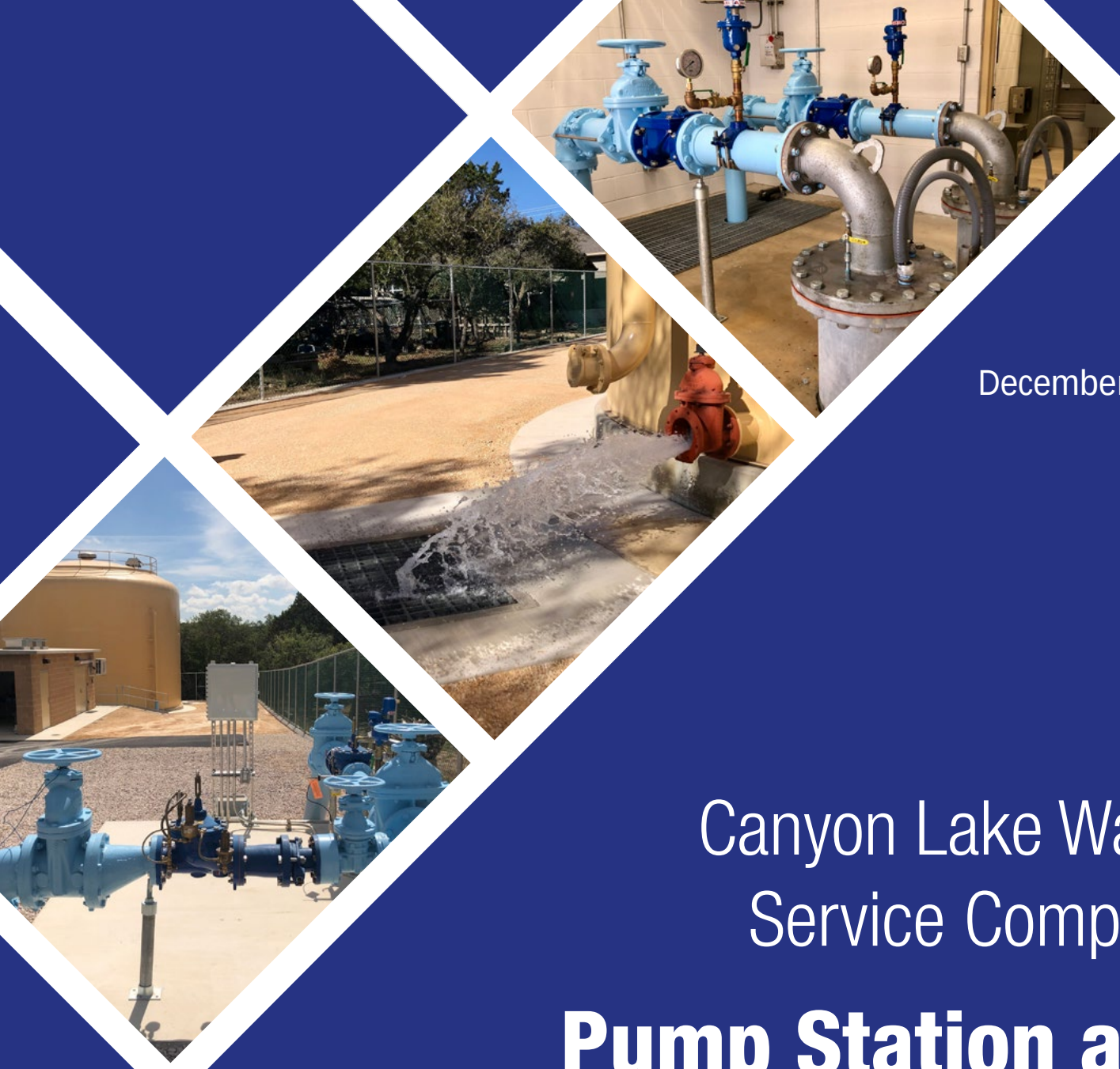

December 2022

Canyon Lake Water Service Company

Pump Station and Ground Storage Tank Design Criteria

CLWSC

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Part 1 – Introduction and Purpose

A. These design criteria establish the process and standards to be followed for the engineering design and the preparation of construction plans and specifications for potable water pump stations with a 300-gpm to 2,000-gpm firm pumping capacity for Canyon Lake Water Service Company (CLWSC). Coordinate with CLWSC directly for design criteria for pump stations with a firm pumping capacity higher than 2,000 gpm.
B. It is the responsibility of the user of these documents to reference and/or utilize industry standards for items not otherwise directly referenced within this document.
C. The Design Engineer may not deviate from the criteria presented in this document without prior written approval of CLWSC.
D. The purpose of these design criteria is as follows:
    i. Provide adequate service capacity to meet all customer needs (firm capacity).
    ii. Provide maximum service reliability for customers.
    iii. Provide adequate working space and safe working conditions for maintenance personnel.
    iv. Provide maximum operating efficiency.
    v. Provide durable, low maintenance, long-lasting equipment and facilities.
    vi. Provide neighbor-friendly site development and building architecture.
E. The Design Engineer shall observe all applicable codes and other requirements adopted by local permitting agencies. The current version of these documents effective at Notice to Proceed of the design phase shall be used as a reference for design purposes. In case of conflict between the requirements of these reference documents and any code adopted by a local permitting agency, the code requirements prevail.
F. Design/Sizing Criteria
    i. Coordinate with CLWSC modeling department to confirm pump capacity requirements.
    ii. Facilities shall meet or exceed the requirements of 30 Texas Administrative Code (TAC) Chapter 290.
    iii. During max day demand, the minimum pressure at the highest elevation to be served in the affected pressure zone must not be less than 45 psi.
G. Construction Sequencing
    i. It is CLWSC's preference that all existing facilities (if applicable) remain functionally in service while construction occurs. In some cases, this preference is mandatory.
H. Electrical Power
    i. Engineer is responsible for coordinating the extension of primary power to the pump station site if required. Power should be the responsibility of the Contractor until the site is substantially accepted by CLWSC.
    ii. Provide 480Y/277V three-phase power with a 120/240V single-phase step down transformer, unless otherwise approved by CLWSC.
    iii. Coordinate with CLWSC during power application process. CLWSC will submit payment for utility fees directly to utility company.

Part 2 – Site Design

This section is intended to describe design requirements of a facility including site layout, site access, ground cover requirements, and site appurtenance requirements.

A. Site Layout and Sizing
   i. Provide 15’ minimum clear space around all buildings, tanks, etc. Provide widths and slopes to allow vehicle access around and between structures. Additional space may be required for project-specific access and/or maintenance, such as crane positions for vertical turbine pump removal, spacing for concrete tank erection, etc.
   ii. Additional space for future facility expansion may be required at CLWSC’s discretion.

B. Driveway and Access
   i. Provide a 16’-wide hot-mix asphaltic concrete (HMAC) driveway connected to the existing road with a concrete header. The minimum section requirements for the driveway are 2” HMAC placed over 10” compacted flexible base (TxDOT Item 247 Type A Grade 1-2), supported by a 6” compacted sub-base compacted to 98% standard proctor.
   ii. Access drives shall have a longitudinal slope not to exceed 10%, a transverse slope not to exceed 5%, no vertical grade breaks greater than 10%, no vertical curve with grade change greater than 1% per horizontal foot.
   iii. The HMAC driveway should lead to the pump station building. The Design Engineer should include means to turn a vehicle around as part of the site layout (i.e. hammerhead, looped access, etc.).

C. Site Cover
   i. Provide 8” flexible base in site areas to be accessed by vehicle for periodic maintenance.
   ii. Provide 6” of Grade 57 Rock above a geotextile fabric on the remaining areas of the site.

D. Site Grading
   i. Finished grades should not exceed 10% slope in areas to be accessed by vehicle.
   ii. Finished grades should not exceed 25% slope in all other areas on the site.
   iii. Retaining walls should be installed when finished grades exceed 10% slope in areas to be accessed by vehicles and 25% in all other areas on the site.
      1. Where retaining walls are provided around structures (building, tanks, etc.), provide a galvanized steel handrail on top of the retaining wall.

E. Tank Overflow Storm Drain
   i. Provide a 4’x4’, or larger, grate inlet centered at overflow pipe discharge. Place grate inlet a minimum of 5’ from tank shell. Increase placement, as needed, for overflow pipes larger than 8”. Inlet and grate should be designed for H20 traffic loading.
   ii. Provide a 2’ concrete apron around all edges of the inlet. Slope apron at a grade of 2% toward the inlet.
   iii. When concentrated flows (including flow from tank overflow, periodic tank draining, etc.) are directed onto adjacent properties, provisions and considerations shall be made

to return flow to sheet flow or provide easements across adjacent tracts when left as concentrated flow.

F. Drainage Retention/Detention
   i. Refer to Local Jurisdiction (City/County) drainage code for retention/detention requirements.

G. Gate and Fence
   i. Provide an 8’ tall fence (with no barb wire) with an 18”-wide reinforced, concrete mow-strip base around the entire site. Fence fabric and members should be green vinyl coated.
   ii. Gate should be a minimum 20’ wide double-swing gate with lock.
   iii. Provide a 3.5’ personnel gate adjacent to the 20’ wide double-swing gate with lock.
   iv. Additional gates may be required in areas where additional site access/maintenance is required.
   v. The Contractor shall be responsible for providing a temporary combination lock until station is accepted by CLWSC. Upon acceptance of station, CLWSC will furnish their standard lock.

Part 3 – Building Design

This section is intended to describe design requirements of a pump station facility building including building layout, building access, and mechanical and plumbing requirements.

A. Space and Function Preferences
   i. Provide adequate room within the building for equipment loading and unloading using the overhead roll up door.
   ii. Allow for sufficient floor space around piping and equipment so that dollies may be used where overhead crane access is not available.
   iii. All equipment shall be accessible without the need for ladders or climbing over pipes or other equipment.
   iv. Allow for a minimum 4-foot clearance between pump piping and appurtenances and away from all pumping station walls, stairways, ladders, etc.
   v. When using vertical turbine pumps, provide exterior lockable hatches on roof of pump station building centered above pumps and cans. Hatches should be sized to allow a minimum 3” clearance on all sides of the largest piece of equipment (i.e. pump head, can flange, piping, etc.) or provide 36” hatches, whichever is most stringent.
   vi. Allow for space of all electrical gear, including SCADA equipment. At minimum, electrical room shall be designed to comply with NEC working clearance requirements.
   vii. Allow for sufficient space for air compressor within the pump room.

B. Access/Doors
   i. Electrical Room, Pump Room, and Chemical Room (if applicable) should be separate rooms.

ii. An interior door should be provided for access between the Electrical Room and Pump Room.
iii. Provide exterior double doors at outside entrance to Electrical Room and Chemical Room.
iv. Pump Room
    1. Provide an 8’ minimum exterior overhead roll-up door for maintenance and/or truck access. Avoid locating the maintenance/truck access over the inlet and discharge penetrations into the station to prevent pipe shear loadings at these locations.
    2. Provide a single exterior personnel door for access.
    3. Contractor to furnish and install cylinders which can be changed out by CLWSC at a later date.

C. Building Composition and Painting
    i. Building material should be split-faced Concrete Masonry Units (CMU) (color selected by CLWSC).
    ii. Building should have concrete roof double pitched from center. Bottom of roof should be flat to provide a consistent sized bond beam along building/roof interface.
    iii. All interior walls should be painted in accordance with the *CLWSC Standard Painting Specification*.
    iv. Materials used in the construction of the facility shall conform in composition and application to all applicable regulations, including those concerning volatile organic content, lead, mercury, CFCs, and asbestos.

D. Ventilation/HVAC
    i. Appropriately sized A/C should be provided for Electrical Room.
    ii. Provide exhaust fan and light on separate exterior mounted switches in Chlorine Room.
    iii. Provide adequately sized automatic motor operated louvers and fans to create a draft within the pump room when A/C is not provided.
    iv. If mini-split system is utilized, provide a housekeeping pad for outdoor condensing unit on grade.

E. Heaters
    i. Heaters should be provided in the Pump Room and Chlorine Room, or any room where risk of freezing temperatures could cause issues.
    ii. Heaters shall be sized to maintain a minimum of 45°F indoor temperature.

F. Building Drain System
    i. Provide 4” floor drains in the Chlorine Room and Pump Room. Floors of the pump station building shall be reinforced concrete, sloped to area drains.
    ii. Install stub-ups from drain line along walls in Chlorine room to direct any excess water from equipment to drain.
    iii. Equipment in the electrical room should be elevated at least 4-inches to mitigate flood damage in the event of a pipe failure.

G. Sidewalk and Landings
   i. Provide 4’ sidewalk for building access at doors.
   ii. Provide a retaining wall with galvanized steel handrail along the sidewalk for any vertical drops exceeding 12”.
   iii. Provide adequate 4’ clearance around HVAC equipment.

H. Building Utilities
   i. A 1-inch water service and hose bibb should be placed inside the pumping station building for water sampling and cleaning the building. A pressure reducing valve should be installed upstream of the hose bibb. All hose bibbs should be equipped with a vacuum breaker.
   ii. Isolation kits must be placed between connections of brass and ferrous piping and between any other pipes made of dissimilar metals.

Part 4 – Ground Storage Tank Design

This section is intended to describe design requirements of ground storage tanks including tank type, piping, and tank accessories/appurtenances.

A. Ground storage tank types for Various Sizes
   i. Tanks up to 500,000-gallon capacity should be welded steel meeting the requirements of AWWA D100.
      1. Welded steel tanks under 26’ diameter should have a self-supported dome roof.
      2. Reference *CLWSC Standard Tank Coating Specification* for coating of welded steel tanks.
      3. Cathodic protection is not required for newly constructed welded steel tanks.
   ii. 500,000-gallon capacity tanks and over should be prestressed concrete in accordance with AWWA D110.

B. Inlet Piping Design
   i. Inlet piping should have an air gap in accordance with 30 TAC Chapter 290.
   ii. To allow for adequate tank mixing, the inlet pipe should have a 90-degree bend parallel to tank wall where water enters the tank.
   iii. Install a hose bibb with vacuum breaker connected to the tank inlet piping near the exterior of the tank for chlorine sampling; install when on-site chlorine dosing is planned for.

C. Outlet Piping Design
   i. Provide an appropriately sized anti-vortex baffle for the outlet pipe.

D. Overflow Piping Design
   i. Provide an appropriately sized overflow pipe designed to the maximum tank inlet flow per the current version of AWWA standard.

E. Accessories/Appurtenances
   i. Shell Manways
      1. Provide one 36” shell manway on the side of the tank closest to the driveway. Provide a second 36” shell manway for tanks larger than 30’ diameter. Place the second shell manway and any additional shell manways at locations requested by CLWSC.
   ii. Roof Hatch
      1. Roof Hatch should be adequately sized to install and remove tank mixer and associated equipment or 42”x42”, whichever is greater.
      2. Install lock per 30 TAC Chapter 290 requirements on roof hatch.
      3. Roof hatch should be aluminum or as approved by CLWSC.
   iii. Interior and Exterior Access
      1. For all tanks smaller than 15’ diameter, provide OSHA-compliant ladder with safety climbing rail for roof access and ladder gate. For tanks larger than 15’ diameter, provide OSHA-compliant stairs around tank for roof access.
      2. For all tanks, provide OSHA-compliant handrail around perimeter of tank roof.
      3. Provide a 3’ sidewalk around the entire tank foundation.
      4. A tank interior ladder is not required, unless determined to be required by CLWSC. When required, interior ladders, with safety climbing rail, should be stainless steel for tank access through the roof hatch. Interior ladders should be bolted or welded to tank.
   iv. Tank Vent
      1. Tank vent should be appropriately sized for the maximum inlet and outlet flow.
      2. Provide four (4) hand holds on vent housing for lifting and removal of vent.
      3. Tank vent should be centered on the tank roof. For tanks with more than one vent, vents should be located per CLWSC’s recommendation.
   v. Shell Couplings
      1. Provide one (1) ¾” outlet with isolation valve for pressure transducer as close to the tank floor as possible per AWWA requirements.
      2. Provide one (1) ¾” outlet with isolation valve for TCEQ-compliant pressure gauge and sample tap.
      3. If applicable, provide two (2) ¾” outlets with isolation valve for Chlorine Analyzer test line and return lines.
      4. Provide one (1) spare ¾” outlet per tank with isolation ball valve.
   vi. Nameplate
      1. A permanently attached nameplate should be provided for each tank. The nameplate should include the following:
         (a) Nominal Tank Diameter
         (b) Nominal Tank Height
         (c) Overflow Height
         (d) Finished Floor Elevation

(e) Nominal Tank Capacity
(f) Tank Type (e.g. AWWA D100-11, Section 14)
(g) Year Constructed
(h) Name of Contractor
(i) Contract Number

vii. Tank Mixer
1. An active tank mixer should be provided as requested by CLWSC and/or Texas Commission on Environmental Quality (TCEQ).

viii. Dome Penetrations
1. Provide appropriately sized dome flanges for tank mixer and/or any other tank penetrations. During construction and after construction, all penetrations should be sealed with a stainless steel blind flange.

ix. Tank Drain Line
1. Tank drain line should be adequately spaced adjacent to tank overflow pipe so that water exiting the tank drain line will flow into the grate inlet per the Tank Overflow Storm Drain Section of this document.
2. Provide blind flange with 2" FIPT (female iron pipe thread) installed onto the gate valve.

x. Sump
1. For steel and concrete tanks, provide one (1) 24" diameter sump near the 36" shell manway closest to the driveway.

xi. Tank Level Control
1. Tank Levels should be controlled by a calibrated pressure transducer.

Part 5 – Hydro-pneumatic Tank Design

This section is intended to describe design requirements of hydro-pneumatic tanks including tank functionality, piping design, and tank accessories/appurtenances.

A. Design Requirements
i. The tank shall meet all ASME Boiler and Pressure Tank Vessel Codes and be in compliance with all paint and primer codes (AWWA standards). Tanks must withstand and exceed all design pressures and be rated for full vacuum.
ii. All hydro-pneumatic tanks shall be installed outside and clear of overhead obstructions.

B. Accessories/Appurtenances
i. Nameplate
1. A permanently attached nameplate should be provided for each tank. The nameplate should include the following:
(a) Tank Dimensions
(b) Bottom Tank Elevation
(c) Nominal Tank Capacity
(d) Tank Type

(e) Year Constructed
(f) Name of Contractor
(g) Contract Number

ii. Pressure Relief Valve
    1. Provide a minimum 2” NPT ball valve and 2” pressure relief valve with 90-degree bend down and screen.

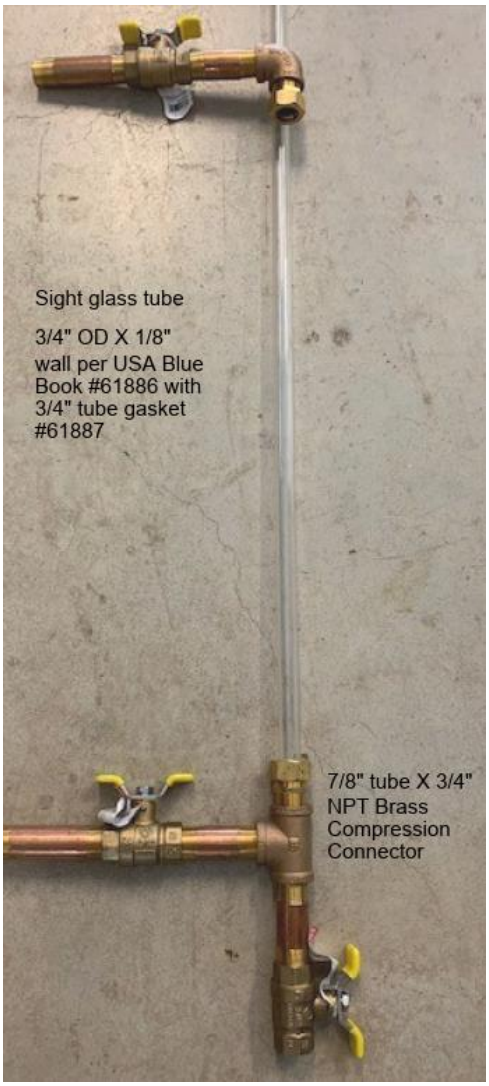
iii. Vacuum Relief Valve
    1. Provide 2” check valve and vacuum relief kunkle valve with 90-degree bend down and screen.

iv. Drain Line
    1. Provide 2” NPT ball valve centered at bottom of tank.

v. Air Supply Line
    1. Air supply line should be ½” galvanized pipe. Provide freeze protection for air supply line above ground.

vi. Air Compressor
    1. Provide oil-lubricated 240V air compressor for air supply line. Air compressor should be oil lubricated and have an air-water separator.
    2. Air compressor should be sized to meet the air and pressure requirements of the hydro-pneumatic tank.
    3. Air compressor should be installed in the pump room within the pump station building.
    4. At air compressor, provide a ¾” tap off the air line for pressure transmitter with shut off ball valve.

vii. Sight Glass
    1. Provide a sight glass at the hydro-pneumatic tank per image below.



Part 6 – Pump, Piping, and Appurtenance Design

This section is intended to describe design requirements of pump station piping, valves, appurtenances, and additional gauges.

A. Pipe and Fittings for Pump Station and Yard Piping
   i. These guidelines shall not take precedence over CLWSC Design Criteria guidelines for piping, or CLWSC standard technical specifications.
   ii. Size requirements
      1. All yard piping (excluding pump suction lines) and above-ground piping shall be sized such that the water velocity at the firm pumping rate is a maximum of 5 ft/s.
      2. Pump suction lines should be sized such that the water velocity at the firm pumping rate does not exceed 4 ft/s or the latest version of the Hydraulic Institute standards, whichever is most stringent.

iii. All pumping station suction and discharge piping should be ductile iron or engineered shop fabricated steel or as directed by CLWSC.

iv. Restraint Requirements
   1. All pipe, valves, and fittings installed above-ground or located in a structure should have flanged ends.
   2. All fittings installed below-ground should be mechanical joint restrained with retainer glands.
   3. All pipe installed below-ground shall be push-on pipe restrained with an interference type joint method integrated into the pipe bell (i.e. American CIPC Flex-Ring, U.S. Pipe HDSS or TR Flex).

v. All fittings/appurtenances (exterior, buried) shall have adequately designed thrust blocking at all changes of direction. Thrust block shall be per CLWSC standard details.

vi. Minimum Pressure Class Requirements
   1. Engineer is responsible for selecting appropriate pipe pressure class for project-specific system pressures. System pressures not included in the pressures below should be evaluated on a case-by-case basis.
   2. All pump station and yard piping should be Class 350 Ductile Iron. All pipe penetrations through walls should be via cast-in-place wall sleeves.

vii. Flexible type fittings or joints with restraining devices should be provided when transitioning from structures (pump stations, tanks, vaults, etc.) to buried piping to allow for differential settlement.

viii. See *CLWSC Design Criteria* guidelines for piping and CLWSC standard technical specifications for acceptable linings and coatings of station piping.

ix. A minimum of 3 feet of cover shall be provided for all buried piping.

B. Pump and Motors

i. Pump and Motor Requirements
   1. Pumps should be sized appropriately to meet the Engineer's specified duty point. Pumps should be designed in accordance with the latest requirements of the Hydraulic Institute.
   2. When selecting a pump, Design Engineer should consider the following:
      (a) Select a pump operating curve where the required operating point is greater than the minimum and slightly above the maximum efficiency point of the pump curve.
         (i) The pump should move closer to its maximum efficiency point as the system ages to minimize total life cycle operational cost
      (b) Avoid pumps with "flat" pump operating curves where a small change in total dynamic head (TDH) results in a large change in pump flow.
   3. Engineer should note following information on the plans:
      (a) Pump manufacturer and selected pump model
      (b) Pump and motor horsepower

(c) Design Flow
(d) Design Head
(e) Pump and motor power requirement
(f) Pump Curve

4. Pumps and motors should be short set vertical turbine or horizontal split-case type pumps depending upon conditions.
   (a) Vertical Turbine Pumps
      (i) Vertical Turbine Pumps should have vertical turbine motor or submersible motor.
      (ii) Pump impeller and bearings should be Nickel-Aluminum-Bronze.
      (iii) Vertical Turbine Pumps with vertical turbine motor should have mechanical seals.
   (b) Horizontal Split-Case Pumps
      (i) Pump impeller and bearings should be Nickel-Aluminum-Bronze.
      (ii) Vertical Turbine Pumps with vertical turbine motor should have mechanical seals.
5. Vertical Turbine Pump Cans, when applicable:
   (a) Pump can should terminate above-ground within the pump station building and have a flange connection.
   (b) Provide watertight electrical coupling for all electrical connections.
   (c) Pump can flanges should be equipped with a ¼" ball valve for pressure/water release.
6. Motors
   (a) Motors should be inverter duty rated.
   (b) Motors should be suitable for installation, i.e. WP1 type for outdoor vertical installation.
   (c) Pumps and motors should operate on VFDs.
   (d) Provide premium efficiency motors for non-submersible installations.
   (e) Pumps and motors should be 1800 RPM.
   (f) A minimum of 2 Resistance Temperature Detectors (RTD) should be installed in each motor less than 25 hp. Additional RTDs may be required in each motor greater than 25 hp.

ii. Pump On/Off Control
1. Pumping systems are normally controlled by a level control from an elevated storage tank or a closed zone system (where a set pressure is maintained using hydro-pneumatic tanks).

C. Gate Valves
i. Gate valves should be per CLWSC standards.

ii. Gate valves should be installed before and after each pump for isolation. Above-grade valves should be installed with a handwheel. Buried valves should be installed with a gate valve box.

D. Check Valves
   i. Check valves should be installed on each pump discharge.

E. Air Release Valves
   i. Provide air relief valves when high points are unavoidable. Interior air relief should be screened with a 90-degree bend.
   ii. Air release valves should be combination valves on pump discharge piping.
   iii. Install air release valves with appropriately sized service saddle.

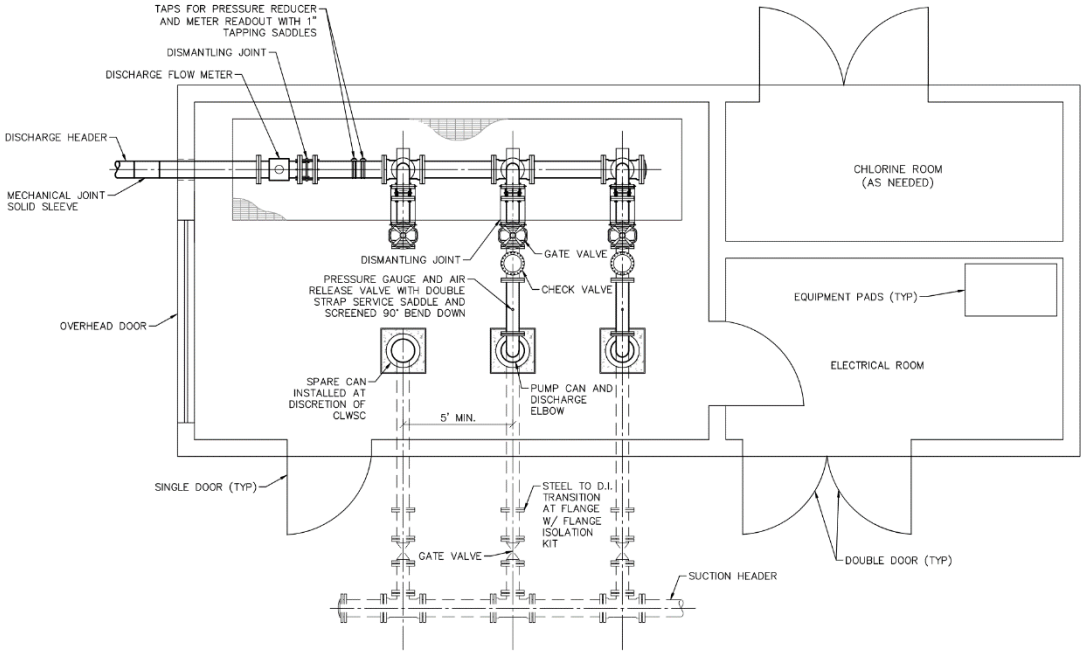
F. Dismantling Joints
   i. Provide sufficient dismantling joints adjacent to meters, control valves, etc. for maintenance and repair of flanged piping.

G. Pipe Supports
   i. Provide sufficient concrete and adjustable flange piping supports for pumps, valves, and piping.

H. Pressure Gauges
   i. Provide a pressure gauge on each pump discharge piping.
   ii. Provide a pressure transducer at the discharge header.

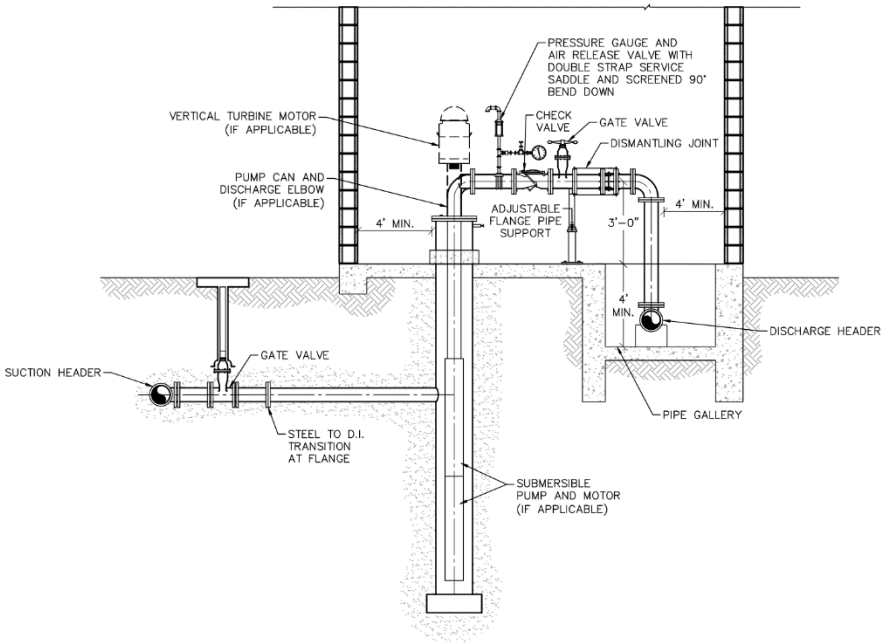
I. Flow Meter
   i. Provide a flow meter on the discharge header.
   ii. Flow Meter Requirements – See Magnetic Meters Section of this document.

J. Configuration and Layout
   i. See Figure below for general layout/spacing requirements for a vertical turbine pump with submersible motor or above-ground motor configuration.



TYPICAL (VERTICAL TURBINE) PUMP STATION LAYOUT PLAN

SCALE: N.T.S.



TYPICAL (VERTICAL TURBINE) PUMP STATION LAYOUT SECTION

SCALE: N.T.S.

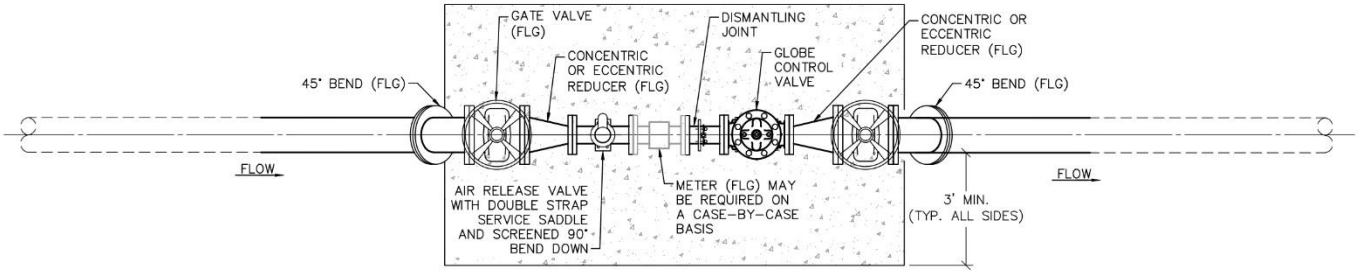
K. Tank Control Valves

i. Globe style control valves should be in accordance with CLWSC standard specification.

ii. Tank Control Valve Functions and Features:

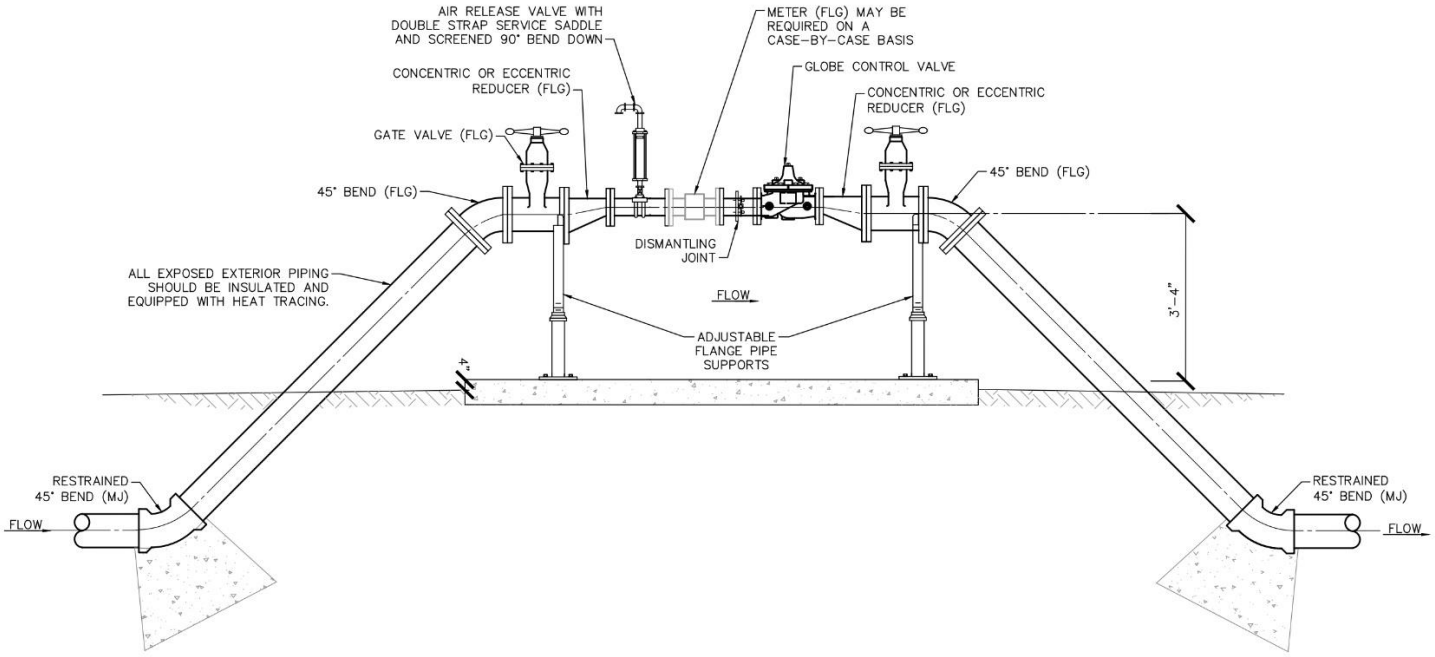
1. Open and close based on tank level
2. Valve to close upon power failure
3. Remote open/close function (solenoid)
4. Pressure sustaining feature will be required on all tank control valves that fill from a system serving customers.

iii. See the figures below for a general above-ground tank control valve piping layout.



TYPICAL TANK CONTROL VALVE (ABOVE GRADE) PLAN VIEW

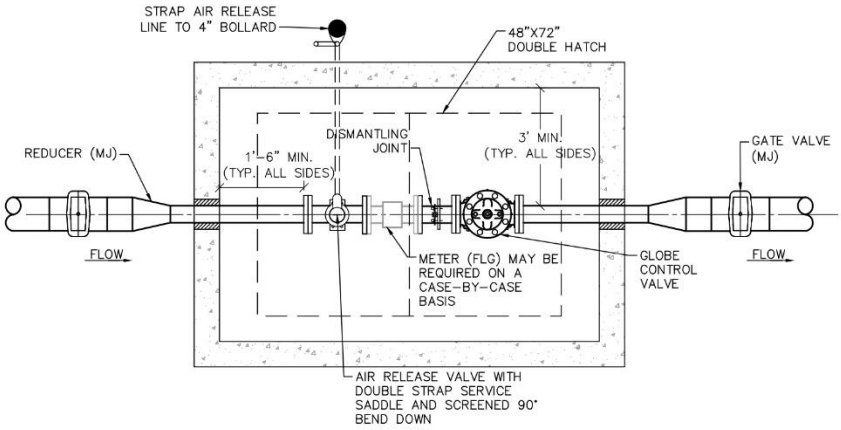
SCALE: N.T.S.



TYPICAL TANK CONTROL VALVE (ABOVE GRADE) SECTION VIEW

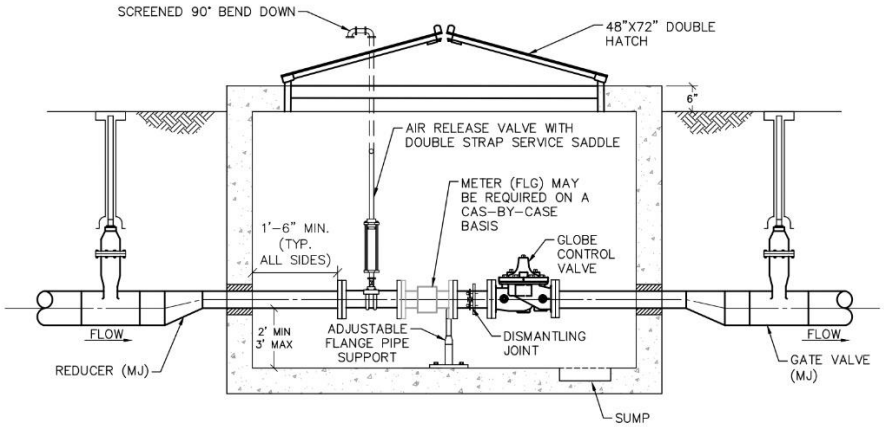
SCALE: N.T.S.

iv. See the figures below for a general below-ground tank control valve piping layout.



TYPICAL TANK CONTROL VALVE (BELOW GRADE) PLAN VIEW

SCALE: N.T.S.



TYPICAL TANK CONTROL VALVE (BELOW GRADE) SECTION VIEW

SCALE: N.T.S.

L. Freeze Protection

i. Provide enclosure and heating or insulation and heat tracing for all above grade piping at risk of freeze

Part 7 – Special Pump Station Requirements

Before the design of any pump station begins, the CLWSC staff shall determine which Special Pump Station Requirements, if any, are required in the project design. Special Pump Station Requirements will be evaluated on a case by case basis and may not be required for all pump stations. Special Pump Stations Requirements are typically for pump station designs with high lift or high flow pumps, special environmental concerns, or other special design requirements as determined by CLWSC.

A. Pump Control Valves, Surge Tanks, and Surge Relief Valves
    i. Coordinate with CLWSC to determine if pump control valves, surge tanks, and/or surge relief valves are required due to special cases such as high pressure discharge.

B. Overhead Crane and Hoist
    i. Overhead bridge crane and hoists will be analyzed on a case-by-case basis for larger capacity pump stations and/or pump stations with a larger building.
    ii. Crane and hoist should be entirely manual.
    iii. Crane and hoist should be appropriately sized to carry the weight of the heaviest piece of equipment in the pump station.
    iv. Cranes shall be capable of lifting each item of equipment (including valves and electrical equipment) above and over all other equipment (with 1' minimum clearance) without removing any other equipment

Part 8 – Water Well Design

This section is intended to describe design requirements for water wells with 50 – 300 gpm pumping capacity. Coordinate with CLWSC directly for design criteria for water wells with a pumping capacity exceeding 300 gpm.

A. Column Piping
    i. Column piping should be appropriately sized for the design conditions.

B. Casing Pipe
    i. Casing Pipe Requirements
        1. Casing piping should be appropriately sized steel casing with cement filing per TCEQ requirements.
        2. All TCEQ permitting procedures should be adhered to for any water well modifications and/or installations.
    ii. Casing Penetrations
        1. Casing should be equipped with one (1) 1-1/2" nipple cut at 45-degrees and welded to casing.

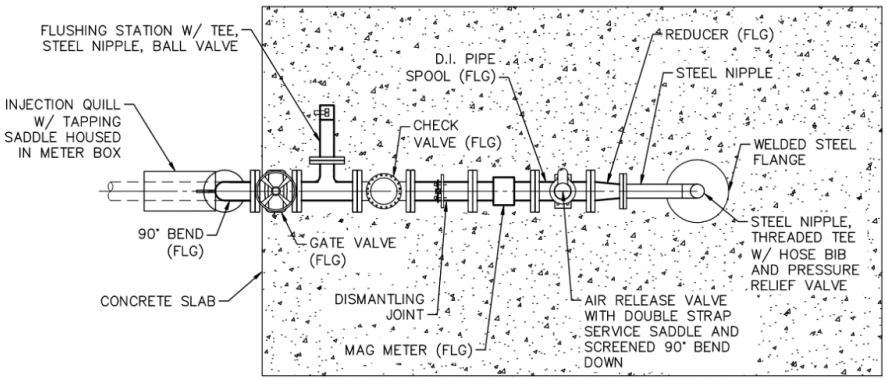
C. Well Pump
    i. Well Pump Requirements
        1. Well pumps should be sized appropriately to meet the Design Engineer's specified duty point.
        2. Well pumps and motors should be of submersible type.
        3. Well pumps and motors should operate on VFDs.
        4. Well pumps and motors should be 1800 RPM.

D. Discharge Flow Meter
    i. Discharge Flow Meter Requirements – See Magnetic Meters Section of this document
        1. The flow meter readout should be in the electrical room only.

E. Flushing Point
   i. Flushing Point Requirements
      1. Well should be installed with a minimum 2” flushing point.

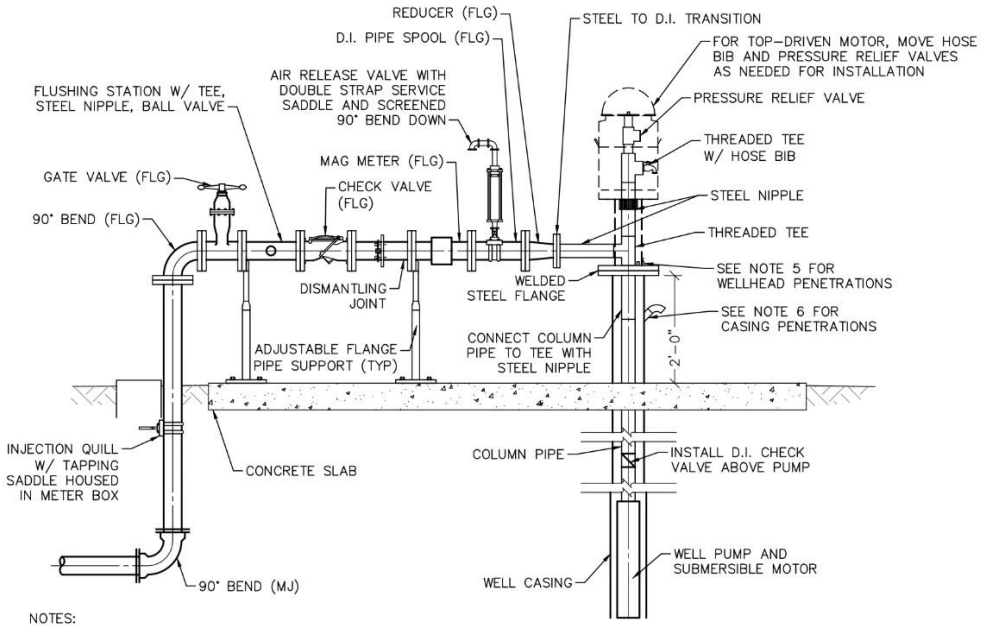
F. Sampling Point
   i. Well assembly should be equipped with one sampling point. See CLWSC Well Standard Detail for sampling point location.

G. Configuration and Layout
   i. See Figure below for general layout/spacing requirements.



TYPICAL WELL LAYOUT PLAN

SCALE: N.T.S.



NOTES:

1. ALL STEEL PIPE JOINTS SHALL BE THREADED GALVANIZED SCH 40.
2. EXPOSED CASING PIPE SHOULD BE PAINTED SAFETY BLUE.
3. PROVIDE PIPE INSULATION AND HEAT TRACING FOR ALL EXPOSED PIPING.
4. CONCRETE SLAB SHOULD HAVE A 2" VERTICAL DROP FROM THE WELL CASING TO THE EDGE OF CONCRETE IN ALL DIRECTIONS.
5. WELLHEAD PLATE SHOULD BE EQUIPPED WITH THE FOLLOWING PENETRATIONS:
   5.1. ¼" PLASTIC COATED STAINLESS STEEL AIR LINE
   5.2. 1-1/4" BLACK STEEL COUPLING WELDED TO WELLHEAD PLATE FOR PUMP AND MOTOR SUBMERSIBLE CABLE
6. CASING PENETRATIONS SHOULD INCLUDE THE FOLLOWING:
   6.1. 1-1/2" BLACK STEEL COUPLING CUT AT A 45° ANGLE AND WELDED TO CASING FOR PUMP CAN VENT AND CHLORINATION AS NEEDED. INSTALL MESH SCREEN AND HOSE CLAMP ONTO 1-1/2" COUPLING.

TYPICAL WELL LAYOUT SECTION

SCALE: N.T.S.

Part 9 – Water Disinfection Design

This section is intended to describe disinfection design requirements for water wells and well pumps including chlorine boosting and chlorine monitoring.

A. Chlorine Analyzer Requirements
   i. A reagentless Chlorine Analyzer should test water from the ground storage tank.
   ii. After water is tested by the Chlorine Analyzer, the water (if reagentless tester is used) should be stored in a 55-gallon polyethylene drum. The drum should be equipped with a sump pump that returns water to the ground storage tank. Design Engineer is responsible for ensuring that the pump can achieve the head required to pump water back to the ground storage tank.

B. Disinfection System
   i. Disinfection System for Wells
      1. Chlorine disinfection should be appropriately sized sodium hypochlorite injection system or on-site generation system.

2. As recommended by the manufacturer, chlorine disinfection system should be equipped with an appropriately sized reverse osmosis system or water softener.
3. Containment should be provided for chemicals by means of double-wall tanks or spill watch container (i.e. spill pallet or floor depression and grating).
4. Proper ventilation is required for all enclosed on-site generation chlorine rooms per manufacturer's requirements.
5. System should be controlled and monitored via SCADA.

Part 10 – Safety, Security Equipment, and Labeling

This section is intended to describe general site safety requirements for pump station sites.

A. Fire Extinguisher
   i. Provide one fire extinguisher in a cabinet in the pump room. Provide one additional fire extinguisher in a cabinet on the building exterior closest to the access road. All fire protection requirements should be in accordance with local governing codes.

B. Eyewash and Shower Station
   i. Provide an exterior eyewash station near exterior doors at chlorine room, when applicable.
   ii. Eyewash station should be per OSHA 29 CFR 1910.151C.

C. Labeling and Placards
   i. Electrical equipment
      1. Signage for electrical hazards and arc flash per NFPA 70E should be provided on all appropriate electrical cabinets
   ii. Pipe
      1. Provide painted arrows every 6 feet indicating direction of flow for all above ground water pipe.
      2. Chemical lines should be white in color.
      3. Water lines should be blue in color.
      4. Drain lines should be grey in color.
      5. Sewer lines (if applicable) should be green in color.
   iii. Facility Sign
      1. Locate sign near the entrance of the facility
      2. Minimum sign size: 24" X 24"
      3. Facility sign labeling:
         (a) Owner Name & Logo
         (b) Phone Number
         (c) Facility Name
         (d) Address
      4. Warning sign will be provided by CLWSC.

D. Security Design
    i. Coordinate with CLWSC for security design requirements.

E. Accessories and Spare Parts
    i. Install a wall-mounted 30" wide NEMA 4/12 cabinet in pump room for operation and maintenance manuals. Install a self-standing 42" (minimum) wide shelf for storage of accessories, spare parts, etc.
        1. Adequate space should be provided in front of the cabinet for access.
        2. Cabinet should have locking doors.

Part 11 – Electrical Coordination Design

This section is intended to describe emergency power provisions, electrical design requirements, and instrumentation and control requirements for pump stations and water well pumps.

A. Primary Electric
    i. Provide utility coordination and extension of utility power to pump station site.
    ii. 120V, 240V, and 480V panels should be placed in separate cabinets.
    iii. 480Y/277V, three-phase is standard for pump station facilities.
    iv. Main disconnect and ATS shall be provided. Mount of electrical rack with shade structure or means to shade equipment from sun. Orient front (door) of equipment North or Northeast to minimize direct sun exposure.

B. P&ID
    i. Provide a Piping & Instrumentation Diagram for each pump station and tank site.

C. Instrumentation and Control Requirements
    i. All sites should have SCADA for monitoring and control.
    ii. See *CLWSC Electrical Standards* for the following:
        1. Grounding
            (a) Grounding grids should be provided for all buildings and tanks per CLWSC Electrical Standards.
        2. PLC
        3. HMI
        4. Pump monitoring points
        5. SCADA Requirements
        6. Pressure Transducers
        7. MCC
        8. VFDs
            (a) All pumps should be provided with appropriately sized VFDs. VFD manufacturer and model should be per CLWSC Electrical Standards.
    ii. Magnetic Flow Meters

1. For 2” and larger discharge header piping, provide a magnetic flow meter on the discharge header within the pump station.
2. Magnetic flow meter should operate with 0.5% tolerance.
3. Magnetic flow meter should be provided with RS485 port for Modbus.
4. Maintain upstream and downstream lay length requirements per manufacturer’s specifications.
5. Provide a flow meter readout at the meter location.
6. All magnetic flow meters should be properly grounded.

iii. Tank Control Valves

1. Provide ability to remotely open/close.
2. Provide SCADA valve status (open/close).

iv. All electric equipment should be installed in the Electrical Room.

D. Lighting

i. Lighting Requirements

1. Site
   (a) See *CLWSC Electrical Standards* for fixture requirements.
   (b) Where sites are located in Dark Sky Communities, the Dark Sky Community requirements shall govern.
2. Facility
   (a) See CLWSC Electrical Standards for fixture requirements.

E. Emergency Power

i. Emergency Power requirements

1. An emergency diesel generator is required at pump station facilities. Generator should have adequate amount of fuel storage per latest version of 30 TAC Chapter 290.
2. An automatic transfer switch is required at all pump station sites. See CLWSC Electrical Standards for additional design information.