General Specifications
City of San Marcos
Lift Stations

NOTE: If construction has not begun on the facility within one year of the approval date, plans must be resubmitted for approval and must include all criteria in effect at the time resubmitted.

This specification shall follow TCEQ Chapter 317.3 for Lift Stations except for, or inclusive of, the items discussed below.

The design criteria specified is a minimum for design and construction of wastewater lift stations. Additional requirements for individual lift stations may be imposed by the City of San Marcos as conditions warrant. The size and depth of the lift station shall be as required to service an area determined by the Engineering Director.

Lift stations are discouraged and will only be allowed where conventional gravity service is not feasible. The owner/developer shall provide the Engineering Director a detailed engineering study of alternative routes for sanitary sewer conveyance. The engineering study shall consider the City of San Marcos Wastewater Master Plan when reviewing alternatives. Lift stations shall only be considered when the owner/developer has exhausted all other engineering studies for alternatives. Final acceptance of the lift station shall be subject to the Engineering Director.

The developer or owner of the proposed development shall bear the entire cost of the sewerage lift station and all appurtenances, unless an oversize agreement has been approved by the City. The developer or owner shall submit a certified cost statement outlining the cost of the lift station and appurtenances and certified documentation showing that bids were sought for construction of the lift station. The proposed lift station shall be adequate in size to serve the proposed development, except with written approval from the Director of Engineering. A Public Improvements Construction Plan permit shall be obtained by the owner, and all guidelines outlined by the permit shall be followed during construction. A one-year maintenance bond and warranty shall be posted by the developer or owner responsible for installation of the sewerage lift station and force main.

All sewerage lift stations, with appurtenances, shall, upon completion, become the sole and exclusive property of the City and shall be operated and maintained as a part of the city sewerage system.

Three (3) copies of an engineering report and design plans shall be submitted for all lift stations. The following information shall be included:

1) Construction Specifications signed and sealed by a professional engineer licensed in the State of Texas
2) Construction Plans with each sheet signed and sealed by a professional engineer licensed in the State of Texas

General. Sheet sizes shall be 24”x36”

Show on all plans, as appropriate – North Arrow, Scale, Property Lines, Right of Way, Easements, 100-yr floodplain boundary

Existing utilities - Water, Wastewater, Stormwater, Gas, Electric (overhead and buried), Communications (overhead and buried)

Cover Sheet - Project Title, Index of all sheets, Vicinity Map (1”=2000’ or larger)

Names and Contact Information for: Owner/Developer, Engineer, Other professionals involved, City of San Marcos Approval Block including: Director of Department of Environment & Engineering, Director of Department of Water and Wastewater and Director of Department of Public Works,

Contact Information for Coordination and Emergency: City of San Marcos Department of Environment & Engineering, City of San Marcos Engineering Inspection Services, Electric Utility, Water Utility, Cable Utility, Telephone Utility, Natural Gas Utility, Railroad, Texas Commission on Environmental Quality (TCEQ), Texas Department of Transportation (if applicable)

General Information

General Construction Notes and Sequence of Construction

a) Erosion and Sedimentation Control Plan and Details (as necessary for project)
    1) Stabilized Construction Entrance
    2) Silt Fence (for use with drainage area<1 acre)
    3) Rock Berms (for use with drainage areas between 1 and 5 acres)
    4) Additional erosion controls for disturbed drainage areas greater than 5 acres
    5) Storm drain inlet protection
    6) Alternative erosion and sediment controls (to be approved on a case-by-case basis)
    7) Identify soil stockpile and construction staging areas and controls
    8) Temporary and permanent re-vegetation specifications
    9) TPDES Stormwater Pollution Prevention Plan or reference thereto (if applicable)
b) Contour map of the property to be used (referenced to NAD83, Texas State Plane South Central Zone) – maximum 10-foot interval
c) Proposed lift station, including provisions for installation of future pumps
d) Existing lift station, if applicable
e) Location within Edwards Aquifer Recharge, Transition or Contributing Zone, if applicable – if located within the Edwards Aquifer Recharge Zone, reference TAC 213.A.
f) Location within San Marcos River Corridor, if applicable
g) Maximum elevation of wastewater in the collection system and wet well in the event of a power failure for the estimated duration of power outage (if required by Director of Engineering).
h) Detailed electrical and control system plans
i) Detailed plans for the force main (with profile, connecting to outfall location).
j) Detailed plans for the lift station and all appurtenances
k) Detailed plans for all-weather access road
l) Test borings and groundwater elevations
m) A plan of operation and sequence of events for continuous and safe transfer of wastewater during construction (if applicable)
n) Soils Map
o) Engineer's Opinion of Probable Construction Cost

Site Selection. If an existing roadway easement with an existing all-weather road is not available for the lift station, one must be provided.

Design. Dry wells are not permitted. At least two pumps shall be provided. If only two pumps are provided, they shall have the same capacity. Each shall be able to handle flows in excess of the expected maximum flow.

Level controllers shall be located as to not to be affected by flows entering the station. Small stations with duplicate units should make provisions to alternate pumps in use.

Suitable and safe means of access shall be provided to wet wells containing either bar screens or other mechanical equipment requiring inspection and maintenance.

Lift stations shall be equipped with suitable devices for measuring, recording, and totalizing sewage flow and power consumption.

Alarm systems shall be provided for all lift stations. The alarm shall activate in cases of pump station malfunction.

1) Flow Development. The following calculations shall be included.
    a) Maximum Wet Weather Flow (Design Flow). This flow is used to determine the lift station design capacity. All lift stations shall be designed to handle the maximum wet weather flow for its service area.
    Equation: (Population of service area x 100 gallons per capita per day (gpcd) x maximum flow peaking factor) + (750 gallons per acre served).
    b) Maximum Dry Weather Flow. This flow is used to determine pipe size in the collection system.
    Equation: (Population of service area) x (100 gpcd) x (maximum flow peaking factor)
    c) Average Dry Weather Flow. This is the flow developed without the maximum flow peaking factor. This flow is used to determine the average detention time in the wet well.
    Equation: (Population of service area) x (100 gpcd)
    d) Minimum Dry Weather Flow. This is used to determine the maximum detention time in the wet well.
    Equation (Population of service area) x (100 gpcd) x (minimum flow peaking factor)

All lift stations shall be sized to handle the service area designated in the City's Wastewater Master Plan. At the discretion of the Director of Engineering, the capacity of a lift station can be increased or decreased.

2) Wet Well Design.
    a) The wet well shall be a minimum of six (6') foot diameter.
    b) The wet well volume shall be sized to provide adequate storage volume at peak design flows and a pump cycle time of sufficient duration to prevent pump short cycling and consequential motor damage. Pump cycle time, defined as the sum of "pump off" time plus "pump on" time, shall be as follows:

Motor H.P.	Minimum Cycle Time in Minutes (tc)
2 to 50	10
51 to 75	15
76 to 250	30
251 to 1500	45

    Volume between "pump on" and "pump off" elevation (of the pump cycle) shall be determined by the following criteria:
    c) $V = (tc/4)\ q$; where q = pump capacity in gpm
    d) All "pump on" levels shall have a minimum separation of one (1) foot between levels. All "pump off" levels shall be at least six (6) inches above the top of the pump casing. For more than two (2) pumps, the "pump off" levels shall be staged with a minimum separation of one (1) foot between levels.

3) Wet Well Detention Time
    a) Calculate the detention time (Td) in the wet well for the maximum wet weather flow, maximum dry weather flow and average dry weather flow using the following equation:
    $T_d = t_f + t_e$
    Where:
    $t_f = (v) \div (i)$ = time to fill the wet well in minutes
    $t_e = (v) \div (q - i)$ = time to empty the wet well in minutes
    V = volume of wet well between "pump on" and "pump off" elevations in gallons
    q = Pump capacity in gpm

i = flow into the station corresponding to the maximum wet weather flow, maximum dry weather flow or average dry weather flow in gpm.

Maximum detention time shall be calculated with i = minimum dry weather flow.

Odor control shall be provided for the wet well if the total detention time in the wet well and force main system exceeds 180 minutes. If odor control is necessary, see attachment Guidelines for Sulfide Generation.

b) Utility line markers are to be used on all cross-country wastewater lines, or on wastewater lines where development has not yet occurred, to locate the existing/proposed line. Locating tape is to be used on all wastewater lines.

4) Specific Station Requirements
   a) Stations deeper than 30 feet, measured from the finished floor to the top of the entrance tube, shall require an electrically powered personnel lift.
   b) Entrance hatches larger than 40 inches in diameter shall be spring loaded.
   c) Valves higher than six (6) feet above the floor shall have chain operators.
   d) Flow monitoring will be provided for all lift stations, as outlined under Instrumentation.

Emergency Provisions. Back-up power is only required if requested by the Director of Engineering.

Exceptions. Exceptions to these design criteria must be requested in writing. Written approval from COSM or a designee must be obtained before any exceptions will be allowed.

Approval. Once the design and plans are approved, submit 3 (three) final copies of the engineering report and plans to the Department of Engineering.

Construction. A permit is required for construction of every lift station. Permit guidelines and the most recent City of San Marcos Construction Notes shall be followed.

Miscellaneous Construction

The base slab and wet well shall be monolithic to prevent infiltration or leakage. Bolts for pumps shall be cast-in-place in the base slab.

All penetrations of the wet well walls shall be sealed with non-shrink grout or an approved wall seal.

The top slab shall be provided with floor doors sized to allow for pump removal and to carry HS-20 loading.

Installation.

Prior to beginning the installation of the wastewater lift station, the Engineering Dept. shall be given forty-eight(48) hours advance notice.

All erosion control measures are to be in place prior to and during installation. Follow the most recent COSM Construction Requirements.

Materials.

1) Pre-Fabricated Lift Stations.

   Prefabricated lift stations can be submitted for review and acceptance.

2) Valves
   a) Iron-Body Gate Valves

      Unless otherwise indicated, Iron Body Gate Valves, 4" to 12" (102 mm to 305 mm), including Tapping Valves, shall conform to AWWA C509, "Resilient Seated Gate Valves for Water and Sewerage Systems".

      Iron Body Gate Valves larger than 12" (305 mm), including Tapping Valves, shall be double disc, parallel seat valves meeting the requirements of AWWA C500.

      16“ (406 mm) Iron Body Resilient Seated Gate valves may be used if called for in the design and if indicated in the Standard Product List WW-282.

b) Ball Valves
Ball valves shall be brass, bronze, stainless steel or PVC as indicated on the drawings or details or as approved by the Engineer or designated representative.

c) Air-Vacuum Release Valves
Valves shall be combination air-release, air-vacuum units having small and large orifice units contained and operating within a single body or assembled unit.
The small orifice system shall automatically release small volumes of air while the pipe is operating under normal conditions. The large air-vacuum orifice system shall automatically exhaust large volumes of air while the pipe is being filled and shall permit immediate re-entry of air while being drained.
Valves shall be rated for at least 150 psi (1 megapascal) {maximum} normal service pressure.
Unless otherwise indicated, these valves shall be ARI Combination Air Release for wastewater force mains.

3) Pumps.

a) Acceptable Manufacturers
All equipment approved for this project shall meet or exceed all performance, service, and warranty requirements of this specification. Products that comply with these specifications by the following manufacturers will be acceptable.
1) Hydromatic
2) KSB
3) Flygt
4) Myers

b) Data sheets supplying the following information for the pumping units shall be submitted with the shop drawings.
1) Make and type of pump
2) Speed _____ RPM
3) Horsepower at rated head _____ HP
4) Total weight (pump and motor) _____ Lbs.
5) Rated capacity and head on pump curve
6) Maximum capacity and head on pump curve
7) Minimum capacity and head on pump curve
8) Minimum overall efficiency

c) Motor
1) Make and type of motor
2) Brake horsepower of motor _____HP
3) Locked Rotor Current at full nameplate voltage _____ Amps
4) Full load current at full nameplate _____voltage
5) Motor service factor
6) Insulation class and temperature rise at service factor load
7) Shaft Seal: Provide dry run/leakage test procedures and data for the specific pump shaft seal system.

4) Submersible Sewage Pumps

a) Each pump, motor, and cable assembly shall be furnished in one integral unit, factory assembled by the Pump Manufacturer.

b) The pump design shall be such that the pumping unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection. The discharge connection shall be permanently installed to the wet well using SS cast in place bolts. The pump shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be disconnected. Connection and disconnection of the pumping unit from the discharge piping shall not require personnel to enter the wet well.

c) Each pump shall be fitted with an adequate length of stainless steel chain of adequate strength to permit raising and lowering the pump. The pump supplier shall provide a grip eye, which, when lowered into position over the stainless steel chain, will automatically attach to the chain for lifting and automatically release the chain after lowering the pump back into position. The grip eye, pump chain, and associated hardware shall have a minimum capacity of 1 1/2 times the pump weight.

d) The pump assembly shall also be capable of running dry or partially submerged for extended periods without any damage to the pump, motor, seals, or accessories.

e) Major parts, such as the stator casing, oil casing, sliding bracket, volute, impeller, and base coupling shall be constructed of cast iron. Surfaces coming into contact with the pumped liquid shall be protected by a factory-applied epoxy coating or shall be stainless steel. External bolts, nuts, and fastening hardware shall be a minimum of 316 stainless steel.

f) Motor

    1) The motor shall be housed in an air filled, water tight enclosure. The motor shall conform to NEMA design Class B, and incorporate Class H insulation material to withstand a continuous operating temperature of 180° C (356°F). The pump and motor shall be capable of handling liquids with a maximum temperature of 40°C (104°F). The motor shall be capable of sustaining up to 12 evenly spaced starts per hour. The motor shall be capable of operating in dry or partially submerged conditions for extended periods without damage. The nameplate motor service factor shall be at least 1.15. The motor shaft shall be 400 series stainless steel, or carbon steel 1035 if completely isolated from the pumped media. The motors shall be 460 volt, 3-phase, 60 cycle and rated for VFD duty (NEMA MG-1, inverter duty rated). The motors shall not be more than 1200 RPM at full load, and shall be completely isolated from the pump to media. Lead wires shall be suitable for operation in oil. The motor shall be provided with motor thermal switches embedded in the windings to protect the motor from burnout due to excessive heating. Inrush on starting shall be no more than allowed by NEC Code Letter G (5.6 KVA/HP).
    2) The electrical cable entranceway to the motor shall be provided with positive strain relief to prevent leakage or pullout of the cable in the event that a force is accidentally placed on the cable during the raising or lowering of the pump.
    3) The motor, cable, and electrical controls shall be sized, furnished, and installed so that the motor shall never exceed the nameplate rating at any point on the pumping curve.

g) Sliding Coupling System

    1) A sliding guide bracket shall be an integral part of the pumping unit or securely attached thereto. The guide bracket shall be designed such that no strain is placed on the pump or guide rails. The volute casing shall have a machined discharge flange to automatically and firmly connect with the discharge connection, which when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps or similar devices. Discharge base elbow and base plate shall be supplied by the Pump Manufacturer.
    2) The pump sliding coupling system shall be designed so that the downward force of the machined mating flanges shall shear away rags, hair, or other debris that would prevent a uniform watertight seal. No portion of the pump unit shall bear directly on the floor of the wet well. Nor shall the pump have any protrusions below the pump intake, such as legs that could cause debris and rags to hang up and cause coupling system misalignment. The pump body and slide coupling mating faces shall be non-sparking bronze.

3) The slide rails shall be continuous stainless steel designed to resist corrosion in sewage or sludge applications. Any joints in the rails shall be reinforced from within. If pipe is used, it shall be minimum Schedule 80 and shall be continuously full-depth welded, ground smooth, and treated to resist corrosion.
4) The rail support system shall be furnished by the Pump Manufacturer, of adequate length to extend from the lower guide holders on the pump discharge connection to 6" below the top of the wet well. The system shall be mounted with stainless steel hardware

5) Sump Pump.

The sump pumps for the meter vaults and valve vaults shall be Hydromatic Model SP50A1, or approved equal.

6) Submersible Sump Pumps

The sump pumps shall have cast iron motor housing and volute, non-clog, cast iron impellers threaded to a stainless steel shaft and capable of handling 2-inch spherical solids. Each pump shall be equipped with a heavy-duty, wide-angle float switch.
The backup pump float switch shall be set at 6 inches above the primary pump float switch. Each pump shall have a capacity of not less than 100 gpm at a total dynamic head of 10'. Each pump shall be equipped for automatic operation.
Motor. The motor shall be totally-encased, sealed, non-ventilating, and the motor windings shall contain automatic-reset, thermal overload protection for continuous duty.

7) Access Doors
   a) Acceptable Manufacturers:
   Products that comply with the specifications by the following manufacturers will be acceptable:
   Bilco
   USF
   Halliday

   b) Aluminum Floor Access Door (with channel frame)
   Floor access door shall be Aluminum Leaf, Channel Frame, rated for 300 pfs.
   c) Fall Through Prevention System
   Fall through prevention systems shall be manufactured by and compatible with the installed aluminum access doors.

8) Swing Check Valves
   a) The check valves used shall be swing check valves unless otherwise specified and shall be constructed with a heavy cast iron body and bronze seat ring, non-corrosive shaft for attachment of weight and lever, and complete bronze air cushion chamber. Shaft, counter-weight, and cushion assembly shall be field reversible.
   b) The valve disc shall absolutely prevent the return of water or gas back through the valve when the inlet pressure decreases below the delivery pressure. The valve shall be tight-seating. The seat ring shall be renewable and shall be securely held in place by a threaded joint. The valve disc shall be of cast iron and shall be suspended from a non-corrosive shaft which passes through a stuffing box or O-rings and shall be connected to the weight and lever on the outside of the valve. The shaft shall be keyed into the disc and lever arm. Set screws shall not be acceptable.
   c) Swing check valves shall be furnished with ANSI 125 pound flanges. Swing check valves shall be Golden-Anderson 250-D Cushioned or Non-Cushioned, as appropriate.

9) Protective Coatings

Protective coatings will be required for the interior and exterior of the lift station. The exterior coating can be similar to coatings approved for wastewater manholes.
Interior coatings must be submitted for review.

10) Electrical Control

Electrical work shall be executed in accordance with local, State, and national codes, ordinances, and regulations. The applicable provisions of the following standards shall apply to all electrical installations and equipment:

National Electrical Manufacturing Association (NEMA)
American Society for Testing and Materials (ASTM)
National Fire Protection Association (NFPA)
National Electrical Safety Code (NESC)
Institute of Electrical and Electronic Engineers (IEEE)
National Electrical Code (NEC)
Underwriters Laboratories (UL)
American National Standards Institute (ANSI)

Identification of electrical equipment shall be in accordance with the NEC, local authorities, and as specified.

Conductors shall be soft-drawn, annealed copper with conductivity of not less than that of 98% pure copper bearing the UL label. Conductors shall be stranded THHN/THWN. Conductors shall be properly labeled and tagged with reference to "as built" blueprints for future troubleshooting.

Disconnects and motor control centers shall comply with the specifications and shall be by the following manufacturers:

Cutler-Hammer
Square D
Allen Bradley

Variable Frequency Drives shall have harmonic filters, power factor correction, drive isolation transformers, and all appurtenances needed to meet the requirements of the application.

Acceptable manufacturers of VFDs:

Robicon
Allen Bradley
Square D

All outdoor instrument and control enclosures shall be NEMA 4x.

11) Instrumentation

a) On stations without generator backup, odor control, or flow meters, primary duplex and triplex pump control shall be by Tac Pack controller manufactured by Data Flow Systems, Inc. 605 N John Rodes Blvd. Melbourne, FL 32934 Phone: 321-259-5009 Fax: 321-259-4006 www.dataflowsys.com
Primary 4 pump control shall be by Data Flow Systems PLC with redundant pump control using SC2000 station controller manufactured by Motor Protection Electronics, Inc., 2464 Vulcan Rd., Apopka, FL 32703 ph 407.299.3825. www.mpelectronics.com

b) On stations with generator backup, and/or odor control, and/or flow meters primary control shall be as follows: 2 pump stations will use DFS PLC with redundant control using Mercoid MPC station controller manufactured by Mercoid Controls, Division of Dwyer Instruments,102 Indiana Highway 212, P.O. Box 373, Michigan City, IN 46361, Phone:(219)879-8000 Fax:(219)872-9057 www.mercoid.com . 3 & 4 pump stations will use DFS PLC with redundant control using SC2000 controller.
Transit time ultrasonic flow meters shall be Polysonic Triton TX10 or approved equivalent.
Level probe for pump control shall be GE Druck PTX1290 submersible level transducer or approved equivalent.
Contractor shall provide Owner with certificates of calibration for all instrumentation upon completion of installation.
Telemetry transmission will be by DFS Radio operating at City's licensed frequency.
HMI inputs/outputs may include, but not be limited to, the following:

Start/Stop for each pump
PLC failure alarm
Motor current
Motor speed
Wet well level
Discharge flow
Discharge pressure
Pump status Auto/Manual
Run status On/Off
VFD failure alarm
Wet well alarm Hi/Low
Generator status Auto/Fail/Running/HOA position
Transfer Switch status
Security contacts

12) Backup Generator

Where backup generator is specified by the COSM, the gen-set shall be Caterpillar, sized to fit application.
Acceptable automatic transfer switch manufacturers shall be:
ASCO
Cutler-Hammer
Square D

13) Odor Control Equipment

Acceptable odor control equipment shall be provided by Bioway America, Inc., Greentree Executive Campus, 3002E Lincoln Drive, West Marlton, NJ 08053 Tel: 856.988.9414 Fax: 856.988.9166
Alternate odor control can be submitted for review by the City.

14) Operations and Maintenance Manuals

Prepare a complete and detailed Operation and Maintenance Manual for each type and model of equipment or product furnished and installed under this contract. Include updated “as built” prints for all structural, mechanical, and electrical components.
Prepare the manuals in the form of an instruction manual for the Owner. The manual is to be suitable for use in providing operation and maintenance instruction.
Provide complete and detailed information specifically for the products or systems provided for this project. Include the information required to operate and maintain the product or system.
Manuals are to be in addition to any information packed with or attached to the product when delivered. This information is to be taken from the product and provided as an attachment to the manual.
Provide copies of the Manufacturer's warranties, guarantees, or service agreements.
Provide affidavit stipulating start of warranty periods for all equipment at full acceptance by COSM, with copies to all equipment vendors.

<u>Testing and Approval.</u>

1) Start Up

Start up of the lift station shall be performed in the presence of the designated City Representative. Prior to start up, forty-eight (48) hours notice shall be given to the City.

2) Alternate Power Supply Present.

A two (2) hour continuous load bank test of the generator shall be performed prior to connection to the transfer switch. Loads from ten (10%) percent to one hundred (100%) percent of rated capacity shall be checked for voltage, frequency, and fuel. Correct phasing between the generator and the station shall be verified, and a

simulation of generator alarms shall be performed. A signed test report shall be provided to the City.

A total of two (2) power failures shall be simulated.

3) All pump operations and alarm controls shall be demonstrated.
4) Training

   A minimum one (1) day training session for the City staff shall be provided covering the system operation and basic maintenance of all aspects of the lift station, One week notice shall be provided to the City for scheduling the training session.
5) As-Built Drawings

   Upon completion of the project, as-built drawings shall be submitted to the City's inspector for review and approval. Once the as-builts are approved, two (2) hard copies, as well as one PDF and one DGN copy shall be submitted to the City. Each sheet within the as-built set must be stamped RECORD DRAWING and initialed.
6) Approval

   Upon completion and acceptance of the start up operations and the one day training session and as-builts, a Certificate of Acceptance may be submitted for project approval. A one-year warranty and 100% maintenance bond shall be required.