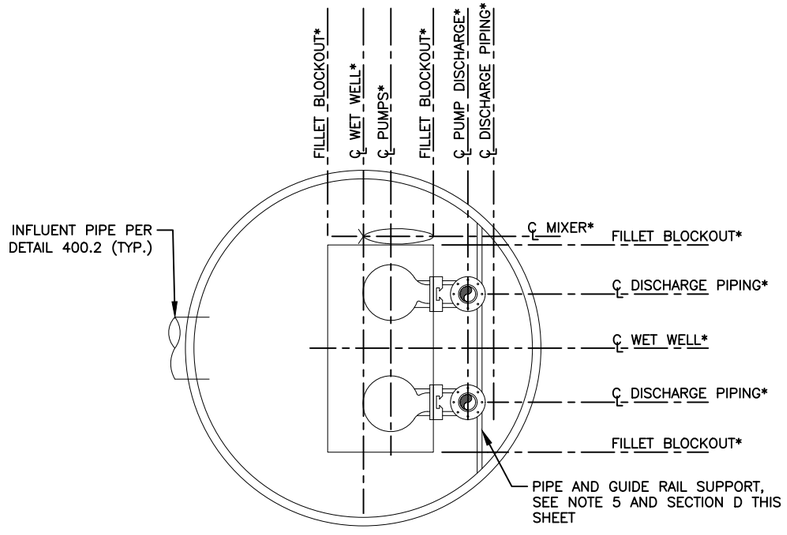
1. THIS IS FOR OVER PRESSURE PROTECTION AND SHALL LOCK THE ADD AIR SOLENOID VALVE CLOSED
2. THE SWITCH SHALL BE NORMALLY CLOSED
3. HIGH SIDE SHALL BE SET 5 PSI ABOVE SYSTEM PRESSURE FOR ALL PUMPS OFF (SWITCH OPEN)
4. LOW SIDE SHALL BE SET AT SYSTEM PRESSURE FOR ALL PUMPS OFF (SWITCH CLOSED/RESET)

INITIAL STARTUP:

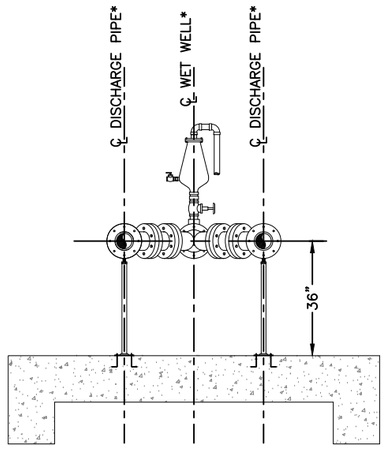
1. FILL SYSTEM WITH WATER
2. ISOLATE HYDROPNEUMATIC TANK FROM SYSTEM
3. FILL HYDROPNEUMATIC TANK WITH WATER TO 2/3 OF TANK VOLUME (63% OF TANK INSIDE DIAMETER)
4. ADD AIR TO SYSTEM PRESSURE FOR ALL PUMPS OFF
5. GRADUALLY INTRODUCE PRESSURE FROM HYDROPNEUMATIC TANK INTO SYSTEM
6. ALLOW SYSTEM TO STABILIZE
7. FULLY OPEN VALVE FROM HYDROPNEUMATIC TANK TO SYSTEM



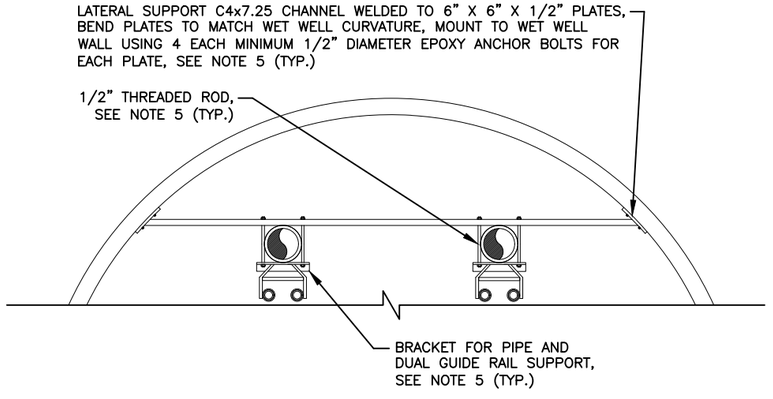
PLAN VIEW @ GRADE



SECTION B 400.2
* SEE NOTE 1



SECTION C 400.1
* SEE NOTE 1



SECTION D 400.2

NOTES TO DESIGN ENGINEER:

A. 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.

B. ELEVATIONS AND INFORMATION OMITTED ARE DETERMINED BY DESIGN ENGINEER FOR SPECIFIC SITE REQUIREMENTS.

C. THE DESIGN ENGINEER SHALL INCORPORATE ONLY THE NECESSARY STANDARD GUIDELINE DRAWINGS AND DETAILS INTO THE PROJECT CONTRACT DOCUMENTATION PACKAGE, AND SHALL ADJUST PAGE NUMBERS AND CROSS REFERENCING ACCORDINGLY.

D. THE DESIGN ENGINEER SHALL CONSULT THE LATEST GUADALUPE-BLANCO RIVER AUTHORITY DESIGN GUIDELINES MANUAL AND THE LATEST TCEQ RULES FOR FURTHER INSTRUCTIONS AND INFORMATION PERTINENT TO THESE STANDARD DESIGN GUIDELINE DRAWINGS.

E. DESIGN ENGINEER SHALL VERIFY THE SIZE AND LOCATION OF WET WELL HATCHES ACCORDING TO THE CLEARANCES SPECIFIED HEREIN AND THE SELECTED PUMP, MIXER, AND VALVE MANUFACTURERS' REQUIREMENTS; VERIFY SUFFICIENT SPACE BETWEEN PUMPS, MIXERS, PIPING, VALVES, HATCHES, ETC.

F. SUBGRADE AND STRUCTURAL SHALL BE DESIGNED BASED ON THE WET WELL DIMENSIONS, SOIL CONDITIONS, BUOYANCY, ETC.

G. 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 THE LIFT STATION DESIGN.

NOTES:

1. CONTRACTOR SHALL CONFIRM THE SIZE AND LOCATION OF WET WELL HATCHES PER SELECTED PUMP, MIXER, AND VALVE MANUFACTURERS' REQUIREMENTS. PROVIDE 4" MIN. CLEARANCE IN ALL DIRECTIONS FROM PUMPS AND MIXERS TO HATCH CLEAR OPENING. PRIOR TO ORDERING HATCHES AND PIPING, CONTRACTOR SHALL SUBMIT DIMENSIONED LAYOUT DRAWINGS OF WET WELL AND VALVE PAD, INCLUDING PIPE/FITTING/VALVE LAY LENGTHS AND CONDUIT ROUTING, DEMONSTRATING ALL REQUIRED CLEARANCES BETWEEN PUMPS, MIXERS, PIPING, VALVES, HATCHES, TOP SLAB PENETRATIONS, HOIST, ETC.
2. INSTALL FLANGED JOINT ROUND PORT PLUG VALVES WITH HORIZONTAL SHAFT, CLOSING DOWNWARD. INSTALL ORIENTATION OF SEAT END ("SE") AS SHOWN ON DRAWINGS.
3. INSTALL SWING TYPE CHECK VALVES WITH EXTERNAL LEVER AND WEIGHT.
4. PAINT TOPCOAT FOR PUMP DISCHARGE PIPE, VALVES, AND FITTINGS OUTSIDE OF WET WELL SHALL BE GREY PANTONE #431-U COLOR.
5. ALL SUPPORTS, GUIDE RAILS, BRACKETS, AND ANCHORS WITHIN THE WET WELL SHALL BE TYPE 316 STAINLESS STEEL; ANY ASSOCIATED BOLTS, RODS, AND NUTS SHALL HAVE FLAT WASHERS; NUTS SHALL BE LOCK NUTS.
6. CRANE SHALL BE HOT DIP GALVANIZED. ELECTRIC HOIST SHALL BE EPOXY COATED. WIRE ROPE SHALL BE STAINLESS STEEL. MINIMUM LIFTING CAPACITY SHALL BE TWICE THE COMBINED PUMP AND MOTOR WEIGHT.
7. FLOW METER SHALL BE PER GBRA STANDARD SPECIFICATION 13442. PROVIDE UNOBSTRUCTED UPSTREAM AND DOWNSTREAM STRAIGHT PIPE DIAMETERS IN ACCORDANCE WITH PUBLISHED MANUFACTURER RECOMMENDATIONS.
8. PROVIDE SINGLE RAIL SYSTEM FOR FLOATS. RAIL SHALL BE SOLVENT WELD 2" SCH 80 PVC. BOTTOM OF RAIL SHALL BE CAPPED AND FILLED WITH 12" OF GROUT; CAP SHALL REST ON WET WELL FLOOR. TOP OF RAIL SHALL BE CAPPED AND ATTACHED TO HATCH OPENING WITH STRUT AND STRUT CLAMPS. SECURE FLOAT CABLES TO RAIL WITH DOUBLE ZIP TIES AT 4 FT MAX. SPACING.
9. PROVIDE HEAT TRACING, INSULATION, AND ALUMINUM JACKETING PER GBRA STANDARDS.
10. REFERENCE GBRA STANDARDS FOR ADDITIONAL REQUIREMENTS.
11. INSTALL COMPONENTS PLUMB/LEVEL.

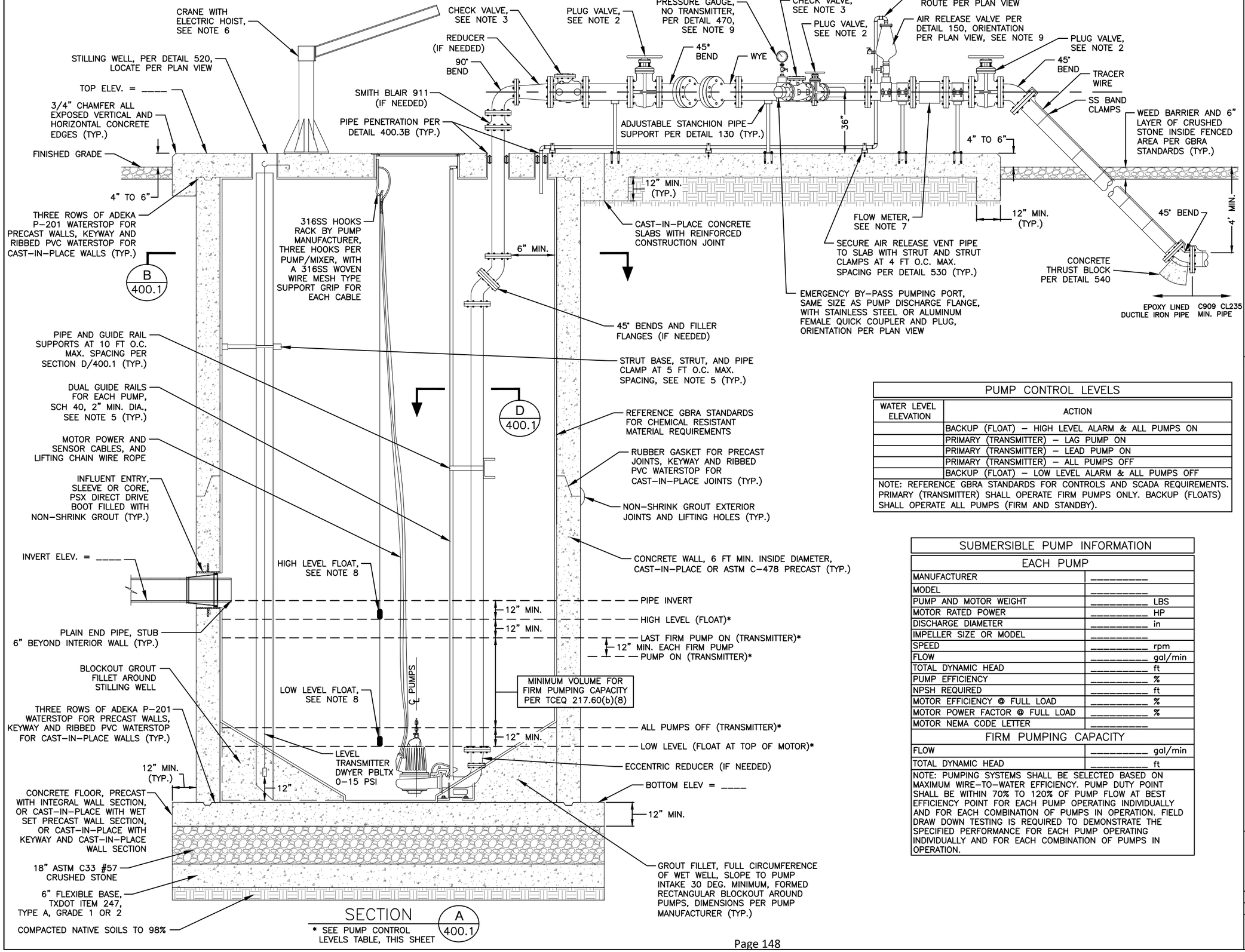
GBRA Guadalupe-Blanco River Authority

SUBMERSIBLE LIFT STATION PLAN VIEW

REVISED JUL. 28, 2025

(NOT TO SCALE)

DETAIL NO. 400.1



SECTION A 400.1

* SEE PUMP CONTROL LEVELS TABLE, THIS SHEET

PUMP CONTROL LEVELS

WATER LEVEL ELEVATION	ACTION
	BACKUP (FLOAT) – HIGH LEVEL ALARM & ALL PUMPS ON
	PRIMARY (TRANSMITTER) – LAG PUMP ON
	PRIMARY (TRANSMITTER) – LEAD PUMP ON
	PRIMARY (TRANSMITTER) – ALL PUMPS OFF
	BACKUP (FLOAT) – LOW LEVEL ALARM & ALL PUMPS OFF

NOTE: REFERENCE GBRA STANDARDS FOR CONTROLS AND SCADA REQUIREMENTS. PRIMARY (TRANSMITTER) SHALL OPERATE FIRM PUMPS ONLY. BACKUP (FLOATS) SHALL OPERATE ALL PUMPS (FIRM AND STANDBY).

SUBMERSIBLE PUMP INFORMATION

EACH PUMP	
MANUFACTURER	_____
MODEL	_____
PUMP AND MOTOR WEIGHT	_____ LBS
MOTOR RATED POWER	_____ HP
DISCHARGE DIAMETER	_____ in
IMPELLER SIZE OR MODEL	_____
SPEED	_____ rpm
FLOW	_____ gal/min
TOTAL DYNAMIC HEAD	_____ ft
PUMP EFFICIENCY	_____ %
NPSH REQUIRED	_____ ft
MOTOR EFFICIENCY @ FULL LOAD	_____ %
MOTOR POWER FACTOR @ FULL LOAD	_____ %
MOTOR NEMA CODE LETTER	_____
FIRM PUMPING CAPACITY	
FLOW	_____ gal/min
TOTAL DYNAMIC HEAD	_____ ft

NOTE: PUMPING SYSTEMS SHALL BE SELECTED BASED ON MAXIMUM WIRE-TO-WATER EFFICIENCY. PUMP DUTY POINT SHALL BE WITHIN 70% TO 120% OF PUMP FLOW AT BEST EFFICIENCY POINT FOR EACH PUMP OPERATING INDIVIDUALLY AND FOR EACH COMBINATION OF PUMPS IN OPERATION. FIELD DRAW DOWN TESTING IS REQUIRED TO DEMONSTRATE THE SPECIFIED PERFORMANCE FOR EACH PUMP OPERATING INDIVIDUALLY AND FOR EACH COMBINATION OF PUMPS IN OPERATION.

NOTES TO DESIGN ENGINEER:

A. 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.

B. ELEVATIONS AND INFORMATION OMITTED ARE DETERMINED BY DESIGN ENGINEER FOR SPECIFIC SITE REQUIREMENTS.

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D. THE DESIGN ENGINEER SHALL CONSULT THE LATEST GUADALUPE-BLANCO RIVER AUTHORITY DESIGN GUIDELINES MANUAL AND THE LATEST TCEQ RULES FOR FURTHER INSTRUCTIONS AND INFORMATION PERTINENT TO THESE STANDARD DESIGN GUIDELINE DRAWINGS.

E. DESIGN ENGINEER SHALL VERIFY THE SIZE AND LOCATION OF WET WELL HATCHES ACCORDING TO THE CLEARANCES SPECIFIED HEREIN AND THE SELECTED PUMP, MIXER, AND VALVE MANUFACTURERS' REQUIREMENTS; VERIFY SUFFICIENT SPACE BETWEEN PUMPS, MIXERS, PIPING, VALVES, HATCHES, ETC.

F. SUBGRADE AND STRUCTURAL SHALL BE DESIGNED BASED ON THE WET WELL DIMENSIONS, SOIL CONDITIONS, BUOYANCY, ETC.

G. 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 THE LIFT STATION DESIGN.

NOTES:

1. CONTRACTOR SHALL CONFIRM THE SIZE AND LOCATION OF WET WELL HATCHES PER SELECTED PUMP, MIXER, AND VALVE MANUFACTURERS' REQUIREMENTS. PROVIDE 4" MIN. CLEARANCE IN ALL DIRECTIONS FROM PUMPS AND MIXERS TO HATCH CLEAR OPENING. PRIOR TO ORDERING HATCHES AND PIPING, CONTRACTOR SHALL SUBMIT DIMENSIONED LAYOUT DRAWINGS OF WET WELL AND VALVE PAD, INCLUDING PIPE/FITTING/VALVE LAY LENGTHS AND CONDUIT ROUTING, DEMONSTRATING ALL REQUIRED CLEARANCES BETWEEN PUMPS, MIXERS, PIPING, VALVES, HATCHES, TOP SLAB PENETRATIONS, HOIST, ETC.
2. INSTALL FLANGED JOINT ROUND PORT PLUG VALVES WITH HORIZONTAL SHAFT, CLOSING DOWNWARD. INSTALL ORIENTATION OF SEAT END ("SE") AS SHOWN ON DRAWINGS.
3. INSTALL SWING TYPE CHECK VALVES WITH EXTERNAL LEVER AND WEIGHT.
4. PAINT TOPCOAT FOR PUMP DISCHARGE PIPE, VALVES, AND FITTINGS OUTSIDE OF WET WELL SHALL BE GREY PANTONE #431-U COLOR.
5. ALL SUPPORTS, GUIDE RAILS, BRACKETS, AND ANCHORS WITHIN THE WET WELL SHALL BE TYPE 316 STAINLESS STEEL; ANY ASSOCIATED BOLTS, RODS, AND NUTS SHALL HAVE FLAT WASHERS; NUTS SHALL BE LOCK NUTS.
6. CRANE SHALL BE HOT DIP GALVANIZED. ELECTRIC HOIST SHALL BE EPOXY COATED. WIRE ROPE SHALL BE STAINLESS STEEL. MINIMUM LIFTING CAPACITY SHALL BE TWICE THE COMBINED PUMP AND MOTOR WEIGHT.
7. FLOW METER SHALL BE PER GBRA STANDARD SPECIFICATION 13442. PROVIDE UNOBSTRUCTED UPSTREAM AND DOWNSTREAM STRAIGHT PIPE DIAMETERS IN ACCORDANCE WITH PUBLISHED MANUFACTURER RECOMMENDATIONS.
8. PROVIDE SINGLE RAIL SYSTEM FOR FLOATS. RAIL SHALL BE SOLVENT WELD 2" SCH 80 PVC. BOTTOM OF RAIL SHALL BE CAPPED AND FILLED WITH 12" OF GROUT; CAP SHALL REST ON WET WELL FLOOR. TOP OF RAIL SHALL BE CAPPED AND ATTACHED TO HATCH OPENING WITH STRUT AND STRUT CLAMPS. SECURE FLOAT CABLES TO RAIL WITH DOUBLE ZIP TIES AT 4 FT MAX. SPACING.
9. PROVIDE HEAT TRACING, INSULATION, AND ALUMINUM JACKETING PER GBRA STANDARDS.
10. REFERENCE GBRA STANDARDS FOR ADDITIONAL REQUIREMENTS.
11. INSTALL COMPONENTS PLUMB/LEVEL.

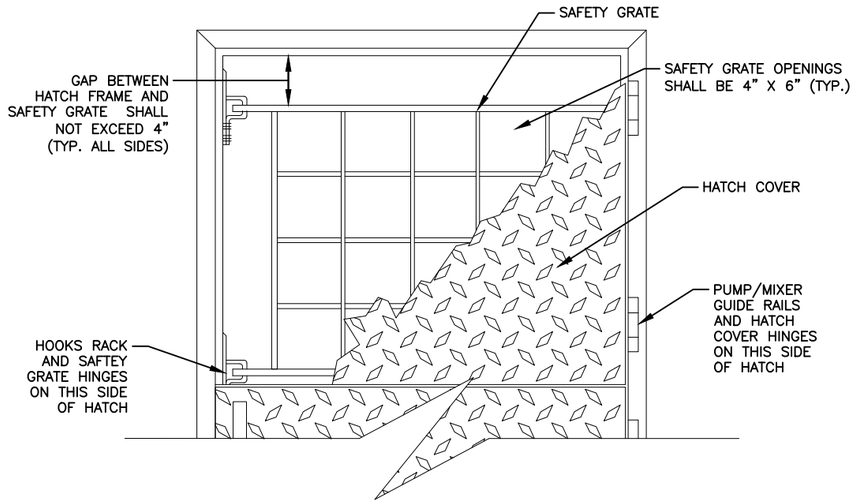
GBRA Guadalupe-Blanco River Authority

SUBMERSIBLE LIFT STATION SECTION VIEW

REVISED JUL. 28, 2025

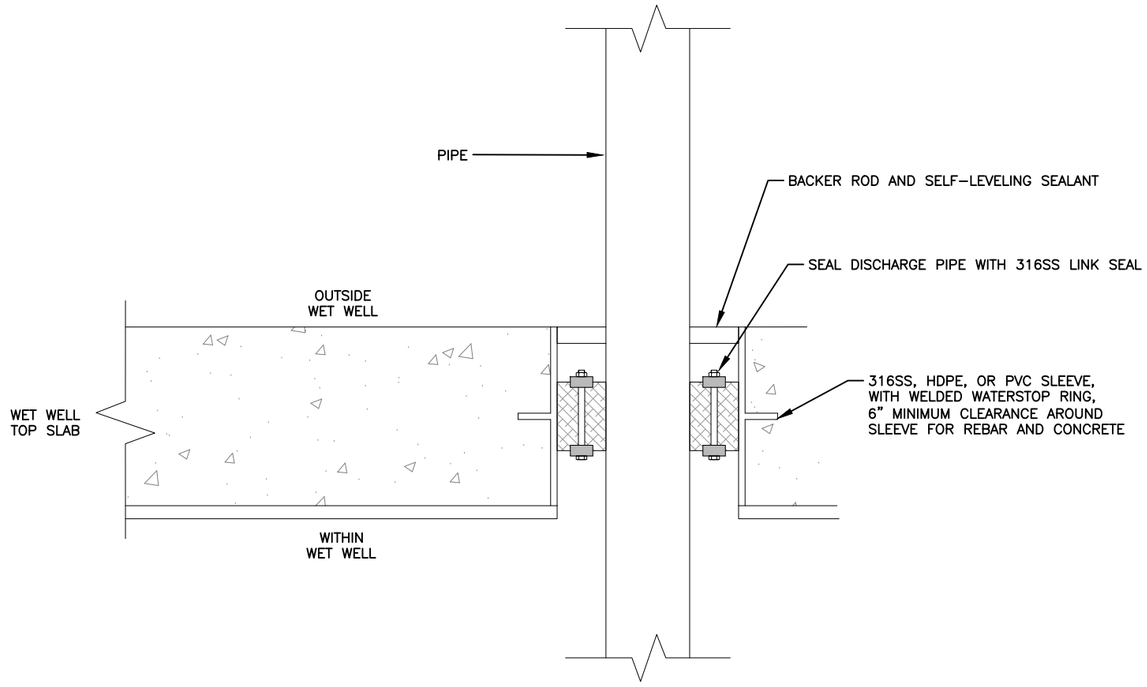
(NOT TO SCALE)

DETAIL NO. 400.2



DETAIL 400.3A
WET WELL HATCH

NOTES:
1. TOP OF SAFETY GRATES SHALL BE 1/2" MAXIMUM BELOW TOP OF CONCRETE SLAB.
2. TOP OF HATCH COVERS SHALL BE INSTALLED FLUSH WITH TOP OF CONCRETE SLAB.
3. HATCH ASSEMBLY SHALL BE EJCO SAFE HATCH OR EQUAL WITH ALUMINUM FRAME, GRATES, COVERS AND 316SS HARDWARE, FASTENERS, AND HINGES. HATCH ASSEMBLY SHALL BE RATED FOR 300 PSF LIVE LOAD.
4. COVERS SHALL BE EQUIPPED WITH SLAM LOCKS AND PADLOCK STAPLES. PROVIDE 2 EACH HATCH KEYS.
5. PROVIDE 4" MINIMUM CLEARANCE IN ALL DIRECTIONS FROM PUMPS AND MIXERS TO HATCH CLEAR OPENING.
6. INSTALL BITUMINOUS COATING ON ALL SURFACES IN CONTACT WITH CONCRETE.



DETAIL 400.3B
WET WELL TOP SLAB PIPE PENETRATION

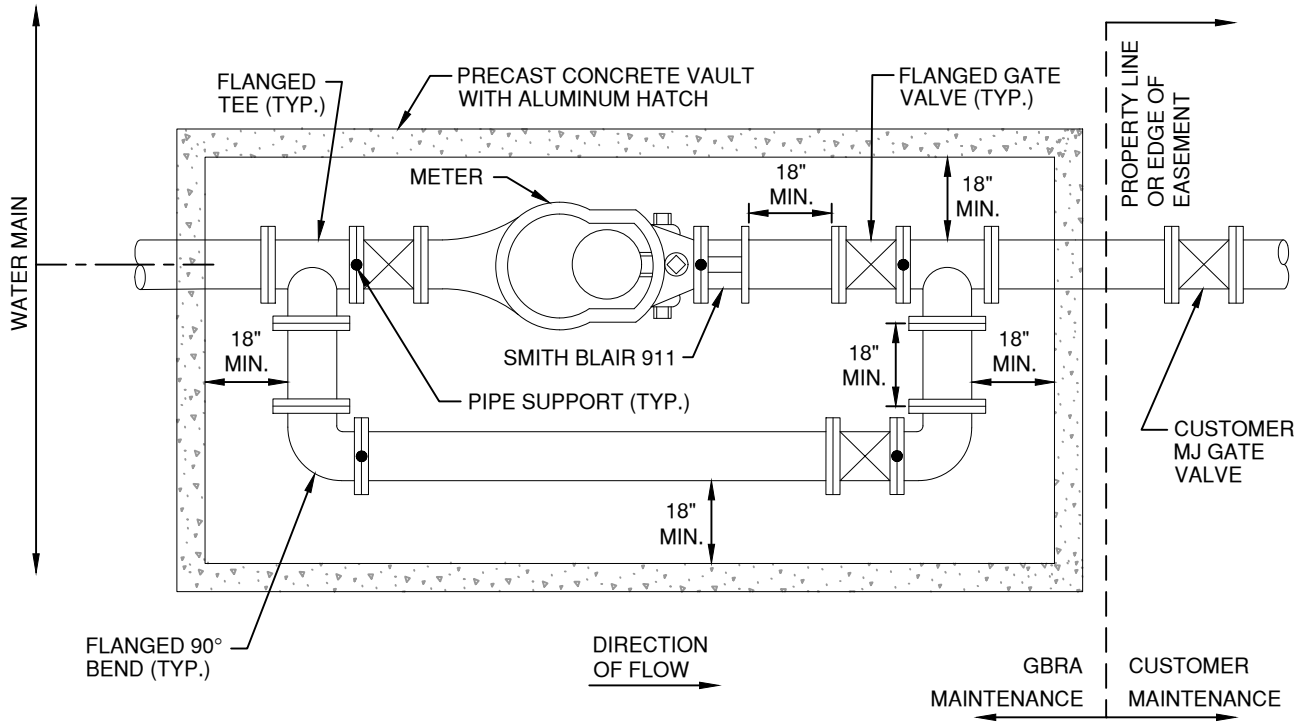
GBRA Guadalupe-Blanco River Authority

SUBMERSIBLE LIFT STATION DETAILS

REVISED JUL. 28, 2025

(NOT TO SCALE)

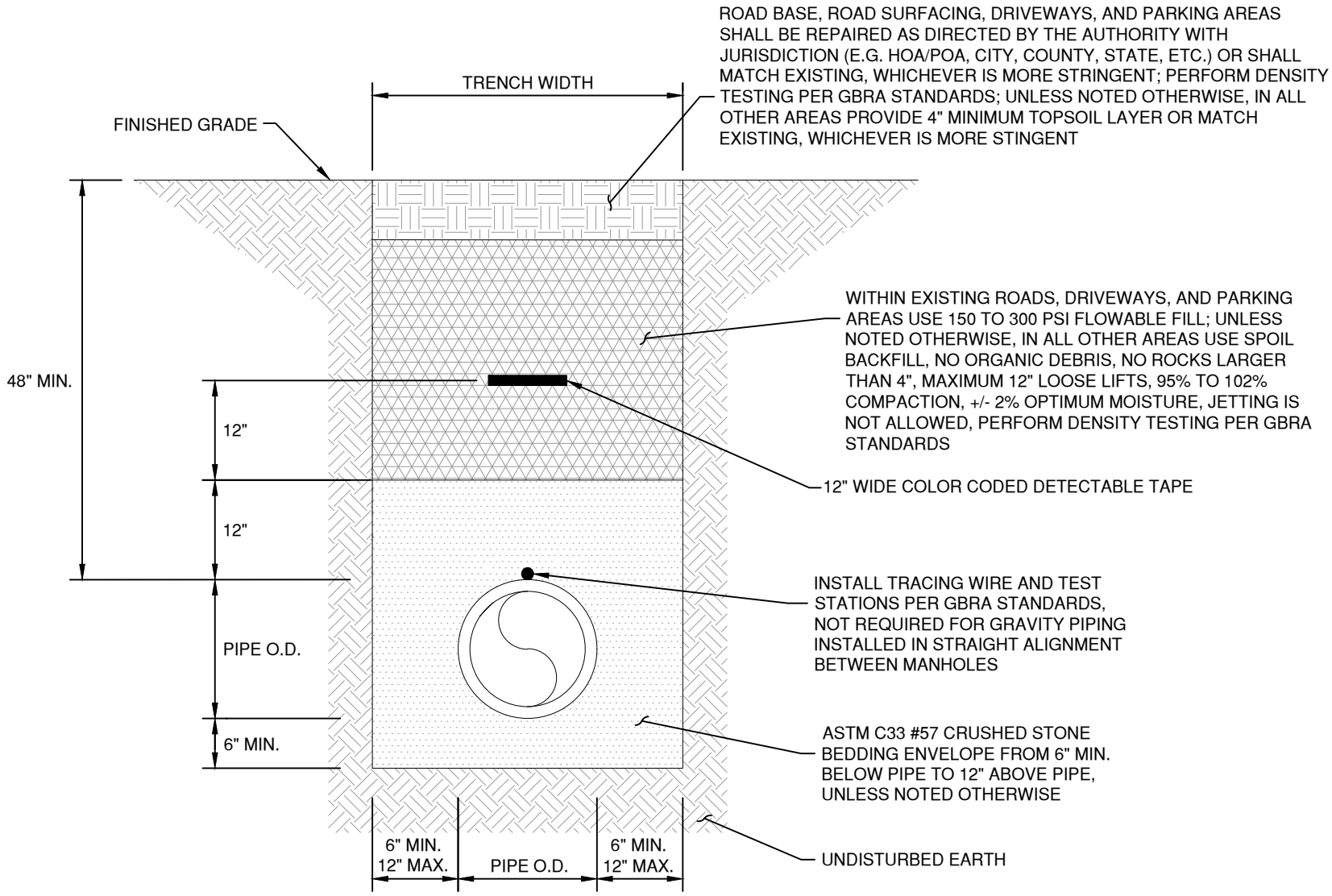
DETAIL NO. 400.3



NOTES:

1. INSTALL SEPARATE TAPS AND VAULTS FOR POTABLE AND FIRE SERVICE. REFERENCE GBRA STANDARDS FOR TAP REQUIREMENTS.
2. SUBMIT PRODUCT DATA FOR ALL MATERIALS AND A DIMENSIONED VAULT AND PIPING LAYOUT DRAWING DEMONSTRATING ALL REQUIRED CLEARANCES AND OBTAIN GBRA APPROVAL PRIOR TO ORDERING ANY MATERIALS.
3. FUNISH AND INSTALL THE ENTIRE ASSEMBLY AS DETAILED INCLUDING NEPTUNE MACH 10 R900i WATER METER.
4. FURNISH AND INSTALL APPROPRIATE BACKFLOW PREVENTION DEVICES IN SEPARATE VAULTS DOWNSTREAM OF METER VAULTS FOR EACH SERVICE TYPE (REFERENCE TCEQ 290.47 APPENDIX F).
5. BYPASS PIPING SHALL BE SAME SIZE AS METER PIPING.
6. ALL EXPOSED VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE FORMED WITH 3/4" CHAMFER STRIPS.
7. PRECAST CONCRETE VAULT AND ALUMINUM HATCH SHALL BE H-20 TRAFFIC RATED. HATCH SHALL BE PER CITY OF AUSTIN SPL-614A WITH PADLOCK STAPLE. INSTALL HATCH LENGTHWISE IN CENTER OF VAULT.
8. TOP OF VAULT SHALL BE 4" ABOVE FINISHED GRADE.
9. VAULT SHALL BE OPEN BOTTOM INSTALLED ON 6" MINIMUM LAYER OF ASTM C33 #57 CRUSHED STONE.
10. PROVIDE 24" CLEARANCE FROM BOTTOM OF PIPE TO BOTTOM OF VAULT. DEPTH OF PIPE SHALL BE IN ACCORDANCE WITH DESIGN PROFILES AND MINIMUM COVER REQUIREMENTS.
11. PROVIDE PRECAST BLOCKOUTS WITH KEYWAY AT WALL PIPE PENETRATIONS. FORM AND FILL WITH NON-SHRINK GROUT.
12. PIPING OUTSIDE VAULT SHALL BE RESTRAINED IN ACCORDANCE WITH GBRA STANDARDS.
13. ALL PIPING INSIDE VAULT SHALL BE FLANGED DUCTILE IRON.
14. GATE VALVES SHALL BE FLANGED AMERICAN FLOW CONTROL SERIES 2500 RISING STEM OR EQUAL.
15. INSTALL AN ADJUSTABLE STANCHION PIPE SUPPORT WITH FLANGE CONNECTION AT EACH LOCATION SHOWN. INSTALL A SQUARE CAST-IN-PLACE REINFORCED CONCRETE BEARING PAD UPON UNDISTURBED EARTH CENTERED UNDER EACH SUPPORT. BEARING PADS SHALL BE SQUARE WITH WALLS AND SHALL EXTEND 6" BEYOND BASE PLATES ON ALL SIDES. TOP OF BEARING PADS SHALL BE 2" ABOVE CRUSHED STONE LAYER. REFERENCE DETAIL 130 FOR ADDITIONAL REQUIREMENTS.
16. PAINT PIPING, FITTINGS, AND VALVES WITHIN VAULT (REFERENCE GBRA STANDARDS FOR PAINTING REQUIREMENTS).
17. REFERENCE GBRA STANDARDS FOR INSPECTION REQUIREMENTS.

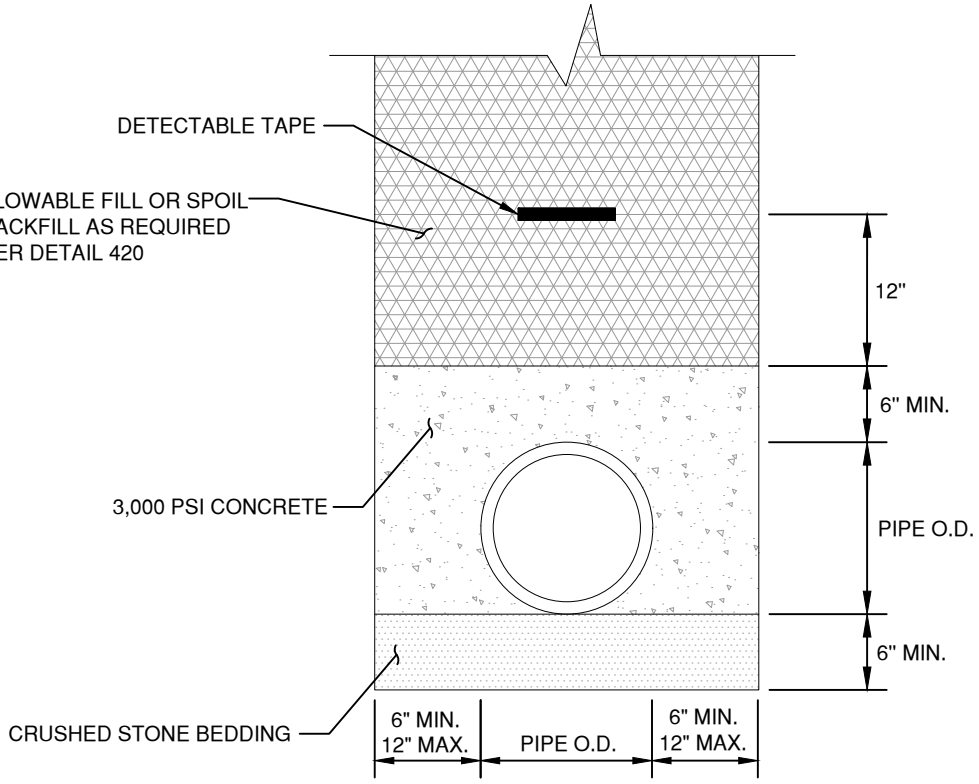
GBRA Guadalupe-Blanco River Authority	METER WITH BYPASS VAULT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 410	



Guadalupe-Blanco River Authority

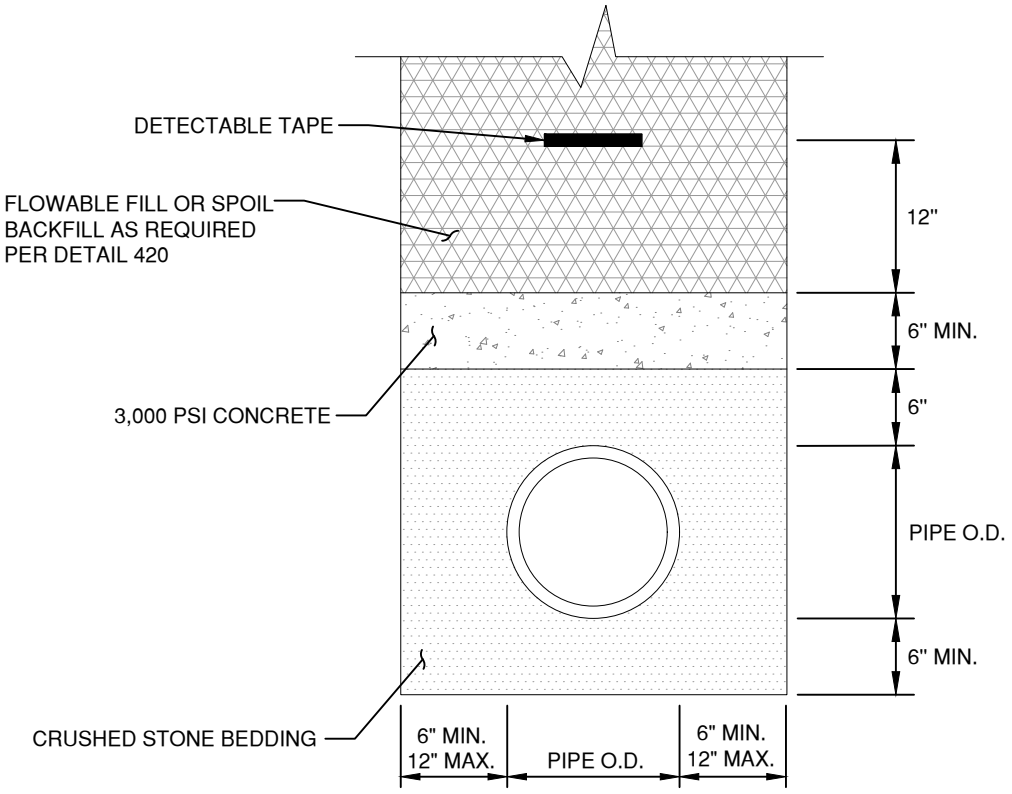
PIPE TRENCH

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 420	



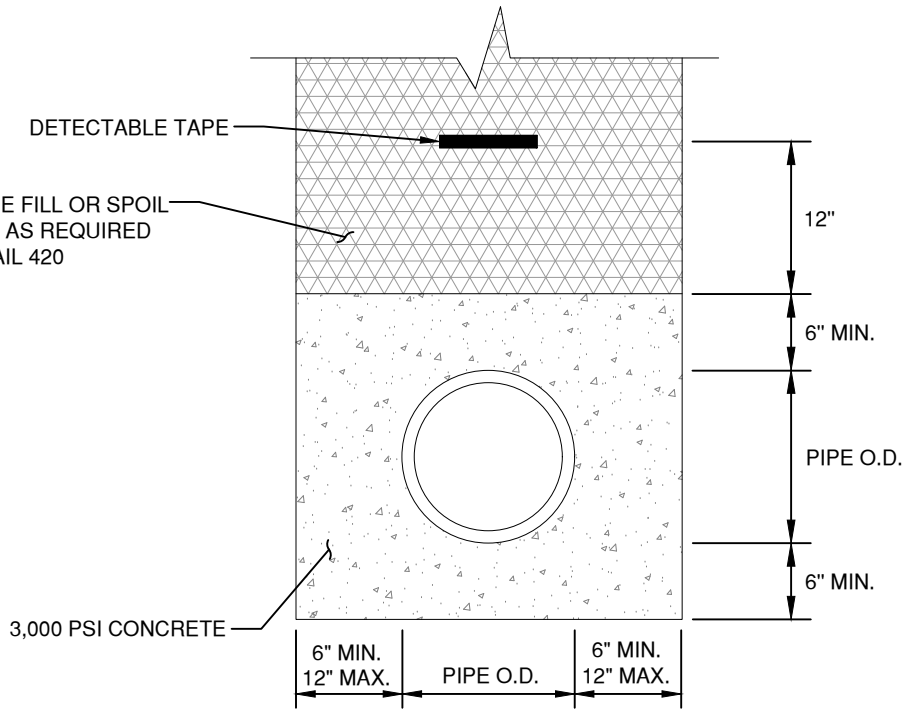
NOTES:
1. REFERENCE DETAIL 420 FOR ADDITIONAL REQUIREMENTS.
2. CONTRACTOR SHALL SECURE PIPE TO MAINTAIN LINE AND GRADE DURING CONCRETE PLACEMENT.

GBRA Guadalupe-Blanco River Authority	PIPELINE CONCRETE CAP TYPE 1	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 430	



NOTES:
1. REFERENCE DETAIL 420 FOR ADDITIONAL REQUIREMENTS.

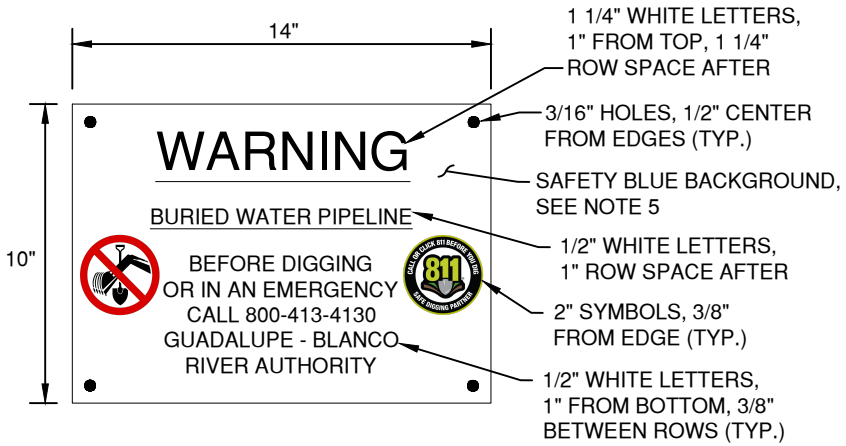
GBRA Guadalupe-Blanco River Authority	PIPELINE CONCRETE CAP TYPE 2	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 440	



NOTES:
1. REFERENCE DETAIL 420 FOR ADDITIONAL REQUIREMENTS.
2. CONTRACTOR SHALL SECURE PIPE TO MAINTAIN LINE AND GRADE DURING CONCRETE PLACEMENT.

GBRA Guadalupe-Blanco River Authority	PIPELINE CONCRETE ENCASEMENT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 450	

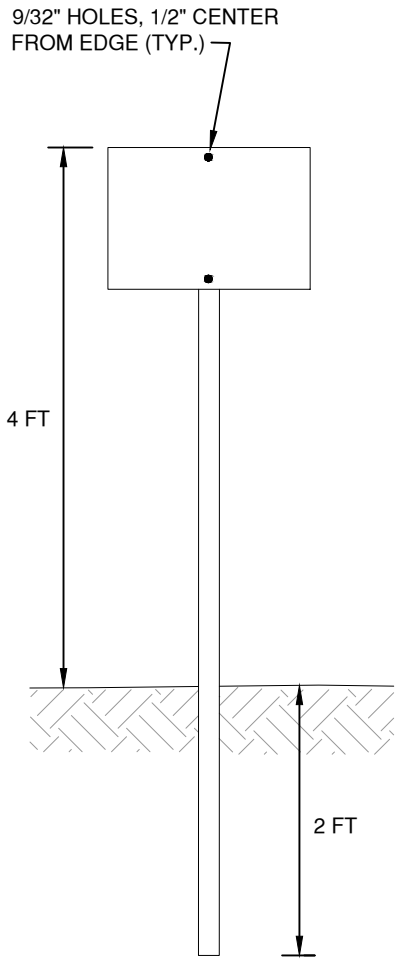
TYPE 1 PIPELINE MARKER



NOTES:

1. MARKERS SHALL BE FABRICATED IN ACCORDANCE WITH TXDOT ITEM 636 TYPE B.
2. INCLUDE "NO DIG" SYMBOL AND "811 CALL OR CLICK" SYMBOL.
3. INSTALL TYPE 1 MARKERS ON PIPE CENTERLINE AT ALL GATE AND FENCE CROSSINGS AND AT ANY OTHER LOCATIONS INDICATED ON THE DRAWINGS AS DIRECTED BY GBRA.
4. ATTACH TO GATES AND FENCES WITH 14 GAUGE STAINLESS STEEL WIRE.
5. COLORS AND LABELS SHOWN ARE FOR POTABLE WATER. FOR WASTEWATER, CHANGE BACKGROUND TO SAFETY GREEN AND REPLACE "WATER" WITH "SEWER". FOR RECLAIMED, CHANGE BACKGROUND TO SAFETY PURPLE AND REPLACE "WATER" WITH "RECLAIMED WATER". FOR RAW WATER, CHANGE BACKGROUND TO TAN AND REPLACE "WATER" WITH "RAW WATER".
6. INSTALL PLUMB/LEVEL.

TYPE 2 PIPELINE MARKER



NOTES:

1. REFERENCE TYPE 1 MARKER DETAIL FOR SIGN REQUIREMENTS. ATTACHMENT HOLES WILL DIFFER AS SHOWN.
2. POST SHALL BE DRIVE-IN TYPE GALVANIZED U-CHANNEL (MCMASTER-CARR 5735T61 OR EQUAL).
3. USE 1/4" DIAMETER HOT DIP GALVANIZED BOLTS, FLAT WASHERS, LOCK WASHERS, AND NUTS TO ATTACH SIGN TO POST. INSTALL FLAT WASHERS AT BOLTS AND NUTS. INSTALL BOLT HEADS ON SIGN FACE WITH NUTS ON POST. DO NOT OBSTRUCT LETTERING.
4. TYPE 2 MARKERS ARE REQUIRED IN UNPAVED AREAS AT: ALL MANHOLES AND VAULTS, CENTERLINE OF ALL MAIN LINE BENDS, CENTERLINE OF ALL PLUGS/CAPS, 3 FT FROM ALL VALVE BOXES, AND AT ANY OTHER LOCATIONS INDICATED ON THE DRAWINGS AS DIRECTED BY GBRA.
5. SIGNS SHALL BE INSTALLED PARALLEL WITH PIPELINES AND SHALL FACE ADJACENT ROADS, EXACT LOCATION AND ORIENTATION AS DIRECTED BY GBRA.
6. INSTALL PLUMB/LEVEL.

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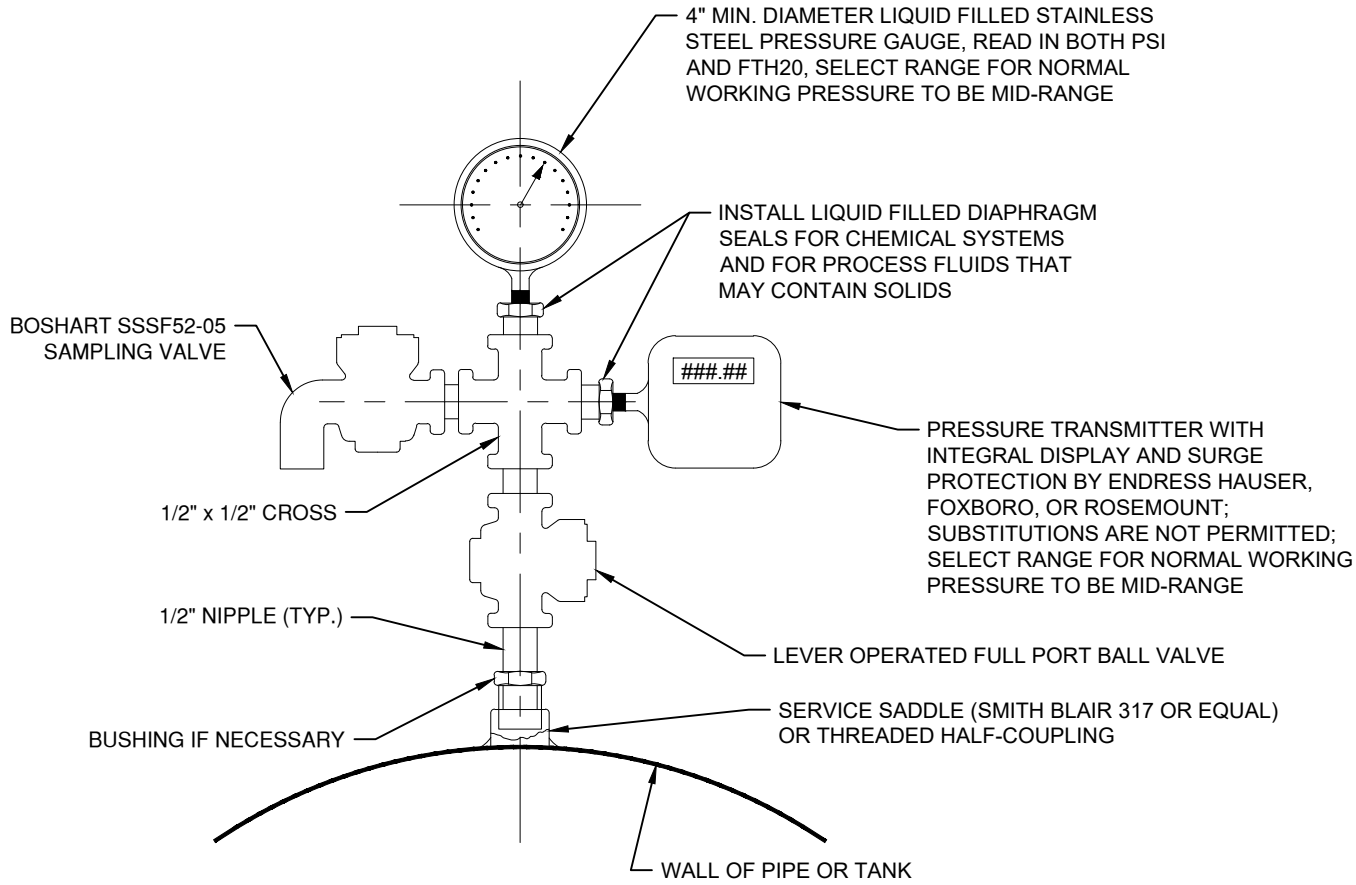
Guadalupe-Blanco River Authority

PIPELINE MARKERS

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 460	



NOTES:

1. UNLESS CHEMICAL COMPATIBILITY REQUIRES OTHERWISE, ENTIRE ASSEMBLY SHALL BE STAINLESS STEEL WITH NICKEL PTFE ANTI-SEIZE THREAD SEALANT TAPE; 304SS FOR WATER PROJECTS, 316SS FOR WASTEWATER PROJECTS.
2. PRESSURE RATING OF EACH ASSEMBLY COMPONENT SHALL BE GREATER THAN OR EQUAL TO PRESSURE RATING OF THE SYSTEM TO WHICH THE ASSEMBLY IS CONNECTED.
3. DIAPHRAGM SEALS SHALL BE ASHCROFT TYPE 101 OR EQUAL BY WIKA.
4. GAUGES SHALL BE WIKA TYPE 233.30, ASHCROFT TYPE T6500, OR ASHCROFT TYPE 1209.
5. LIQUID FILL MATERIAL SHALL BE COMPATIBLE WITH THE CHEMICAL/PROCESS FLUID.
6. POSITION GAUGE AND TRANSMITTER DISPLAYS LEVEL AND FACING DIRECTION OF OPERATOR ACCESS, INSTALL BEND FITTINGS AS NECESSARY.
7. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

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PRESSURE TRANSMITTER AND GAUGE

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 470	

DESCRIPTION	MINIMUM RESTRAINED LENGTH (FT. EACH WAY)
11 1/4° BENDS	30
22 1/2° BENDS	40
45° BENDS	50
90° BENDS, TEES, REDUCERS, TAPPING SLEEVES	60
VALVES, DEAD ENDS	100

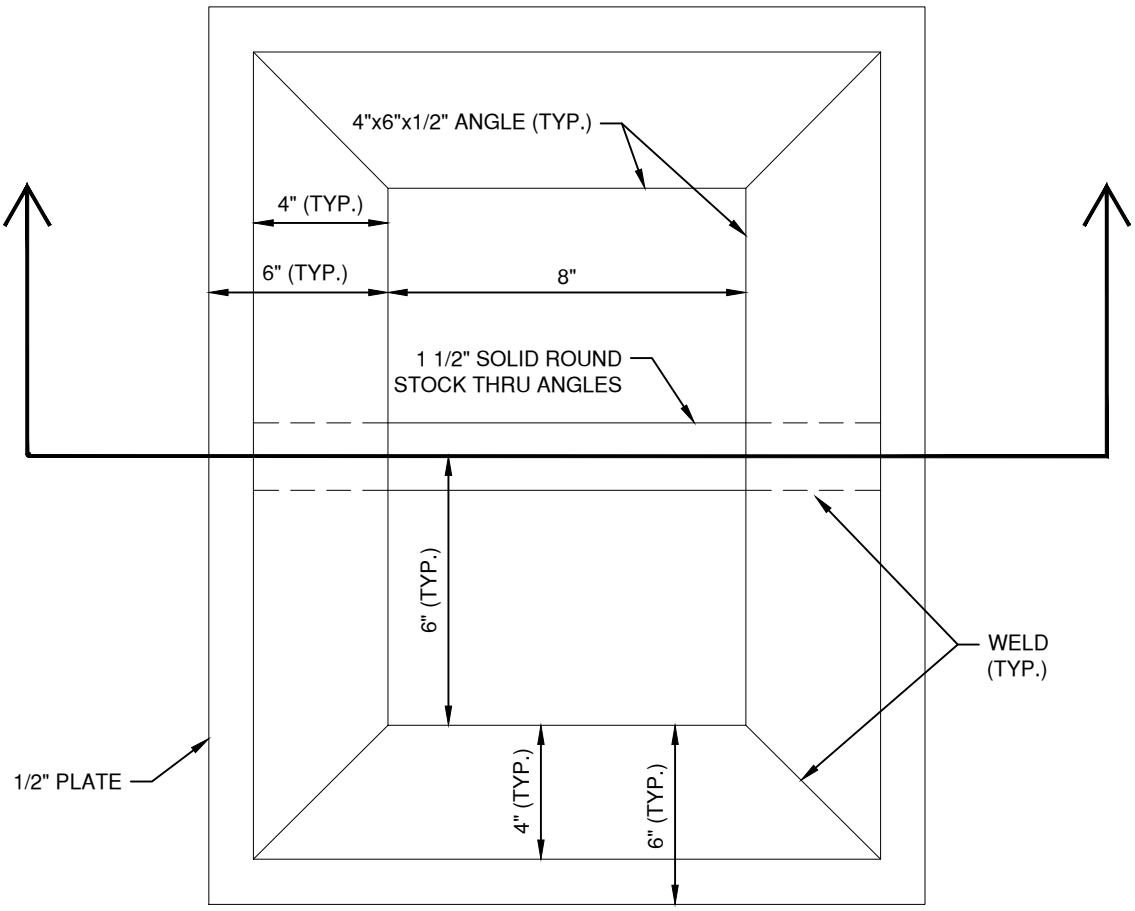
NOTES:

1. THE TABLE ABOVE INDICATES MINIMUM RESTRAINED LENGTH REQUIREMENTS FOR BURIED PRESSURE PIPING SYSTEMS. THE RESTRAINED LENGTHS SHALL BE PROVIDED EACH WAY FROM ALL FITTINGS, VALVES, DEAD ENDS, ETC. THE DESIGN ENGINEER SHALL EVALUATE SOILS AND SYSTEM HYDRAULICS AND DETERMINE IF ANY ADDITIONAL RESTRAINTS ARE REQUIRED.
2. IF THE DESIGN ENGINEER REQUIRES CONCRETE THRUST BLOCKING IN addition TO MECHANICAL RESTRAINTS, THE CONCRETE THRUST BLOCKING MUST BE INSTALLED IN ACCORDANCE WITH DETAIL 540.
3. REFERENCE GBRA STANDARDS FOR PIPE, FITTING, AND RESTRAINT MATERIAL REQUIREMENTS.

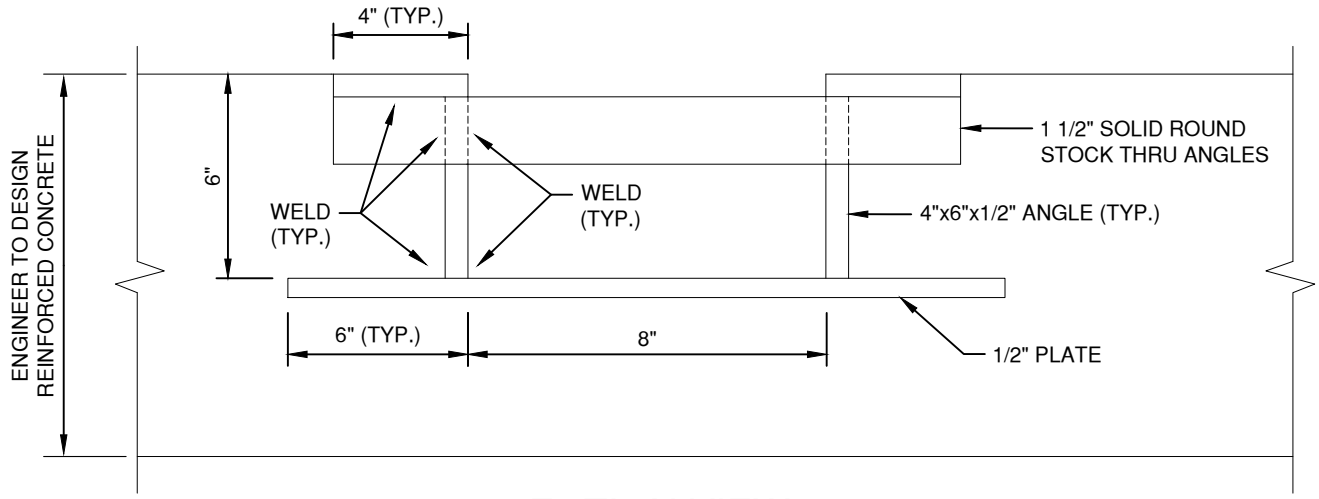
Guadalupe-Blanco River Authority

RESTRAINED LENGTHS

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 480	



PLAN VIEW

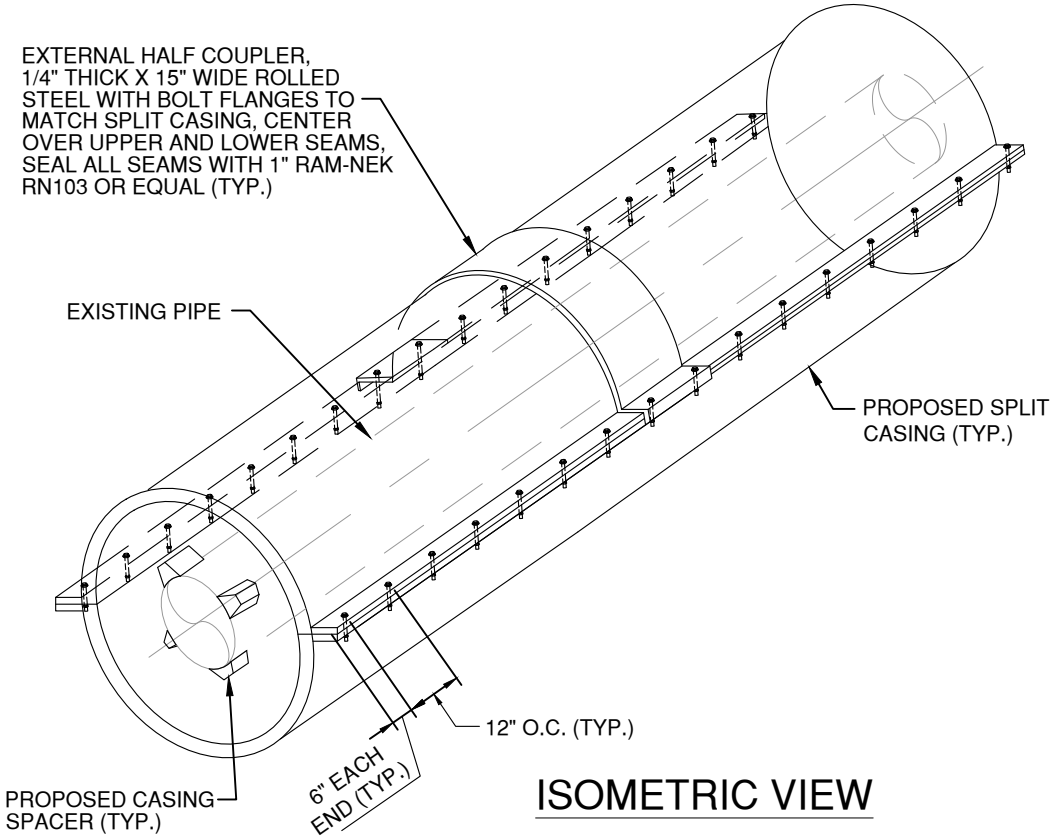


SECTION VIEW

NOTES:

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

GBRA Guadalupe-Blanco River Authority	SLUDGE DEWATERING BOX SNATCH BLOCK EMBED	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 490	



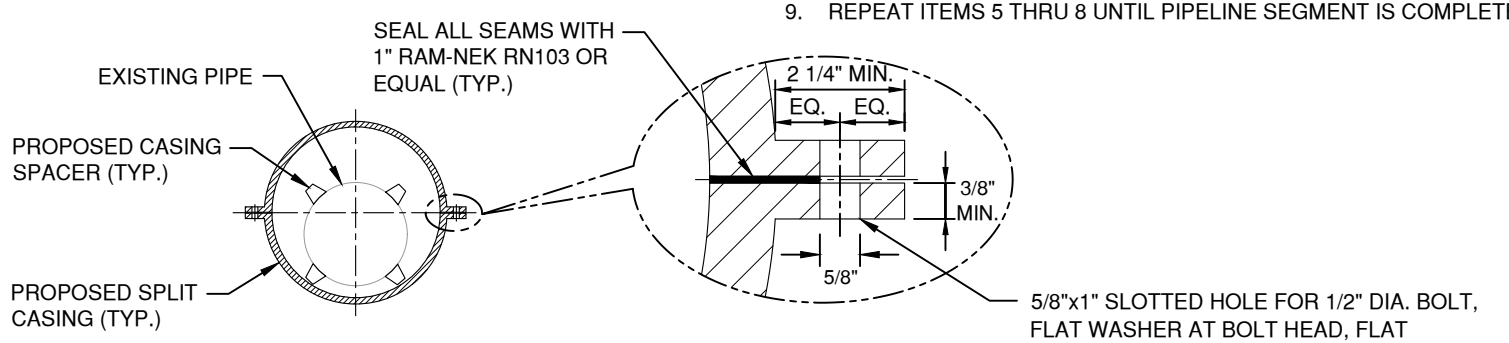
ISOMETRIC VIEW

NOTES:

1. SPLIT CASING SHALL BE STRUCTURAL GRADE ROLLED STEEL, MINIMUM YIELD STRENGTH 35,000 PSI, 3/8" MINIMUM WALL THICKNESS, MAXIMUM 20 LF SECTIONS, STAGGER TOP AND BOTTOM HALVES, INCORPORATE LIFTING EYES AS NECESSARY, SEAL ALL SEAMS WITH 1" RAM-NEK RN103 OR EQUAL.
2. SPLIT CASING HARDWARE (I.E. BOLTS, NUTS, WASHERS, ETC.) SHALL BE STAINLESS STEEL. FIELD APPLY NICKEL ANTI-SEIZE COMPOUND TO THREADS PRIOR TO ASSEMBLY.
3. CASING SPACERS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL SSI OR EQUAL.
4. CASING END SEALS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL AW OR EQUAL, WRAP WITH THREE LAYERS OF 8 MIL POLY AND TAPE.
5. REFERENCE DETAIL 230 FOR ADDITIONAL REQUIREMENTS (E.G. SIZES, DIMENSIONS, CLEARANCES, ETC.).
6. CONTRACTOR SHALL FULLY RESTRAIN ALL EXISTING PIPING THAT WILL BE WITHIN PROPOSED SPLIT CASING. THIS WORK SHALL BE SUBSIDIARY TO COST OF SPLIT CASING. RESTRAINTS SHALL BE FORD UNI-FLANGE SERIES 1390 FOR PVC PIPE AND SERIES 1490 FOR DUCTILE IRON PIPE. RESTRAINTS FOR C303 PIPE SHALL BE IN ACCORDANCE WITH DETAIL 340.

SEQUENCE OF WORK:

1. THE EXISTING PIPELINE SHALL REMAIN PRESSURIZED AND IN SERVICE DURING THIS ENTIRE SEQUENCE OF WORK.
2. POTHOLE AND EXPOSE EACH EXISTING PIPE JOINT THAT WILL BE WITHIN PROPOSED SPLIT CASING.
3. FULLY RESTRAIN ALL EXISTING PIPING THAT WILL BE WITHIN PROPOSED SPLIT CASING.
4. BACKFILL ALL EXCAVATIONS ASSOCIATED WITH ITEMS 2 AND 3.
5. EXPOSE EXISTING PIPING 20 LF MAXIMUM AT A TIME.
6. INSTALL CASING SPACERS ON EXISTING PIPE.
7. INSTALL SPLIT CASING AROUND RESTRAINTS, SPACERS, AND EXISTING PIPE.
8. INSTALL CRUSHED STONE BEDDING AND BACKFILL IN ACCORDANCE WITH DETAIL 420.
9. REPEAT ITEMS 5 THRU 8 UNTIL PIPELINE SEGMENT IS COMPLETED.



SECTION VIEW

GBRA
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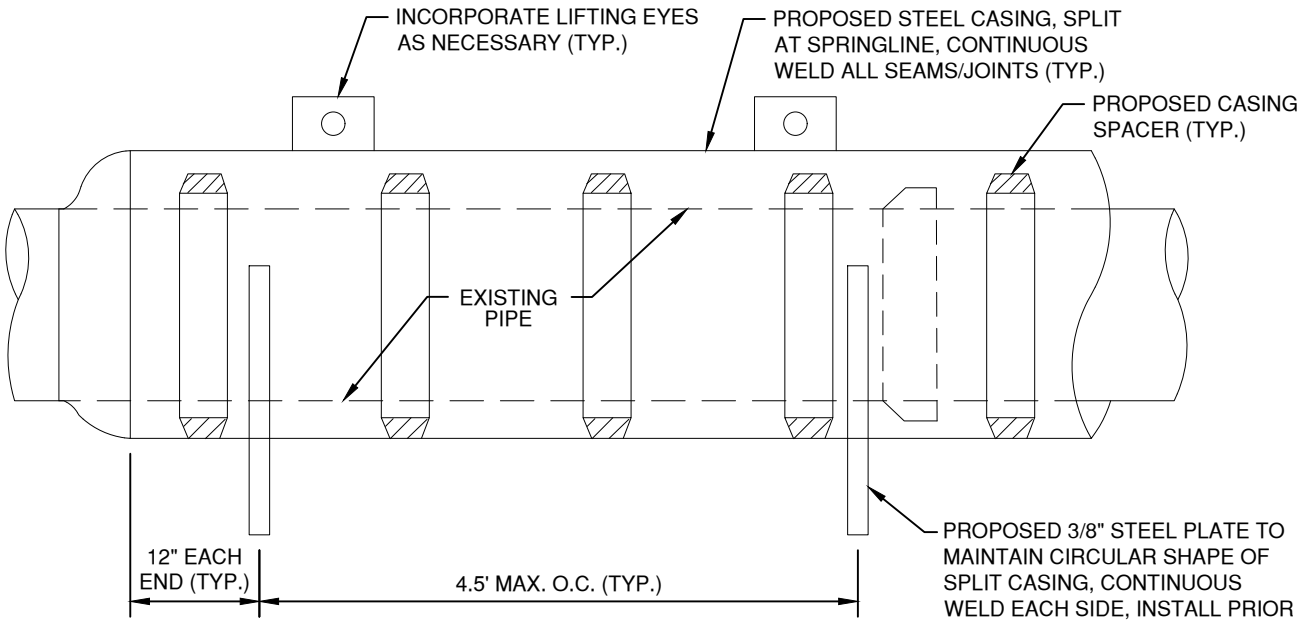
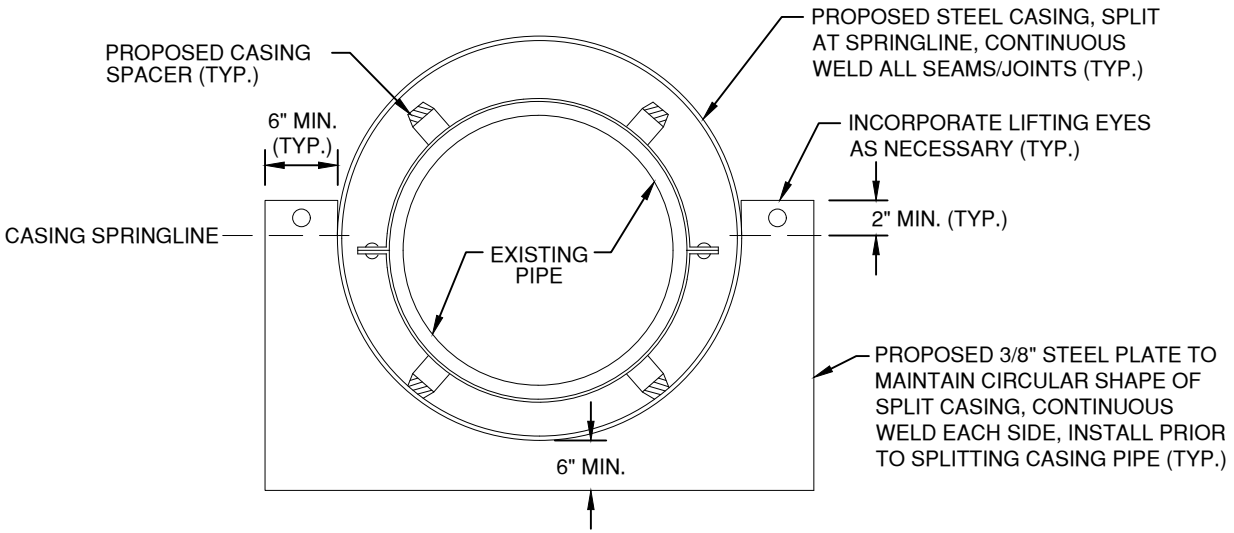
SPLIT CASING - BOLTED

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 500	



PROFILE VIEW



SECTION VIEW

NOTES:

1. CASING PIPE SHALL BE STRUCTURAL GRADE STEEL WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI AND 3/8" MINIMUM WALL THICKNESS.
2. CASING SPACERS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL SSI OR EQUAL.
3. CASING END SEALS SHALL BE ADVANCE PRODUCTS & SYSTEMS MODEL AW OR EQUAL, WRAP WITH THREE LAYERS OF 8 MIL POLY AND TAPE.
4. REFERENCE DETAIL 230 FOR ADDITIONAL REQUIREMENTS (E.G. SIZES, DIMENSIONS, CLEARANCES, ETC.).
5. CONTRACTOR SHALL FULLY RESTRAIN ALL EXISTING PIPING THAT WILL BE WITHIN PROPOSED SPLIT CASING. THIS WORK SHALL BE SUBSIDIARY TO COST OF SPLIT CASING. RESTRAINTS SHALL BE FORD UNI-FLANGE SERIES 1390 FOR PVC PIPE AND SERIES 1490 FOR DUCTILE IRON PIPE. RESTRAINTS FOR C303 PIPE SHALL BE IN ACCORDANCE WITH DETAIL 340.

SEQUENCE OF WORK:

1. THE EXISTING PIPELINE SHALL REMAIN PRESSURIZED AND IN SERVICE DURING THIS ENTIRE SEQUENCE OF WORK.
2. POTHOLE AND EXPOSE EACH EXISTING PIPE JOINT THAT WILL BE WITHIN PROPOSED SPLIT CASING.
3. FULLY RESTRAIN ALL EXISTING PIPING THAT WILL BE WITHIN PROPOSED SPLIT CASING.
4. BACKFILL ALL EXCAVATIONS ASSOCIATED WITH ITEMS 2 AND 3.
5. EXPOSE EXISTING PIPING 20 LF MAXIMUM AT A TIME.
6. INSTALL CASING SPACERS ON EXISTING PIPE.
7. INSTALL SPLIT CASING AROUND RESTRAINTS, SPACERS, AND EXISTING PIPE.
8. INSTALL CRUSHED STONE BEDDING AND BACKFILL IN ACCORDANCE WITH DETAIL 420.
9. REPEAT ITEMS 5 THRU 8 UNTIL PIPELINE SEGMENT IS COMPLETED.

GBRA
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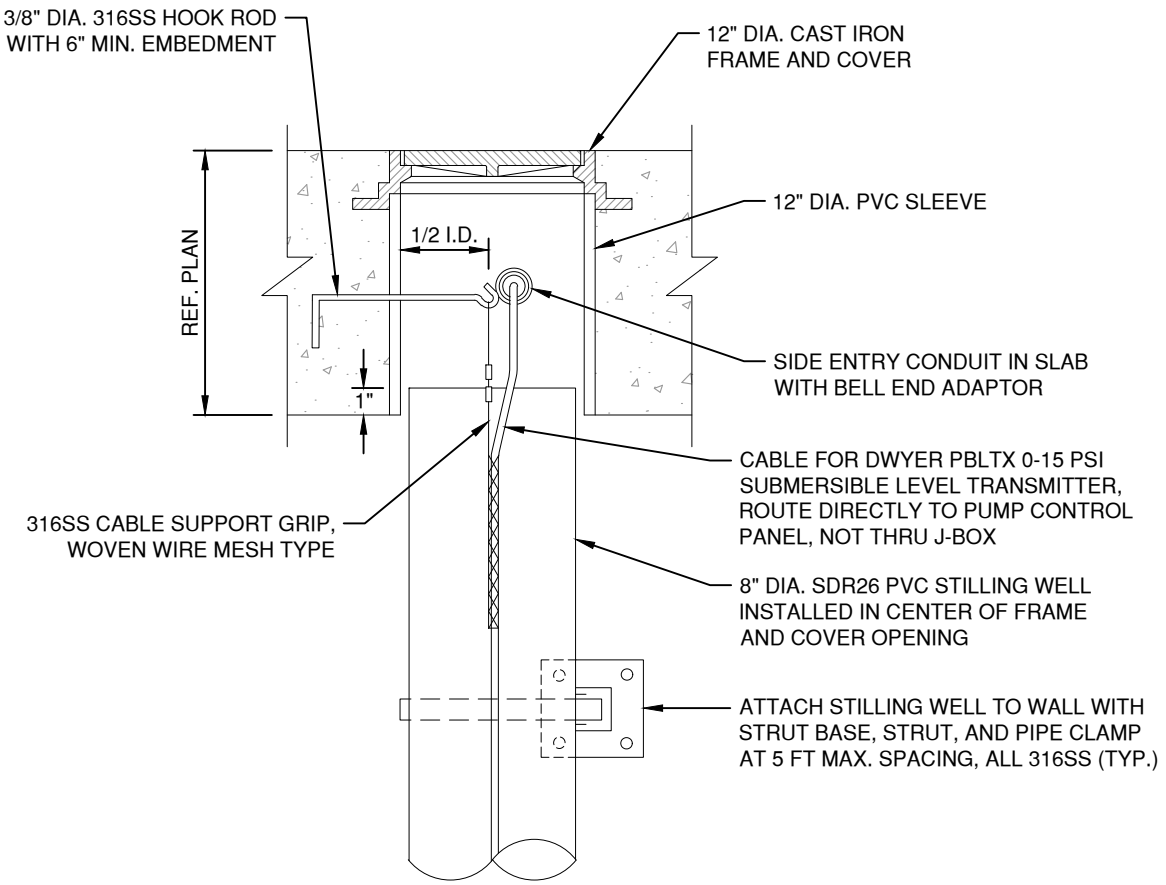
SPLIT CASING - WELDED

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 510	

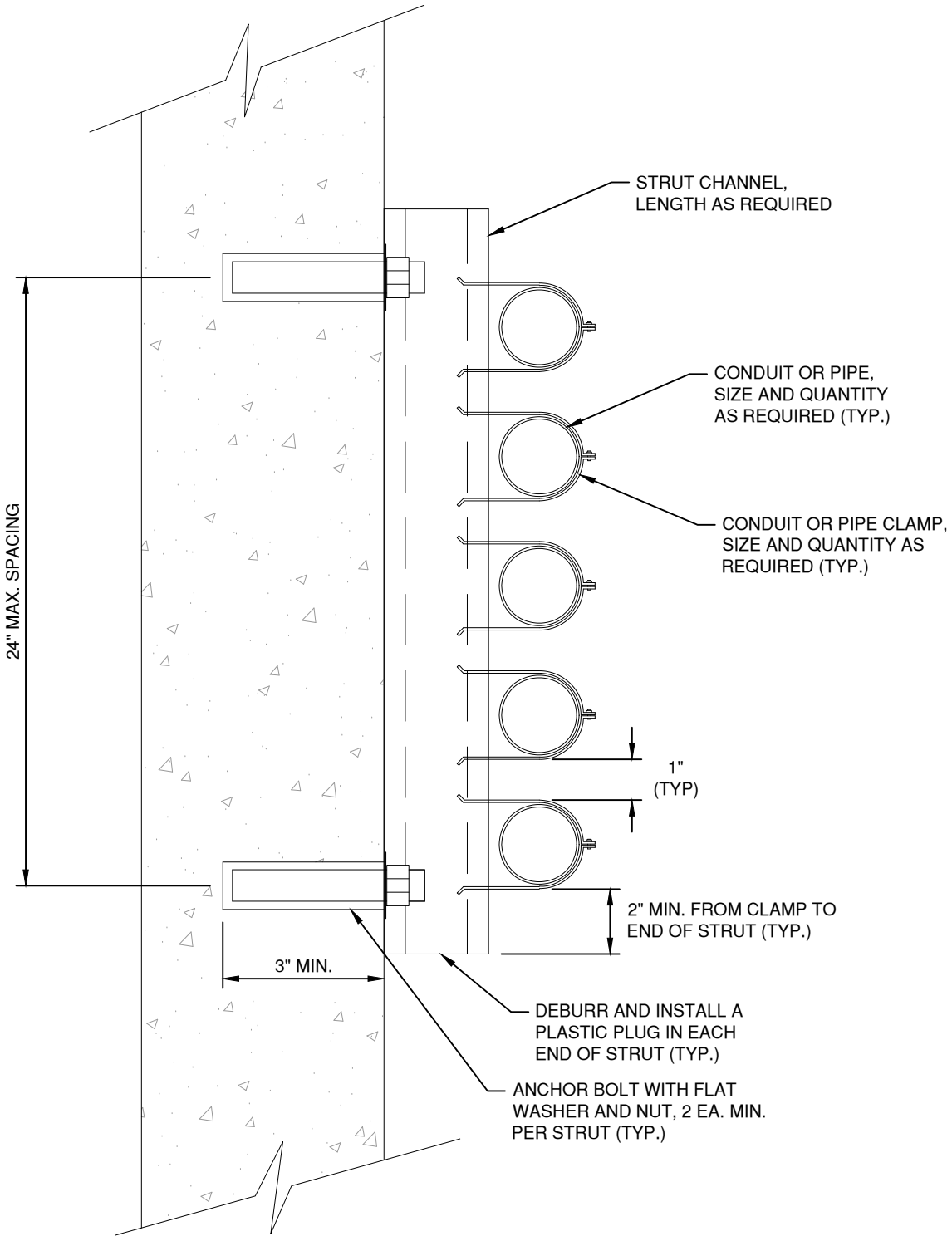


NOTES:
1. INSTALL COMPONENTS PLUMB/LEVEL.

Guadalupe-Blanco River Authority

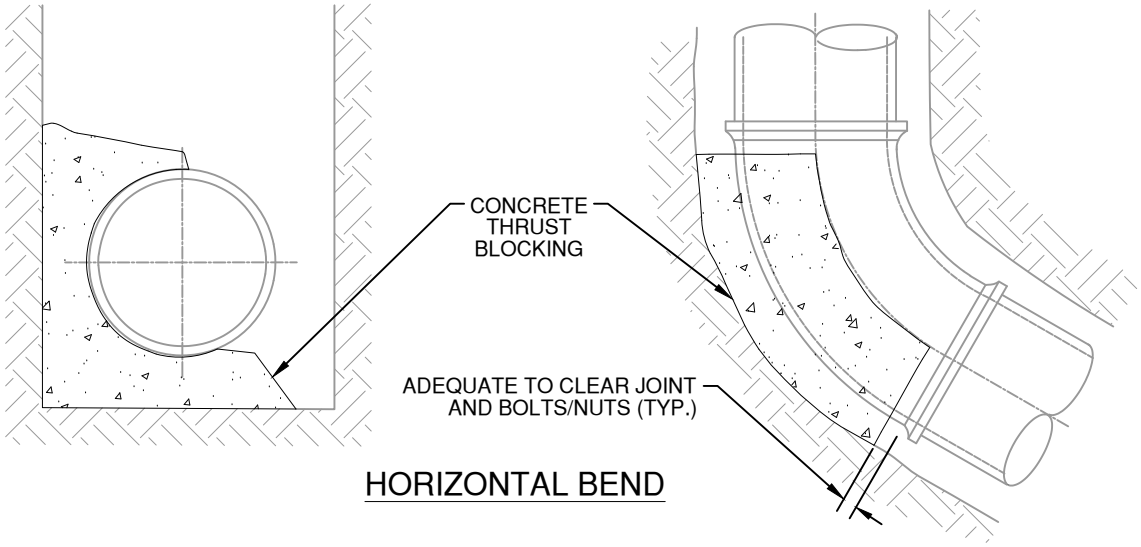
STILLING WELL

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 520	

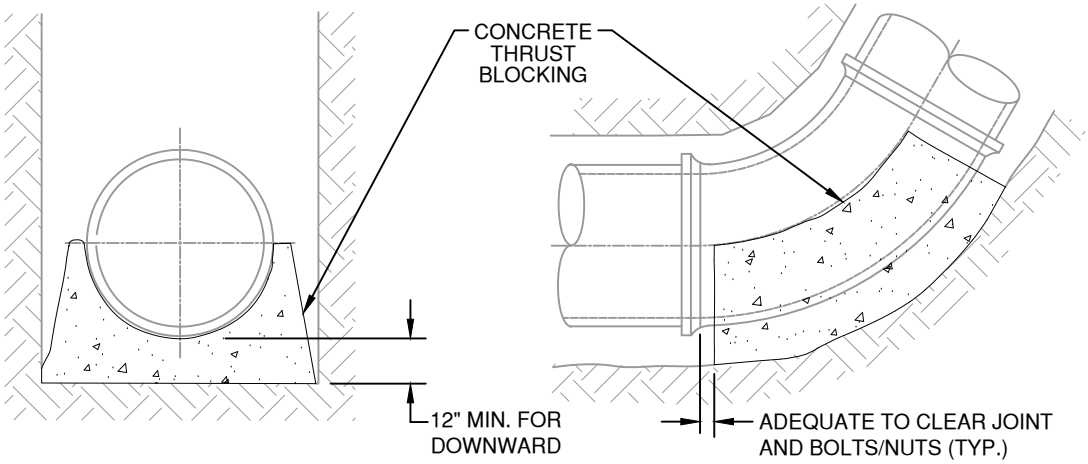


NOTES:
1. INSTALL COMPONENTS PLUMB/LEVEL.

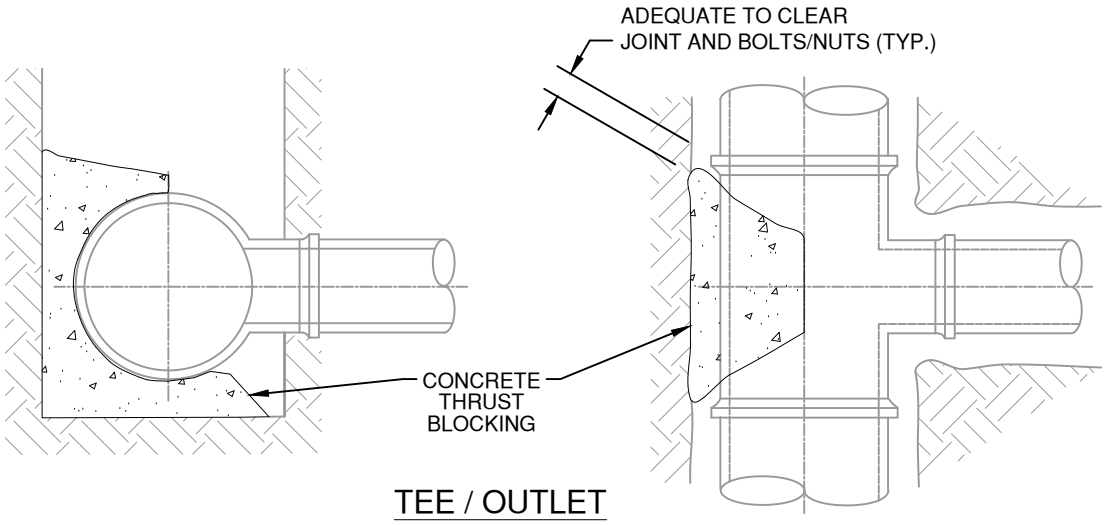
GBRA Guadalupe-Blanco River Authority	STRUT AND CLAMP	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 530	



HORIZONTAL BEND



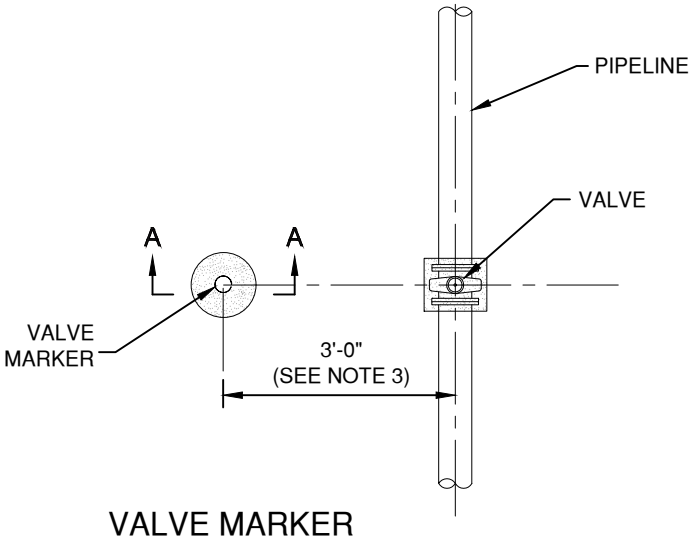
VERTICAL BEND UPWARD (INVERT FOR DOWNWARD)



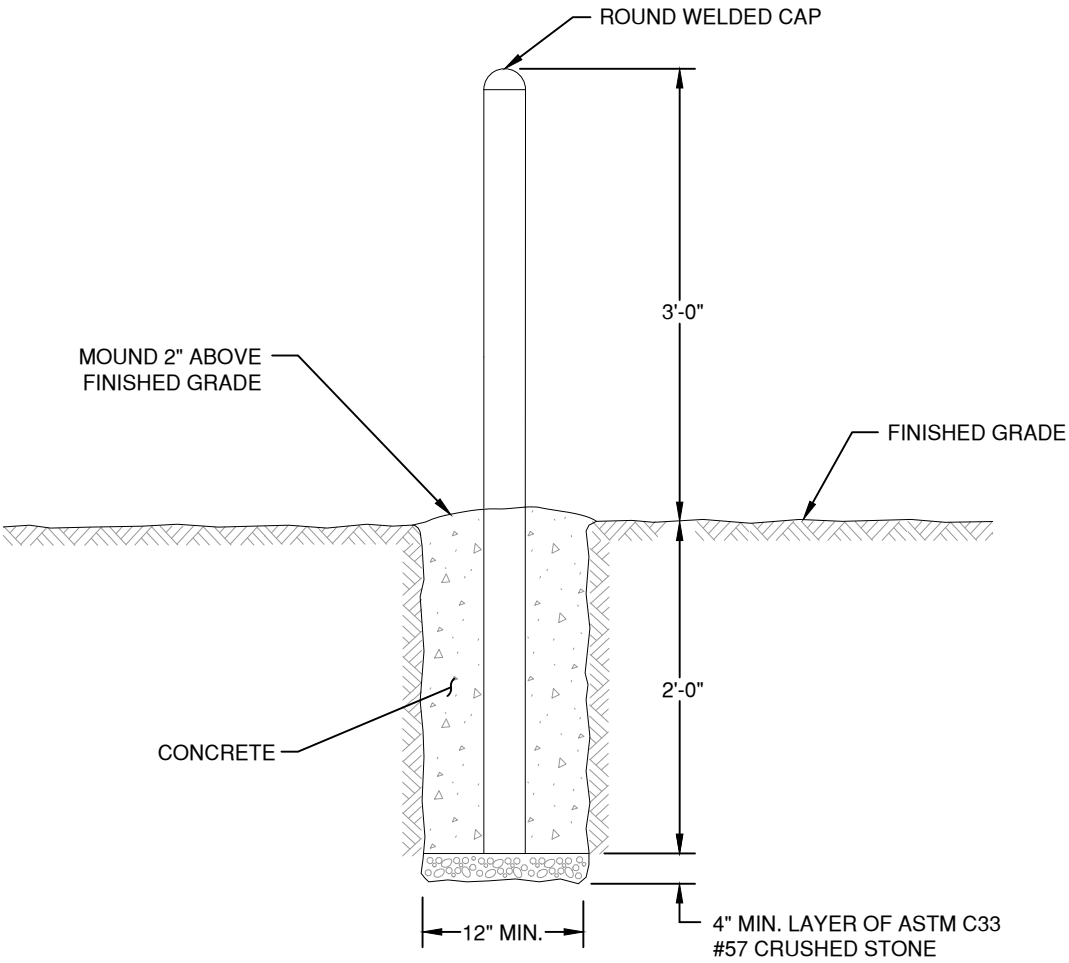
TEE / OUTLET

NOTES:
1. THRUST BLOCKING SHALL BE CAST-IN-PLACE CONCRETE AND MUST BE PLACED UPON AND AGAINST UNDISTURBED EARTH.

GBRA Guadalupe-Blanco River Authority	THRUST BLOCKING	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 540	



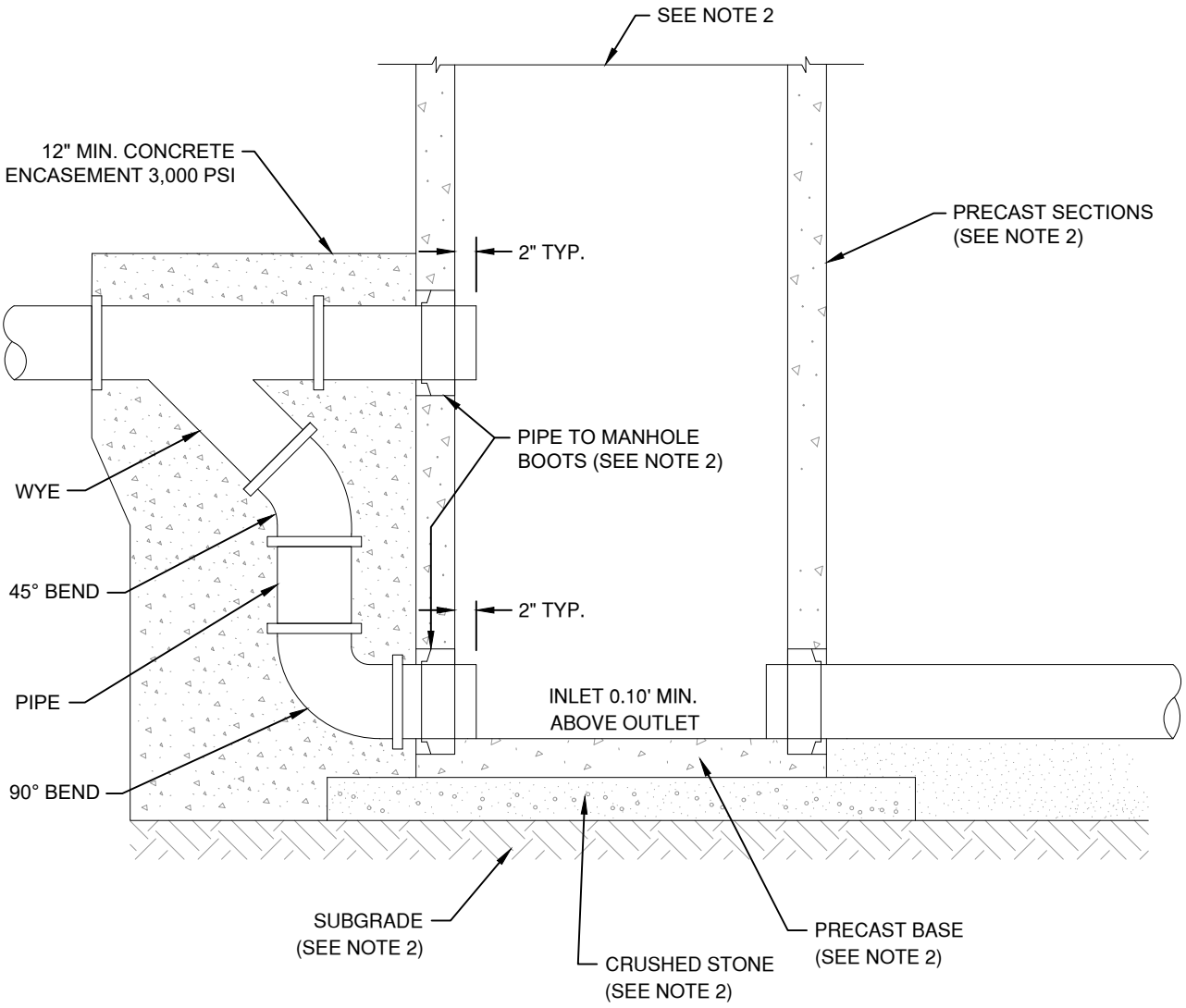
VALVE MARKER



SECTION A-A

NOTES:
1. VALVE MARKERS ARE REQUIRED AT ALL BURIED VALVES IN UNPAVED AREAS AND AT OTHER LOCATIONS INDICATED ON THE DRAWINGS.
2. VALVE MARKERS SHALL BE PAINTED 3" SCH 40 STEEL PIPE (REFERENCE GBRA STANDARDS FOR PAINTING REQUIREMENTS).
3. EXACT LOCATION AS DIRECTED BY GBRA.
4. INSTALL PLUMB/LEVEL.

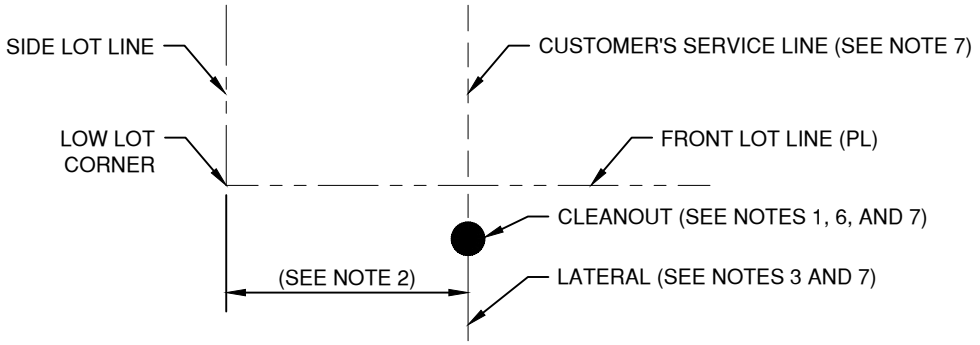
GBRA Guadalupe-Blanco River Authority	VALVE MARKER	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 550	



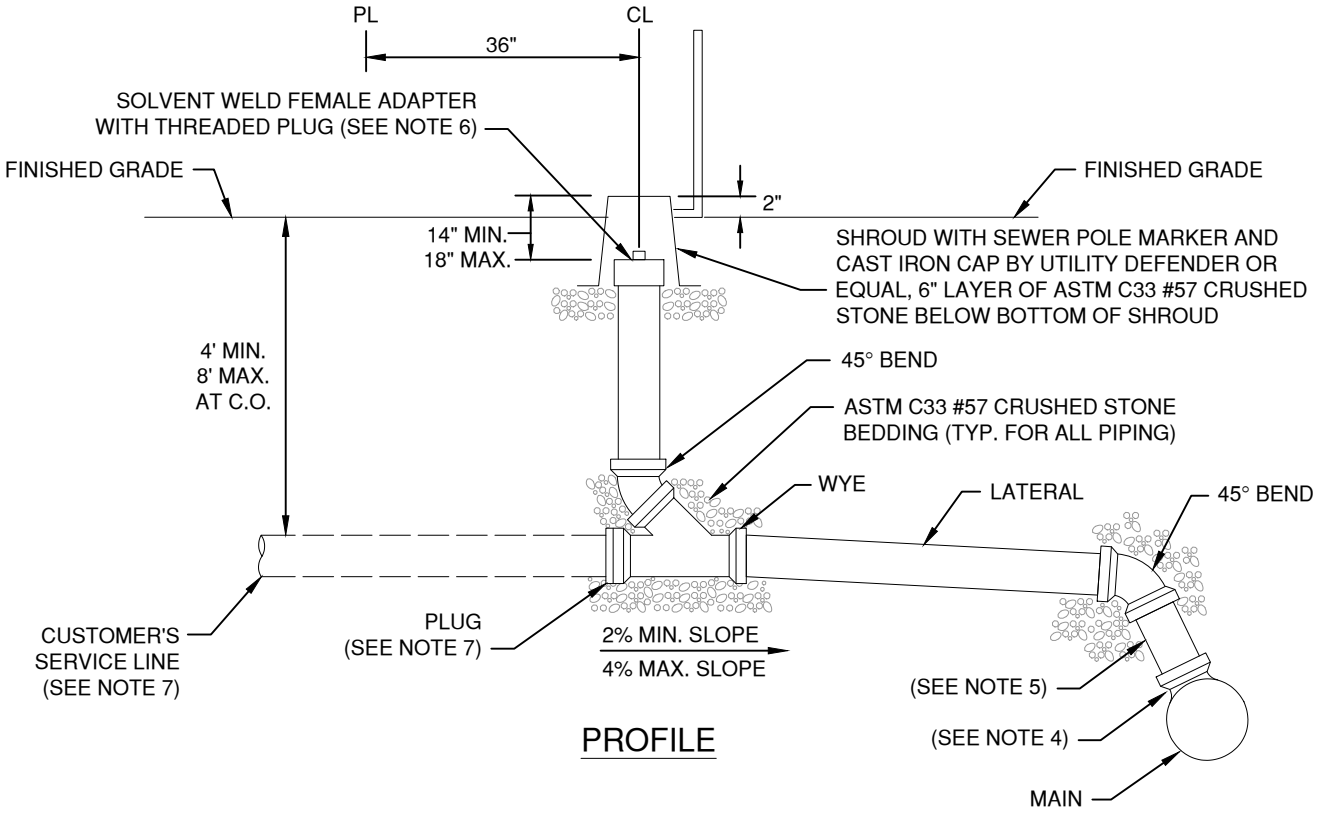
NOTES:

1. A WASTEWATER COLLECTION SYSTEM PIPE, INCLUDING SERVICE LATERALS, ENTERING A MANHOLE MORE THAN 24" ABOVE THE MANHOLE OUT INVERT MUST HAVE AN EXTERNAL DROP PIPE. INTERNAL DROPS ARE NOT ALLOWED.
2. REFERENCE DETAIL 620 FOR ADDITIONAL REQUIREMENTS.

GBRA Guadalupe-Blanco River Authority	WASTEWATER DROP MANHOLE	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 560	



PLAN

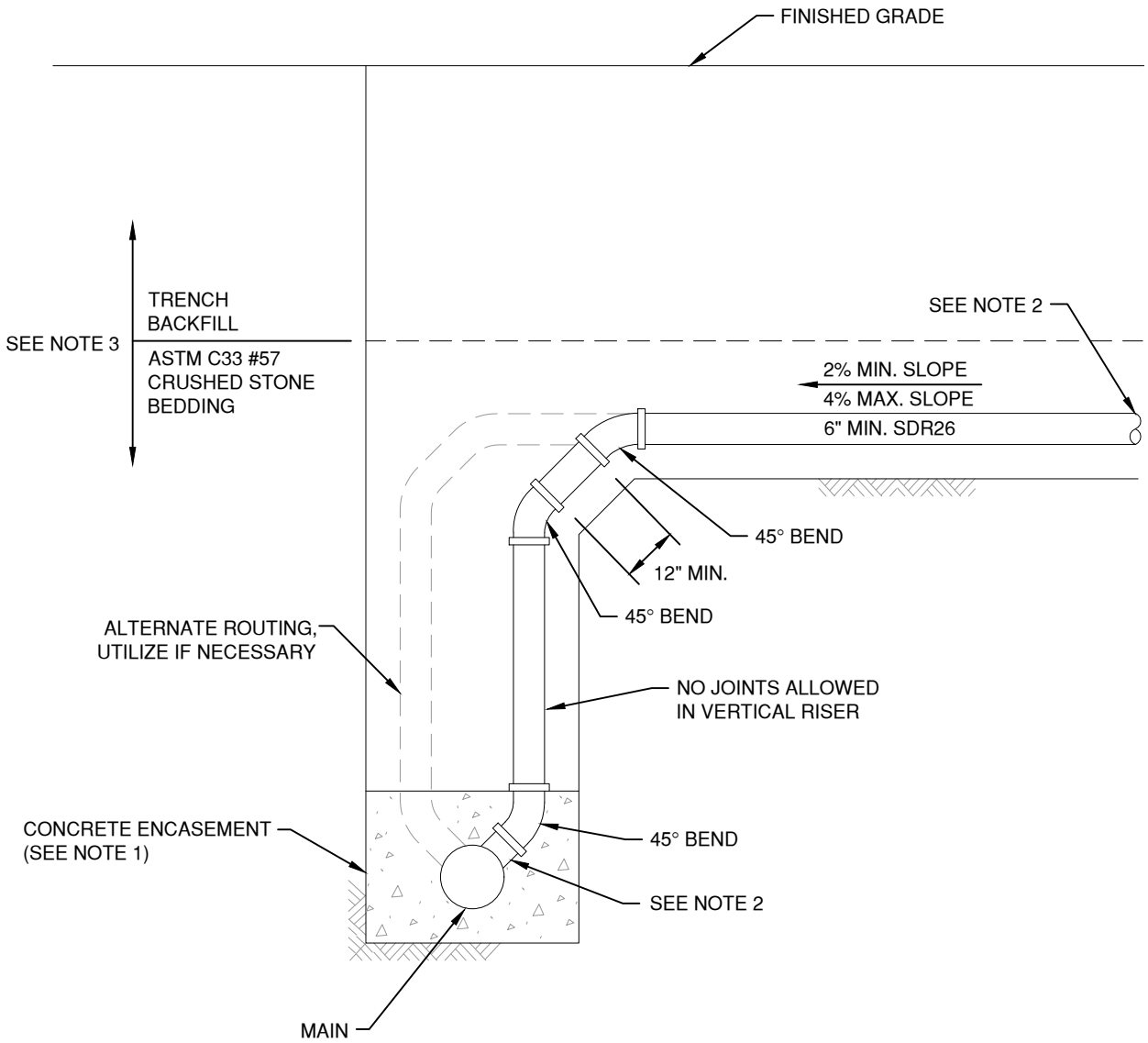


PROFILE

NOTES:

1. CLEANOUTS (C.O.) ARE NOT ALLOWED WITHIN DRIVEWAYS.
2. PROVIDE SINGLE WASTEWATER SERVICES 5 FT FROM LOW LOT CORNER (TYPICAL). PROVIDE 8 FT WHERE LOT CORNER IS SHARED WITH DRY UTILITIES AND 10 FT WHERE LOT CORNER IS SHARED WITH A FIRE HYDRANT OR AIR RELEASE VALVE.
3. PIPE AND FITTINGS SHALL BE 6" DIAMETER, GREEN COLOR, GASKETED ASTM D3034 SDR26, UNLESS NOTED OTHERWISE. AT WATER CROSSINGS PIPE AND FITTINGS SHALL BE WHITE COLOR, GASKETED, AND 150 PSI MINIMUM PRESSURE RATED.
4. UTILIZE SANITARY TEES FOR NEW CONSTRUCTION. UTILIZE TAPPING SADDLES FOR EXISTING MAINS (NAPCO PART H4308-6R OR EQUAL, ADJUST PART NUMBER FOR SIZE REQUIRED). TAPPING SADDLES ARE NOT ALLOWED FOR NEW CONSTRUCTION.
5. INSTALL PIPE BETWEEN FITTINGS IF NECESSARY. INSTALL PER VERTICAL STACK DETAIL 580 IF NECESSARY OR WHERE SHOWN.
6. CLEANOUT RISER AND SHROUD SHALL BE INSTALLED PLUMB/LEVEL. CENTERLINE (CL) OF CLEANOUT RISER SHALL BE 3 FT FROM PROPERTY LINE (PL).
7. ENTIRE ASSEMBLY SHALL BE FURNISHED AND INSTALLED BY THE STREET UTILITY CONTRACTOR, WITH EXCEPTION OF CUSTOMER'S SERVICE LINE. CUSTOMER'S PLUMBER SHALL REMOVE PLUG, INSTALL CUSTOMER'S SERVICE LINE, VERIFY ANY FINISHED GRADE MODIFICATIONS AND ADJUST ASSEMBLY ACCORDINGLY, AND RESTORE ANY DISTURBED WORK.

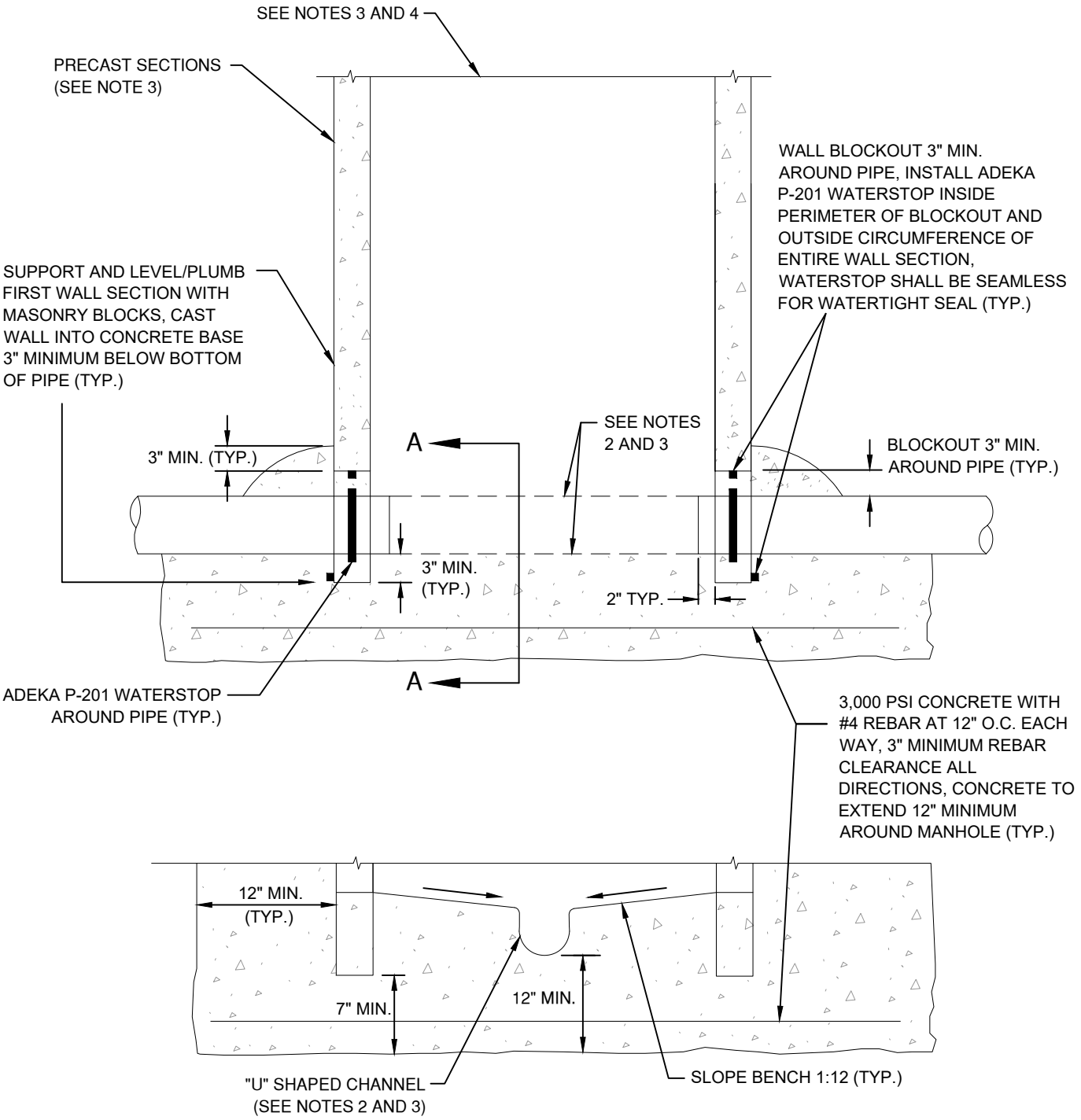
GBRA Guadalupe-Blanco River Authority	WASTEWATER LATERAL AND CLEANOUT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 570	



NOTES:

1. CONCRETE ENCASEMENT SHALL BE PLACED, UPON AND AGAINST UNDISTURBED EARTH.
2. REFERENCE DETAIL 570 FOR ADDITIONAL REQUIREMENTS.
3. REFERENCE DETAIL 420 FOR ADDITIONAL REQUIREMENTS.
4. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

GBRA Guadalupe-Blanco River Authority	WASTEWATER LATERAL VERTICAL STACK	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 580	

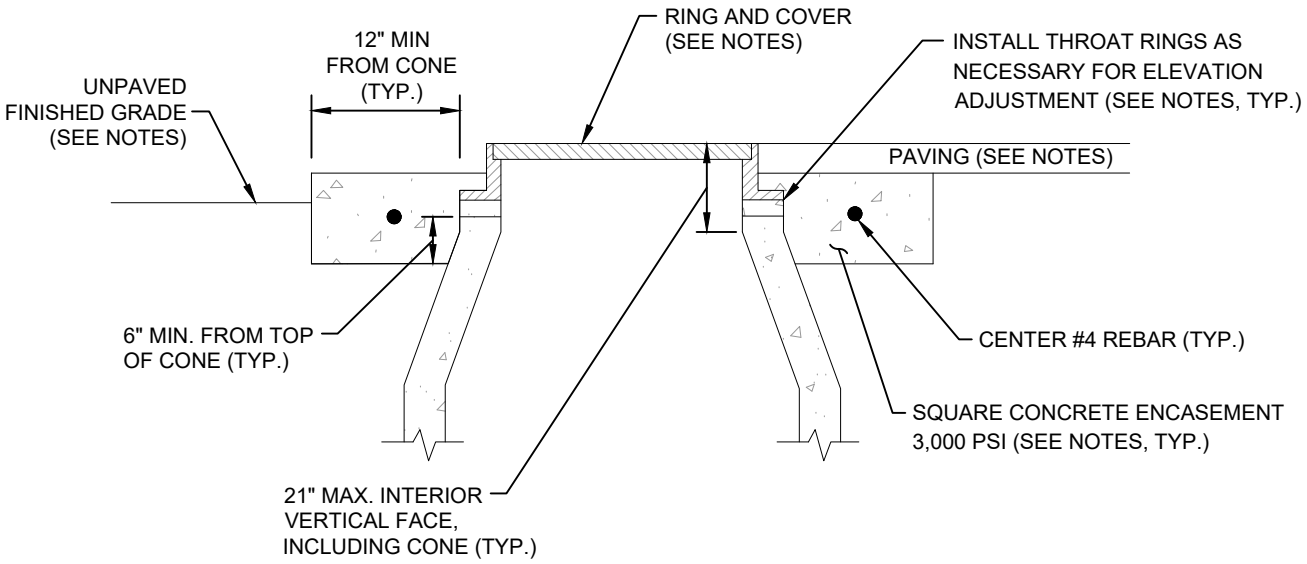


SECTION "A-A"

NOTES:

1. THIS DETAIL SHALL BE USED TO INSTALL MANHOLES ON EXISTING MAINS ONLY.
2. AFTER SUCCESSFUL VACUUM TESTING, REMOVE EXISTING PIPE FULL CIRCUMFERENCE AND SHAPE CHANNELS FOR NEW AND EXISTING PIPES.
3. REFERENCE DETAIL 620 FOR CHEMICAL RESISTANT MATERIAL REQUIREMENTS.
4. REFERENCE DETAIL 620 FOR ADDITIONAL REQUIREMENTS.

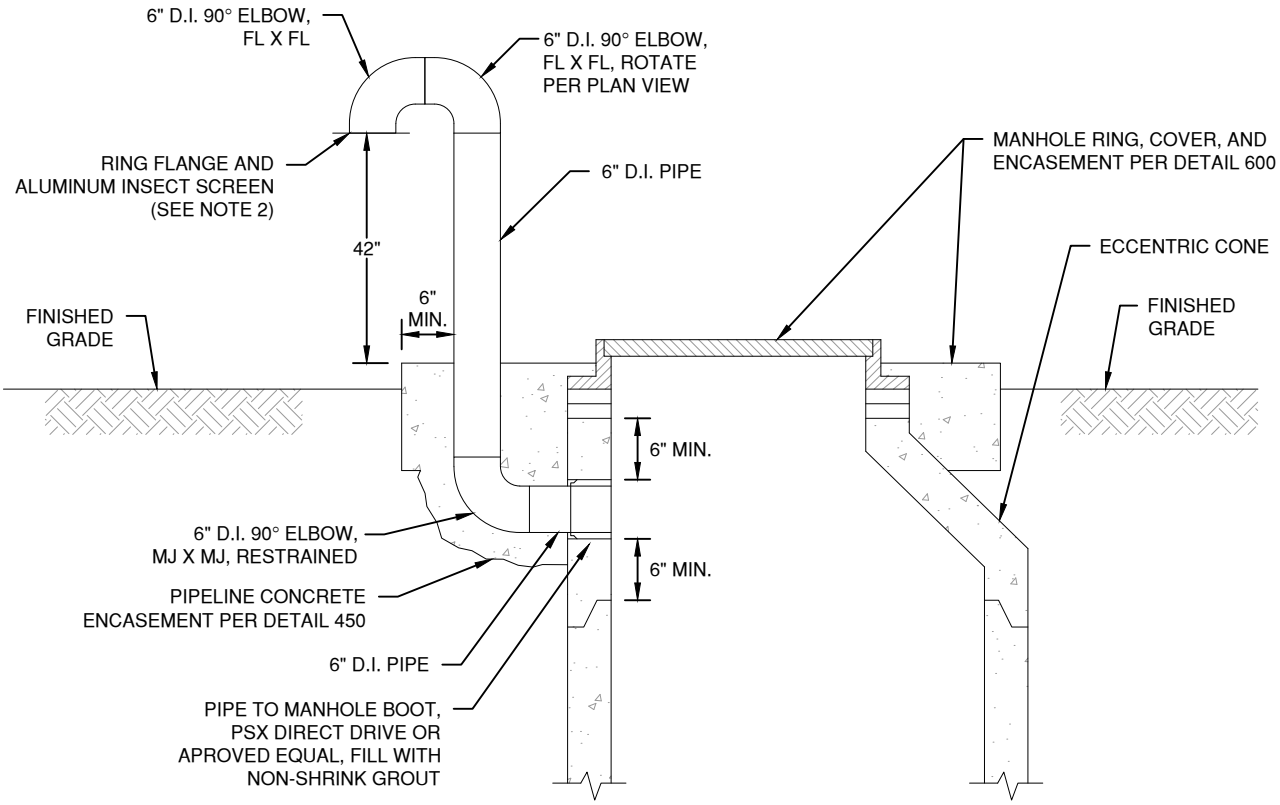
GBRA Guadalupe-Blanco River Authority	WASTEWATER MANHOLE CAST IN PLACE BASE	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 590	



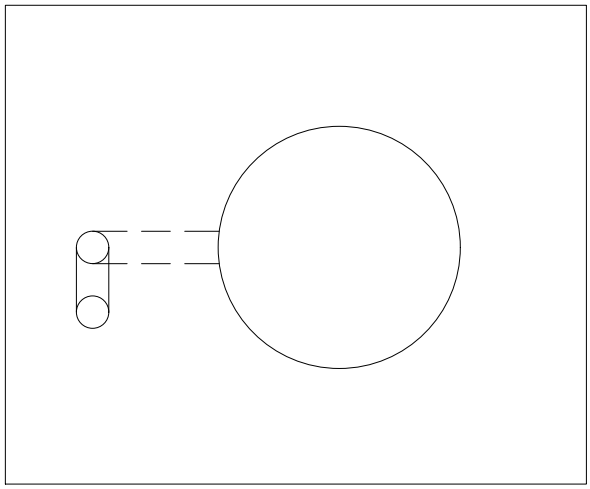
NOTES:

1. MANHOLE RING CONCRETE ENCASEMENT IS REQUIRED FOR ALL MANHOLES.
2. INSTALL CONCRETE ENCASEMENT SQUARE WITH CURB.
3. MANHOLE RIM ELEVATIONS SHOWN IN PLAN AND PROFILE VIEWS ARE APPROXIMATE.
4. IN UNPAVED AREAS, ASSEMBLY SHALL BE INSTALLED PLUMB/LEVEL, TOP OF CONCRETE ENCASEMENT SHALL BE 2" ABOVE FINISHED GRADE, COVERS SHALL BE 2" ABOVE TOP OF CONCRETE ENCASEMENT, ALL EXPOSED VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE FORMED WITH 3/4" CHAMFER STRIPS.
5. IN PAVED AREAS, RINGS AND COVERS SHALL BE FLUSH WITH PAVING AND SLOPED TO MATCH PAVING.
6. THROAT RINGS SHALL BE PRECAST CONCRETE. ALL INTERIOR SURFACES OF MANHOLES SHALL BE CHEMICAL RESISTANT INCLUDING THROAT. UTILIZE NON-SHRINK GROUT FOR INSTALLATION OF THROAT RINGS. GROUT SHALL BE COMPATIBLE WITH THE CHEMICAL RESISTANT SYSTEM.
7. MANHOLE RINGS AND COVERS SHALL BE EJCO PRODUCT NUMBER 42432109W01, SIP INDUSTRIES ITEM NUMBER 4087, OR EQUAL.
8. SCHEDULE GBRA INSPECTOR TO WITNESS FINAL BOLTING OF MANHOLE COVERS.

GBRA Guadalupe-Blanco River Authority	WASTEWATER MANHOLE RING ENCASEMENT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 600	



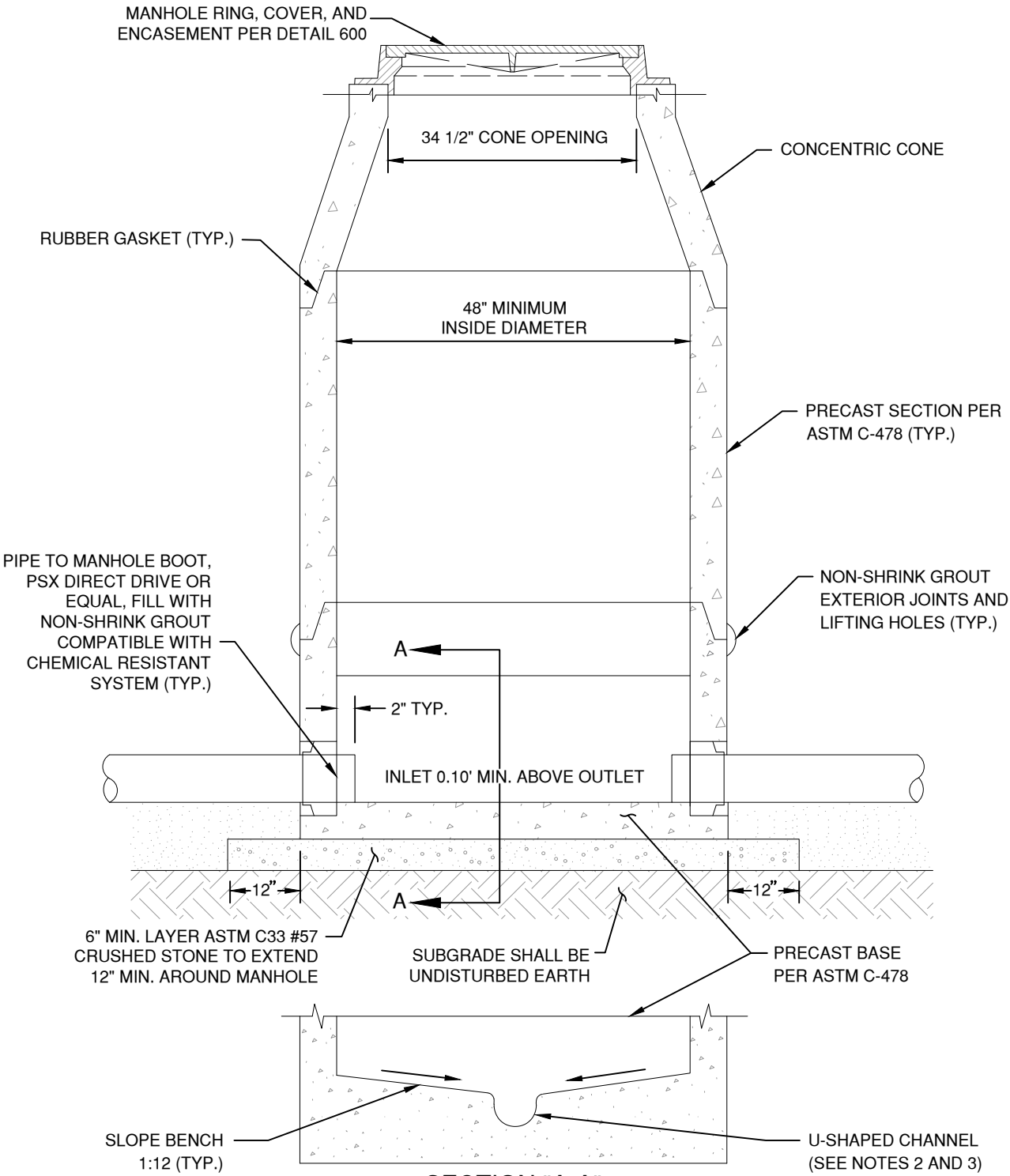
SECTION VIEW



PLAN VIEW

NOTES:
1. REFERENCE DETAIL 620 FOR ADDITIONAL REQUIREMENTS.
2. INSTALL A TEMPORARY BLIND FLANGE FOR MANHOLE VACUUM TESTING.

GBRA Guadalupe-Blanco River Authority	WASTEWATER MANHOLE VENT	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 610	

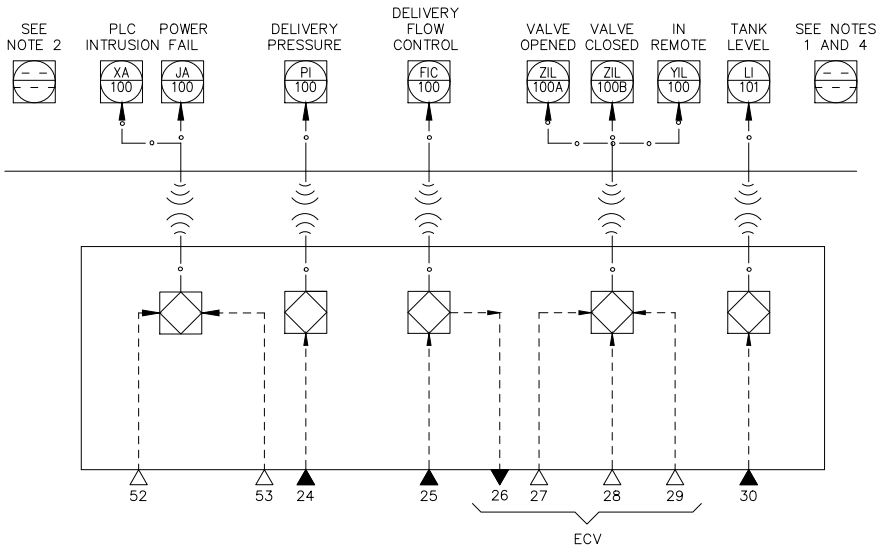


SECTION "A-A"
TYPICAL PRECAST BASE

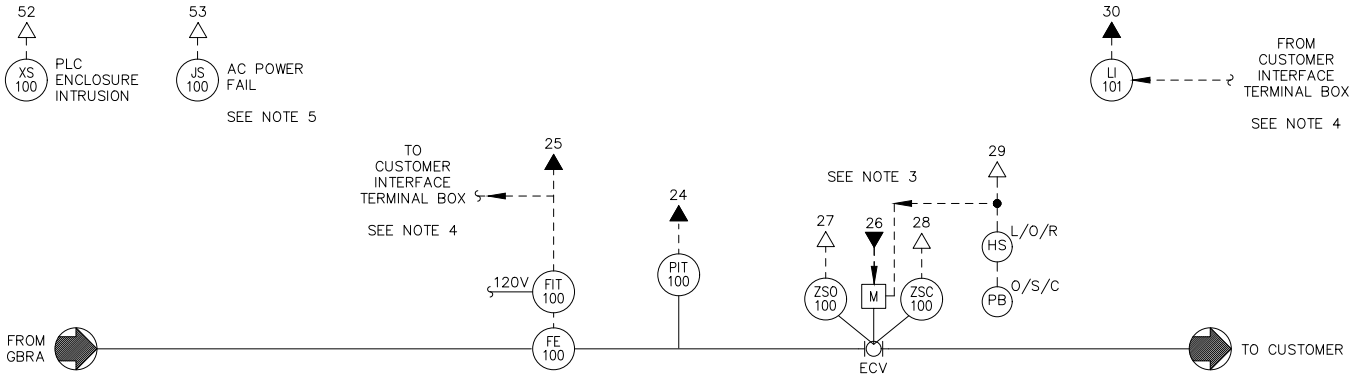
NOTES:

1. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.
2. ALL INTERIOR SURFACES SHALL BE CHEMICAL RESISTANT INCLUDING THROAT RINGS, BENCH, AND CHANNEL INVERTS. REFERENCE GBRA STANDARDS FOR CHEMICAL RESISTANT MATERIAL REQUIREMENTS.
3. IF CHEMICAL RESISTANT LINING IS UTILIZED, ADJUST CHANNEL INVERTS TO ACCOMMODATE THICKNESS OF LINING SUCH THAT CHANNEL INVERTS, AFTER LINING, MATCH PIPE INVERTS.
4. PROVIDE 6" MINIMUM CLEARANCE BETWEEN CONCRETE PENETRATIONS, AND BETWEEN CONCRETE PENETRATIONS AND CONCRETE JOINTS, AS MEASURED FROM NEAREST EDGE TO NEAREST EDGE.

GBRA Guadalupe-Blanco River Authority	WASTEWATER PRECAST MANHOLE	REVISED	SCALE
		JUL. 28, 2025	NONE
		DETAIL NO. 620	



GBRA WATER DELIVERY POINT RTU



METERING AND ELECTRONIC CONTROL VALVE (ECV)

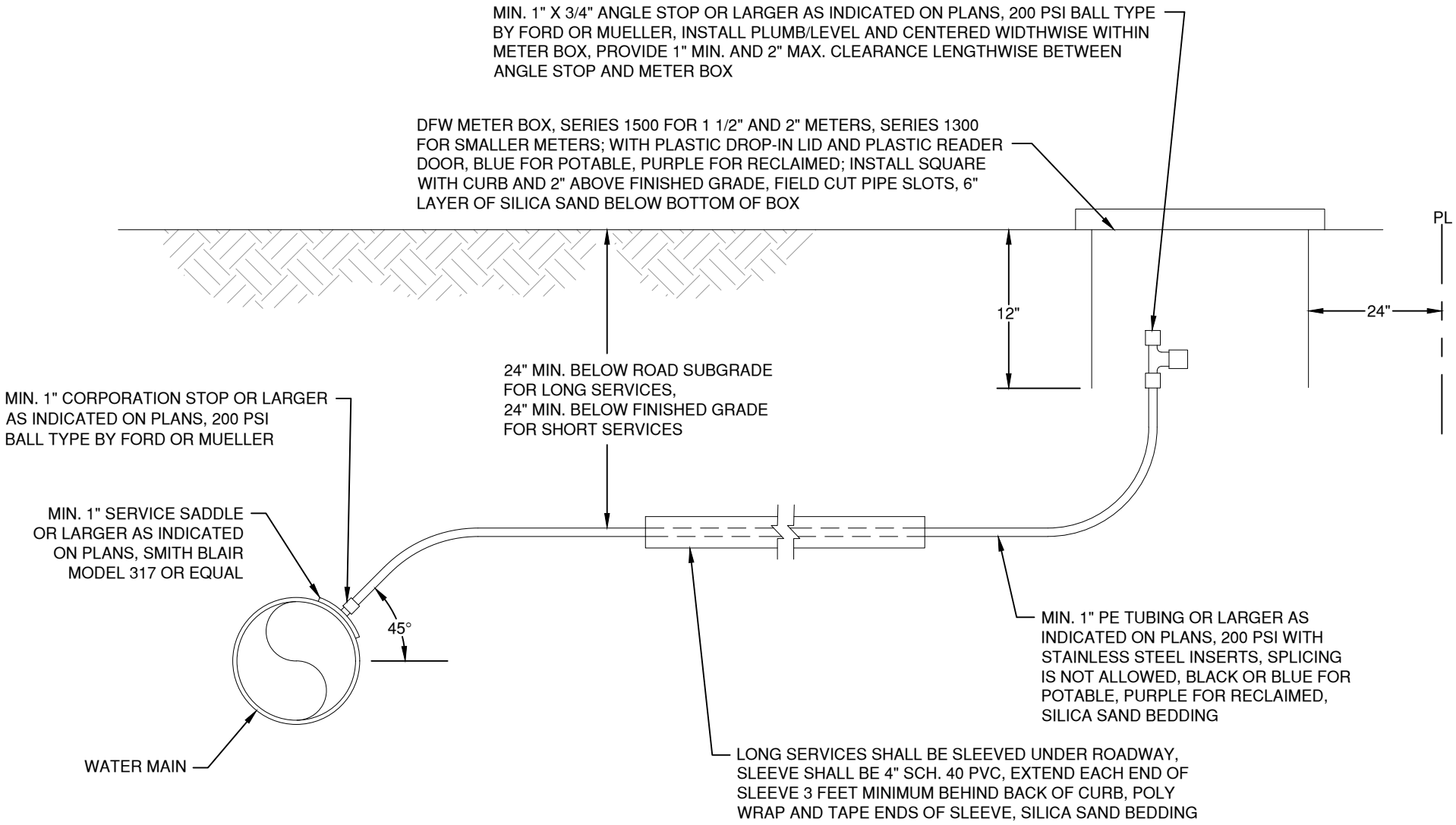
NOTES:

1. PROVIDE CUSTOMER ENABLE CONTACT AND ASSOCIATED CONDUIT AND CONDUCTORS TO GBRA WATER DELIVERY POINT RTU.
2. PROVIDE AN ALARM TO GBRA SCADA FOR GBRA WATER DELIVERY POINT RTU BATTERY SYSTEM LOW VOLTAGE.
3. PROVIDE ELECTRONIC CONTROL VALVE POSITION FEEDBACK TO GBRA SCADA.
4. PROVIDE 4-20MA ISOLATOR FOR EACH CUSTOMER INTERFACE, ISOLATOR SHALL BE INSTALLED INSIDE GBRA WATER DELIVERY POINT RTU ENCLOSURE.
5. AC POWER FAIL SHALL BE A NORMALLY CLOSED SET OF CONTACTS ON LINE SIDE OF PANEL OR LOAD SIDE OF CONTROL POWER TRANSFORMER.
6. REFERENCE GBRA STANDARDS AND DESIGN GUIDELINES, AND GBRA SPECIFICATION SECTIONS 13410 AND 13428 FOR ADDITIONAL REQUIREMENTS.

Guadalupe-Blanco River Authority

WATER DELIVERY POINT PROCESS AND INSTRUMENTATION DIAGRAM

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 630	



NOTES:

1. ALL WATER SERVICES SHALL BE SINGLE SERVICES. DOUBLE WATER SERVICES ARE NOT ALLOWED.
2. UNLESS NOTED OTHERWISE, ALL WATER SERVICES SHALL BE INSTALLED 5 FT FROM THE HIGH LOT CORNER.
3. THE ENTIRE ASSEMBLY AS SHOWN ON THIS DETAIL SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. GBRA WILL FURNISH AND INSTALL THE WATER METER ONLY.
4. UNLESS INDICATED OTHERWISE, INSTALL COMPONENTS PLUMB/LEVEL.

GBRA
Guadalupe-Blanco River Authority

WATER SERVICE

REVISED	SCALE
JUL. 28, 2025	NONE
DETAIL NO. 640	