CITY OF COLLEGE STATION

LIFT STATION DESIGN GUIDELINES

2012

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GENERAL:

These lift station design guidelines are to be used in conjunction with the latest revision of the Texas Commission on Environmental Quality's (TCEQ) TAC 30 Chapter 217 rules. The guidelines do not duplicate the TCEQ's rules and are intended to augment the requirements found in that chapter. Where conflicts exist, the more stringent requirements will be used. For the purposes of these requirements, the terms "lift station" and "pump station" will be interchangeable.

In general, these Guidelines are for Lift Stations utilizing a 4-in force main or greater with capacities of 750 gpm or less. Lift Stations proposing grinder pumps and subsequent smaller diameter force mains will be held to much of the same requirements excluding sizes, which shall be determined at time of design. Requirements for lift stations with capacities greater than 750 gpm shall be determined on a case-by-case basis.

Submittal Requirements

All lift station plans, specifications and design reports shall be sealed, signed and dated by a licensed professional engineer registered in the State of Texas.

Design reports for lift stations that have multiple operational phases shall include complete design calculations demonstrating the adequacy of the facility for future phases. A detailed description of the requirements for future expansions shall be included.

The engineer shall evaluate the potential for odor generation in the station regardless of location and include odor control mitigation in the lift station design.

If the area to be served by the proposed lift station is not within the City's Sewer CCN the applicant must make a formal "Request for Exception to Service Policy" through the Water Services Department for consideration by City Council. Approval of the request is solely at the discretion of the Council.

The engineer shall verify and provide documentation that the receiving manhole and downstream gravity system has adequate capacity for the flow discharged from the proposed manhole. This may be in the form of a capacity analysis, a proof of capacity letter from the City, or other pertinent documentation.

SITE REQUIREMENTS:

Ownership

The proposed lift station site shall be located in a public utility easement (PUE). Bearing and distances of the site boundary shall be shown on the plans as well as the recordation information. Under no circumstances will a lift station be allowed to be placed into service without a recorded site, temporary access easement (if necessary), and a permanent access easement. Include recording information and legal description of all sites, access easements, utility easements, and temporary construction easements affecting the facilities on the drawings.

General Site Layout

The proposed lift station site shall have a minimum fenced area of 30 feet by 30 feet. However, each site shall be reviewed on a case-by-case basis and the minimum overall site dimensions shall be determined at the time of review. It is not the intent of this Utility to maintain any more property than is necessary to operate and its facilities.

Site access shall be provided by a minimum 20-foot wide access easement or PUE from a public right-of-way. Larger widths may be required depending on length of road, drainage and other constraints. As noted above, access requirements will be determined on a site-specific basis.

The wet well and valve vault shall be located a minimum of 10 feet from the site fencing to the outer edge of the structure.

Provide a paved drive of not less than 12 feet in width to the site. City roadway or County roadway standards shall apply for pavement of the 12-ft access drive. Where applicable, the access drive construction shall match the adjacent roadway or street. At a minimum the access drive shall consist of 6-inches (6") of lime stabilized subgrade, six-inches (6") of flexible base, and a 2-inch (2") overlay of hot mixed asphalt concrete (HMAC).

All access roads shall be constructed to ensure that the facilities are accessible during a 25-year storm. At the City's discretion, accessibility during a 100-year storm event may be required.

Provide an on-site turn-around as part of the access drive to accommodate a standard 8-ft x 18-ft vehicle. Where possible the turn-

around shall be located outside the fence, outside the adjacent R.O.W, and within the dedicated access easement.

Fencing

Enclose all sites with an intruder resistant fence in either of the following configurations:

- minimum 6 foot high fence topped with three strands of outward slanting barbed wire
- minimum 8 foot high fence with a single strand of barbed wire.

Fences, including barbed wire if used, shall be located completely inside the site boundary.

Fencing may be of any of the following materials:

- Chain link fencing with galvanized finish or vinyl coating.
- In cases where decorative fencing is used in the surrounding area, the Utilities Engineer may approve other material such as masonry or concrete.

Screening may be required for chain link fencing on a case-by-case basis as determined by the City. This may consist of chain link as described above with wood or plastic slats interwoven into the fence fabric. Landscape screening may be considered on a case-by-case basis if a homeowners association or other entity commits to maintaining it and the landscaping does not interfere with access or site security.

Gates shall be a minimum of 16 feet wide overall and may be split into two openings swinging outward. The gates shall have a down post and receptacle in the driveway as well as provisions for padlocking with a chain. If barbed wire is used on the fencing, barbed wire will be provided on the gate(s) as well. In lieu of swinging openings a single, sliding opening may be considered.

Grading and Drainage

Use drainage swales, driveways, culverts, storm sewers or a combination thereof for access and internal site drainage.

Site drainage may sheet flow to a public right-of-way if allowed by the City and County.

Storm sewers and culverts shall be sized in accordance with applicable design guidelines.

Subsurface Exploration and Geotechnical Study

A minimum of one (1) subsurface exploration boring shall be drilled at the location of the proposed lift station. The depth of the boring shall be at least 10 feet below the planned base elevation of the lift station. A competent geotechnical engineer shall review the samples and field test information determined from the boring and shall assign appropriate geotechnical laboratory testing on select soils recovered from the boring. The geotechnical engineer shall interpret the field and laboratory test information and provide recommendations for the design and construction of the lift station in a written engineering report.

The purpose of the geotechnical study is to provide information for the design and construction of the lift station prior to commencement of construction operations. The information provided in the geotechnical study should include the following items at a minimum:

- A description of the subsurface stratigraphy, including anticipated groundwater elevations at the lift station location.
- Recommended allowable bearing pressures for the base of the lift station and whether an alternate founding depth is recommended due to potentially problematic subsurface conditions at the originally planned founding depth.
- A prediction of the magnitudes of settlement of the lift station at the planned founding elevation.
- A recommendation of the distribution and magnitude of lateral earth pressures that should be considered in the design of the lift station walls.
- A description of subsurface conditions that could impact construction of the lift station, such as the presence of rock, a high ground water table, or the presence of wet, caving soils in significant thicknesses, etc.
- A recommended minimum groundwater elevation that should be used in the buoyancy calculations for the lift station.

Onsite Manhole

Include an on-site manhole no farther than 80 feet from the lift station site. Ideally the on-site manhole shall be located within the fenced area. However, the manhole shall be located so as not to block vehicle access

to the facilities and shall be situated in a location that does not receive vehicle traffic.

Water Service

The design of the lift station shall include a ¾" potable water connection, provide a water meter, meter box, reduced pressure principal backflow assembly (RPBA) conforming to the requirements of AWWA Standard C511-97 or Manual M14, hose bib (self-draining and freeze resistant, installed 12 inches above the 100-year flood plain), hose bib vacuum breaker, and freeze protection.

WET WELL DESIGN:

Location

Flood Protection. The top of the lift station shall be located a minimum of 3-feet above the 100-year flood plain. Where fill is required to raise the lift station to this height or in any other instance requiring site fill, provide transition grades with slope no steeper than 4:1.

The top slab elevation of lift stations (including valve vaults) shall be set six (6) inches above the finished grade.

Locate the wet well and more specifically the pumps in the wet well on the site such that the crane truck can back up to (or beside) the hatch to facilitate removal of each pump without leaving the pavement. Provide sufficient room for construction access as well as on-going maintenance.

Design

All lift station wet wells shall be preceded by an on-site manhole inside the fenced area. The manhole shall have a pre-cast flat top to facilitate removal and installation of by-pass pumps. The line connecting this manhole and the wet well shall be designed one pipe diameter larger than required by the City's gravity sanitary sewer criteria so that additional collection lines can be connected in the future. The inside of this manhole shall be coated in accordance with the section on Corrosion Protection and Odor Control.

Size the diameter or width of the wet well, hatches, and hatch spacing to accommodate the selected pumping equipment Consideration should be given to the dimensions of the ultimate pump in a multi-phased lift station to ensure adequate clearances are provided. Provide a minimum of six-inches (6") of clearance from the inside wet well wall to all flanges to

facilitate removal of all bolts. Cast-in-place or pre-cast concrete wet wells may be used. Fiberglass (FRP) wet wells may be considered on a case-by-case basis.

The wet well volume shall be based on the minimum cycle time of the largest pump planned for the lift station plus additional depth to prevent motor overheating and vortexing. The cycle time shall not be less than the those listed below:

Pump Horsepower	Minimum Cycle Times (minutes)
less than 50	6
50 – 100	10
Over 100	15

The minimum effective volume of the wet well shall be based on the following formula:

$$V = \frac{Q_p\, t}{(4)\ (7.48)}$$

Where:
V = Volume (ft^3)
Q_p = Capacity of largest ultimate pump (GPM)
t = Cycle Time (minutes)
7.48 = conversion factor in gallons/cubic foot

The pump capacity "Qp" is the largest pump in alternation. This capacity is to be the actual flow rate of one pump pumping alone against a system head generated with new pipe friction factors (C=150 for PVC and C=140 for DIP).

The "OFF" elevation of the wet weather pumps shall be deep enough to prevent vortexing and motor overheating based on the manufacturer's recommendations. At a minimum provide 12 inches between "ALL PUMPS OFF" and the finished floor. The design engineer shall verify that each pump is capable of operating continuously at the "OFF" elevation shown on the plans.

The "Lead Pump On" elevation shall be below the flowline of the influent pipe. Subsequent pump "On" elevations shall be sufficiently separated to ensure an adequate cycle time for the lag pumps. Unless a microprocessor based alternator is used which uses first-on-first-off sequencing, the effective volume for each pump shall be used to calculate

a finished floor elevation which allows all of the “Pump On” elevations to be below the influent flow line.

Size the wet well for a minimum of 6-inches (6”) between float settings.

Wet Well Slopes

Slope the wet well floor a minimum of 15 percent to the pump intakes with a smooth finish. Do not allow grout above the “All Pumps Off” elevation where it will occupy part of the effective volume.

Venting

The wet well shall have a vent sized such that the maximum velocity of air through the vent is 600 fpm at the firm pumping capacity. Vents shall have a stainless steel insect screen that is easily replaceable and will prevent the entrance of rain water. Vent pipes shall be constructed of 304 stainless steel. If mechanical ventilation is used, all materials shall be corrosion resistant and explosion proof. 30 air changes per hour should be used for the wet well, and 15 for the valve vault. All vents shall terminate a minimum 36 inches above the 100-year flood plain elevation.

Dry Well/Valve Vault Clearances

All walls shall be a minimum of 18 inches from the outermost edge of all flanges to enable removal of all bolts. Pipes shall have a minimum spacing greater than that required by the pump manufacturer for minimum pump spacing. Swing check valves shall be positioned such that the shafts may be removed without removing the valve body. If concrete pipe supports are provided, ensure that bolt removal is possible. Size hatches to provide unobstructed access to all valves for maintenance and removal.

Structural Considerations

Follow the latest version of ACI 350 with the exception that the minimum concrete cover over steel reinforcing shall be four (4) inches where contact with raw sanitary sewer is possible.

Wet wells are to be designed to resist the effects of buoyancy assuming full saturation of the surrounding soils to the finished grade or the 100-year flood plain, which ever is greater. Surface friction shall not be included in the design unless a friction factor is provided in a geotechnical report, signed and sealed by a licensed professional geotechnical engineer. A safety factor of 1.1 shall be used for buoyancy resistance. Provide buoyancy calculations at the time of review.

Wet well walls shall be designed to withstand lateral earth pressures and static water levels at finished grade as outlined in ACI 350. 3,500 psi concrete shall be used at a minimum. Under no circumstances will ASTM C478 pre-cast sections be allowed.

Top slabs shall be designed for a uniform loading of 300 pounds per square foot. Hinged safety grates shall be provided under the hatch and shall not interfere with the pump removal. Clear space openings shall be six (6) inches larger than the largest pump to be installed/ removed in the wet well.

Where individual hatches are incorporated into the top slab, the separation distance from inside face to inside face shall be a minimum of 12 inches to facilitate the placement of the concrete and to allow adequate cover over the rebar.

If open cut construction is used the excavation shall be backfilled with cement stabilized sand per the City's standard specifications.

If caisson (or drilled) construction is used the exterior annular space shall be pressure grouted.

VALVES AND PIPING:

Valves shall be located in an underground concrete vault. The valve vault shall be structurally connected to the wet well. Equip the valve vault with a stainless steel gooseneck vent or a mechanical ventilation (see Wet well venting requirements), and a gas tight p-trap drain connected to the wet well. The vault shall be constructed as shallow as practical to allow easy access while providing sufficient room for maintenance and removal of all valves. Provide a pad-lockable aluminum or stainless steel access hatch on the valve vault (structural considerations for wet wells apply to valve vaults). See clearance requirements under section on wet well design.

Set the top slab elevation of the valve vault at six (6) inches above finished grade.

Isolation and check valves shall not be located in the wet well.

All bolts, studs and nuts shall be 316 stainless steel. End connections of valves shall be flanged and drilled to ANSI class 125 unless otherwise specified. Provide handwheel operators for valves 4-inches or larger.

Resilient Seat Gate Valves

Provide valves with a rising stem, resilient seat gate valves with a full round port free from pockets. The resilient gate shall provide bubble tight shut-off with threaded operating stems of brass or stainless steel. Buried valves shall have spur or bevel gearing, valve boxes and stem extensions. Valves shall be ANSI\AWWA C515 compliant, and rated for 250 psig. Valves shall meet or exceed AWWA C509.

Air and Vacuum Release Valves.

Provide sewage air and vacuum release valves meeting AWWA C512-92 at all high points in the system. The valve's inlet and outlet shall be sized for the anticipated flow rates experienced during filling and draining. Provide a shut-off valve for each release valve. Accessories will include a one-inch (1") blow-off valve and a flexible back flushing hose with a quick disconnect coupling and a ½-inch (½") shut-off valve. The air and vacuum valves shall be manufactured by Apco or Val-Matic.

Lever & Weight Check Valves

Provide AWWA C508 compliant flanged, cast iron body swing check valves with exterior lever and weight. All three-inch (3") and larger valves shall have Class 125 Flanges. All check valves shall be followed by an isolation valve. TAC §217.62(b)(1)(A) & (B) require swing check valves with an external lever

Eccentric Plug Valves

Valves shall be non-lubricated eccentric plug valves with semi-steel body and semi-steel resilient face to plug. Above ground valves 10 inches and larger shall be worm gear operated. Equip buried valves with extended waterproof gear operators. Provide valves with stainless steel bushings and meeting the requirements of AWWA C500 & C507.

Isolation valves

Shall be provided on the discharge side of pumps, positioned such that the pump and/or check valve can be isolated for removal. Provide one-inch diameter drains with ball valves between the isolation valve and the check valve to relieve pressure.

Surge relief valves, if required, shall be located at the station and piped to discharge back to the wet well.

Force mains

Shall be a minimum of 4-inches in diameter. Force mains shall be designed to reduce electrical consumption, yet maintain the minimum velocities required by the TCEQ. For force mains of short length the resultant velocities may be higher where static headlosses are predominate. For longer force mains use the largest pipe diameter permissible to reduce frictional losses and surge generation. For pump stations with 3 or more pumps, the force main velocity shall not be less than 2.5 fps with the smallest pump only in operation. Force main velocities in excess of 6 fps will require the engineer to perform an analysis for possible high and low negative surge pressures in the event of sudden pump failure.

Force main piping shall conform to the City's guidelines for pressure piping.

Provide a riser pipe to the top of the slab with an isolation valve and male cam-lock with cap to facilitate by-pass pumping operations.

Provide calculations of wet well storage above the high-level alarm elevation.

PUMPS AND MOTORS:

Lift station pumps and motors

Acceptable Manufacturers: Flygt pumps only.

Stations will be designed for submersible pumps mounted in the wet well. Lift stations shall be designed to discharge the peak design flow (firm capacity) at the calculated system head for initial, interim, and ultimate design phases. Where multiple phases are planned, provide calculations and graphs for all phases in the design report.

Firm pumping capacity is defined as the maximum pumping capacity with the largest pumping unit out of service, system losses based on aged piping, and a water level in the wet well at the maximum "Lag Pump On" elevation. Please note that the wet well volumes are based on flow rates greater than the firm capacity.

Select pumps with capacity curves that intersect the system head at the firm capacity or intermediate capacity for multiple pump lift stations. The system curve will be generated using the Hazen-Williams Formula by

calculating the frictional losses for the selected C coefficient value. The C values used for the selected pipe material are presented below.

	C coefficient value	
Pipe Type	New	after 20 years
Ductile Iron (lined)	140	120
Plastic – PVC	150	130

Force main velocities shall be included on the graph as a separate Y axis.

Pumps shall be of a non-clog design, capable of passing a 2.5-inch diameter or greater incompressible sphere, and shall have suction and discharge openings a minimum of 4 inches in diameter.

All submersible pumps shall have tandem mechanical seals with rotating and stationary elements made of tungsten. Cable entries shall have sealed terminal blocks or epoxy-potted connections with gasketed stress-relieving connections. Motors shall be air-filled squirrel cage induction design with class H insulation.

Pump Operation

Efficiencies shall be greater than 60% with a single pump operating into the system.

Leak detection sensors shall be provided in the motor housing.

Motor service factor shall be a minimum of 1.15.

Electric motors shall be sized so as to operate at maximum design load without use of the service factor.

Thermal protection shall be provided in the motor housing.

Electric motors (excluding submersible units) shall be equipped with space heaters.

Pump Installation

Pumps shall be securely supported, per the manufacturer recommendations to prevent movement and vibration during operation. All guiderails shall be vertical and have intermediate supports for section lengths over 10 feet.

Provide guiderail-type pump support systems that allow pump removal and installation without requiring dewatering of or entry into the wet well. Rails, lifting chains, and hardware shall be constructed of Series 316 stainless steel.

CORROSION PROTECTION AND ODOR CONTROL:

The design of the lift station shall include corrosion resistance for those items located within the wet well, valve vault or within five feet of the top slab. In all lift stations, hydrogen sulfide (H_2S) gas generation should be minimized by reducing the turbulence of wastewater discharging into the lift station. It is acknowledged that prediction of H_2S concentrations is difficult with varying flow rates as development progresses therefore the following criteria will be used.

All lift stations shall use 316 stainless steel for bolts, chains, cables, guide rails, cable brackets, strain relief devices, cable seals, anchor bolts and any riser pipe supports exposed to corrosive gases.

All lift stations shall coat the piping in the interior of the wet well with a two coat system of coal tar epoxy with a minimum dry film thickness of 16 mils. Piping in valve vaults not exposed to direct sunlight shall be coated with a three coat system of polyamide epoxy (dry film thickness 10 mils minimum), and piping above ground (or in direct sunlight) shall be coated with a three coat system consisting of two initial coats of epoxy (min 6 mil total) followed by a top coat of polyurethane (2-3 mils). Surface preparations shall follow the SSPC or the NACE recommendations for substrate cleanliness and anchor profile. All coating systems shall be applied in accordance with the manufacturer's recommendations.

All lift stations must have an interior wet well coating. Epoxy coating system shall be 100% solids, solvent less, two-component high build epoxy resin system. Materials shall be Raven 405, Strong Seal Epoxy Top Coat and PCS-320 by Polyurea Coating Systems, Inc. or approved equal. Material shall have the following minimum requirements:

Solids Content (vol%)		100
Compressive Strength, psi	ASTM D579	12,000
Tensile Strength, psi	ASTM D638	7,600
Bond Strength-Concrete	>Tensile Strength of Concrete	

All lift station interior coatings shall be applied by the manufacturer's certified applicator.

Lift stations greater than 12 feet in diameter or having a cross-sectional area greater than 113 square feet, shall have an air-scrubbing unit that actively removes hydrogen sulfide and organic odors.

ELECTRICAL REQUIREMENTS:

The wet well and the area extending up to 12" above the wet well shall be classified as Class 1, Division 1, Group D hazardous location per the National Electrical Code (NEC).

The panel and all controls shall be covered by a constructed overhang to shield operator from rain.

Panel area shall be lit by outside, overhead light fixture.

Service racks and switch racks shall be constructed with metal support poles and cross braces. No wooden poles will be allowed.

Conduit, bodies, and fittings shall be constructed of aluminum. Aluminum conduit embedded in concrete shall be double-wrapped with vinyl tape or PVC coated.

All transformers, control panels, terminal boxes, and other electrical equipment shall be mounted a minimum of 24 inches above the top of slab or finished grade to provide accessibility for maintenance.

All equipment shall be permanently labeled to indicate its function or purpose. Labels shall be constructed of material suitable to withstand the environmental conditions in which they operate.

Electric Power Requirements

Power sources for serving lift stations will follow the guidelines below:

- Where the total motor horsepower does not exceed 10 HP in aggregate and, where any single motor does not exceed 5 HP; 120/240 volt, three-phase service is required.
- Where individual motors do not exceed 5 hp and where three phase service is not available; 120/240 volt, single phase service may be used.
- Motor horsepowers that exceed 10 HP in aggregate or where any single motor is larger than 5 HP shall use 480/277 volt, three-phase service.

Emergency Power Requirements

The engineer shall determine reliability per TAC 30 §217.63:

- All lift station designs shall incorporate a double throw switch (manual transfer switch) with a generator quick-connect plug. Install the switch in a NEMA 4X stainless steel enclosure and locate it down stream of the main disconnect. Coordinate with the City to determine the type of quick connect plug required.
- At its discretion the City may require that the design incorporate an on-site, automatically starting emergency generator.

Electrical Controls

Pump Controller: Solid state, pump alternator, floats, alarm contacts and power supply. The pump alternator shall provide first on, first off (FOFO) operation and mode of operation selector switch to remove a pump from the alternation sequence during maintenance.

Controls and Indicators: Provide the following:

- Pump HOA Selector Switch for each pump
- Pump Run Light for each pump
- Pump Seal-Fail Light for each pump
- Pump Over-Temp Light for each pump
- Pump Run Elapse Time Meter for each pump
- Seal-Fail and Over-Temp Reset Switch for each pump
- Phase-Fail Light
- Control Power Light On
- High Level Alarm Indicator
- Alarm Rotating Beacon Light
- Alarm Horn or Buzzer
- Alarm Reset Switch

Motor Protection Devices

Overload relay with the following specifications:

- Devicenet communications

- Rate supply Voltage 24 VDC (Supply via devicenet connection)
- Rated insulation voltage 300 VAC
- Rated Operating Voltage 25 VAC
- Trip Resistance 3400 Ohms
- User selectable warning and trip settings

    i. Thermal Overload
    ii. Phase Loss
    iii. Ground Fault
    iv. Stall
    v. Jam
    v. Underload
    vii. Current Imbalance

- Four NO/NC Digital Inputs
- Two NO/NC Digital Outputs

Surge Protection Device

Lightning & Surge Protection Device installed on Main Power Bus, single or three phase as applicable. Mount the surge in a separate enclosure and position such that a minimum of bends are required for the leads.

Phase Monitoring Relay

Type: Provide a 600-volt, industrial-rated, phase failure relay for motor circuits. Use a shunt-type device which functions independent of line current.

Operation: The relay will monitor line-to-line voltage through three (3) potential sensors. At l0 percent voltage unbalance, or on phase reversal, or a low phase potential, the relay will open the control circuit. Provide a 0.2-second time delay on trip-out to prevent nuisance tripping form transient voltage fluctuations.

Fuses: Provide one (1) fuse per phase ahead of the relay.

Phase Monitoring: For phase monitoring, use Diversified Electronics Cat. No. SLD-440-ALE or approved equal.

Level Controls

Primary: Provide PVC ball-type float with mercury switch for each pump "on" elevation, "All Pumps Off" elevation, and High Level Alarm.

Set level control points no less than six (6) inches apart. The "All Pumps Off" setting shall be no closer than 12 inches from the finished floor of the wet well.

Other level controls such as pressure transducers or ultra-sonic transducers may be allowed if approved by the City.

Operation

The liquid level in the wet well shall be sensed with float type switches. The floats shall be suspended separately from the roof of the wet well to allow adjustment and maintenance of the individual floats without disturbing the other floats. The floats shall be Teflon coated stainless steel or rubber jacketed polyethylene. The switches shall be direct acting mercury switches operating on 24 VAC.

Pumps are started as the level rises, and when the wet well level is reduced to the "all Pumps Off" elevation, all the pumps are turned off.

The pump alternator, in the controller, alternates the lead/lag pump selection at the end of each pumping cycle.

The high level alarm signal is initiated when the wet well level reaches two (2) feet above the last lag pump "on" elevation. At this elevation any back-up level sensing equipment is energized and used as the primary level control.

Alarm Signals

Provide terminal blocks and wiring from dry contacts for the following points from each pump:

- Pump HOA Selector Switch for each pump
- Pump Seal-Fail Light for each pump
- Pump Over-Temp Light for each pump
- Control Power
- Pump Run indication

- Circuit Breaker Tripped
- Overload Relay tripped

Provide terminal blocks and wiring from dry contacts for the following general station alarm terminals:

- High Level Alarm Indicator
- Loss of Power to Station / Main Circuit Breaker tripped.
- Control Panel Door Opened

Terminal blocks shall conform to the following requirements:

- Size to accommodate wiring size from 16AWG to 22 AWG.
- Rated for 300V AC/DC.
- Maximum voltage on dry contacts not to exceed 4.0 VDC.
- The terminal blocks shall be located no closer than four (4) inches from any edge of the cabinet.

The Design Engineer will work with City personnel to determine best communication method to monitor the lift station. The order of priority is:

- Fiber optic communications. If lift station is within reasonable proximity to existing fiber optic loop, a separate panel shall be installed (see note 4) adjacent to the control panel to house fiber optic terminations. A four (inch) conduit shall be installed from this cabinet to the nearest electrical pole owned by the City of College Station and turned up the pole with cap.
- Wireless radio communication. Engineer will assist City in determining radio path to nearest access point and height of tower needed to successfully implement the wireless infrastructure.
- Provide an auto dialer capable of monitoring eight (8) channels and recording real-voice messages. Coordinate with the City to choose the appropriate manufacturer and form of communication (land line, cellular, or other method of communication).
- In the event Item 1 or 2 is selected as the means of communication, provide 30x30-inch (minimum) cabinet in close proximity to the control panel.

Enclosures

Pump Cable Terminal Boxes

- Use terminal boxes of NEMA 4X stainless steel construction, mounted near the pump access hatch for the termination of the pump power and control cables. Use a separate box for the termination of the float cables.
- Terminal boxes shall be mounted on support frames of unistrut, galvanized angle iron, or other approved materials. The use of conduits alone to support terminal boxes shall not be allowed. Terminal boxes shall be mounted no less than 24 inches from the top of slab.
- Terminal boxes shall be readily accessible and shall not interfere with the removal of the pumps or normal operations and maintenance of the wet well. Coordinate with the City during design.
- Use hub type conduit entries into boxes. Use CSBE seals where cables enter conduits in the wet well to protect the terminal boxes from corrosive gasses.

Control Panel Enclosure

The control panel shall be NEMA 4X stainless steel with factory stainless steel stands, an inside swing door, back plate, three point latch with pad lock access or quick release latches and pad lock clasp. Mount the control panel no less than 24 inches from the top of slab.

Use hub type conduit entries into enclosure.

All indicating lights, selector switches, circuit breaker operators, and autodialer shall be accessible and operable with the interior swing door closed. The exterior door shall have only an engraved nameplate with the name of the station and the City's name. No other items are allowed on the face of the panel.

Provide two (2) double 120V, ground fault protected single phase receptacles. One shall be mounted outside the control panel in a weatherproof-in-use enclosure and the other shall be located behind the inner panel for the autodialer.

DRAWING REQUIREMENTS:

The construction plans shall include the following information:

Site layout showing boundaries, grading, drainage, SWPP and platting/recording information.

A plan and profile view of the lift station and associated site piping.

A profile view of the control levels and settings.

Graphs showing the system curve and selected pump manufacturer's curves for each phase of the lift station.

Electrical single line diagram, wiring and control system schematics.

Structural, mechanical, civil and electrical details.

See the City's Standard drawings for typical requirements.