

SECTION 4: WASTEWATER PUMP STATION

To the extent practicable, wastewater pump stations shall be avoided. In unavoidable cases, a pump station may be considered by the District after submission of a detailed engineering report documenting reasons for proposing a pump station. This report shall establish that there is no reasonable alternative other than a pump station to serve the proposed tributary area. This report will be reviewed by the District and a decision will be made by the General Manager. All wastewater pump stations shall comply with these Wastewater Pump Station Design Standards. Single parcel pump stations shall be owned and maintained privately by the parcel owner.

Calculations pertinent to the design shall be submitted to the District. Such calculations shall be used by the District for determining the adequacy and feasibility of the proposed facilities under review. Any failure on the part of the applicant or authorized representatives to submit such calculations may lead to delay in review and approval of the project.

No pumping facilities shall be incorporated into any sewer plans without prior District approval.

All design and construction shall be in accordance with these Wastewater Pump Station Specifications and every phase of the pump station and force main design shall be closely coordinated with and shall be under the direction of the District. Special provisions may be required by the District to supplement these Specifications and may specify in more detail the construction of sewer, wastewater pump station, and all appurtenances.

Section 4.01 Design Factors to be Considered:

A. Type of Station (Built-In-Place Wastewater Pump Station):

1. All pump stations shall be built-in-place and may be either dry or wet well type.

B. Wastewater Flows and Design Capacity:

1. Wastewater flows:
 - a) Wastewater flows shall be determined in accordance with Section 3 of these Standards.
2. Design Capacity:
 - a) Wastewater pump stations shall be designed to discharge design flows.

C. Location:

1. Wastewater pump stations shall be located where tributary areas will be most effectively serviced and where development, construction, and operational costs would be at a minimum.
 - a) Pump stations should not be subject to flooding and shall be readily accessible.
2. Wastewater pump station sites shall be adequate in size to contain all facilities and to allow on-site parking of service trucks and equipment and to buffer adjoining properties from noise.
 - a) Future modification and expansion requirements shall be given consideration.
3. The minimum distance from any building to the pumping station site shall be 100 feet or as required by the governing agency.

Section 4.02 Plans of Wastewater Pump Stations:

A. General Layout:

General layout shall consist of the following at a minimum:

1. Plan view showing layout and dimensions of site and building(s), including driveway and number of parking stalls, exterior piping and appurtenances, fencing, and all utilities.
 - a) Property ties shall also be shown.
2. Plans and details of grading, drainage, erosion control, landscaping, and sprinkler system.
3. Show FEMA flood elevations if area is in a 100-year flood plain.
4. Show hazardous area boundaries and classifications of spaces.
5. List utility company contacts.

6. Detail Plans:

Detail plans shall consist of the following at a minimum:

- a) Architectural plans, elevations, and details.
- b) Structural plans elevations, sections, and details.
- c) Utility plans (electrical, mechanical, etc.) showing exact location and size and type of all utilities, and elevation(s) to prevent damage from future excavations.

- d) Mechanical plans including pump, isometrics, plumbing, ventilation, air condition and other equipment installations, piping layout, and details.
- e) Electrical and telemetry plans and details, including conduit schedule and lighting fixture layouts, control equipment arrangement, and wiring diagrams (one line and elementary control diagrams) for power distribution and controls.
- f) In accordance with Cal-OSHA, an electrical engineer shall determine if an Arc Flash Survey is required and provide a Survey Report and recommendations if necessary or provide letter certifying otherwise.
- g) Wastewater level control arrangement for operating pumps and alarms.
- h) Other plans, sections, elevations, schematics, details and notes, as required, to adequately show the proposed construction.

Section 4.03 Site Improvements:

A. Grading:

- 1. Wastewater pump stations shall be located two feet (2') above 100-Year Flood Level and provided with adequate drainage facilities to carry away storm waters.
- 2. Adjacent properties shall not be jeopardized by such provisions.

B. Driveways and Parking Areas:

Paved driveways and parking areas shall be provided for service trucks.

- 1. Width of driveways shall be 12 feet minimum.
- 2. Pavement shall be asphalt or Portland cement concrete.
- 3. Concrete curbs shall be required for all pump stations.
- 4. Entrance gates shall be set inward, toward the station, at least 18-feet to provide safety for trucks entering or leaving the station.
- 5. Shared residential driveways or any access routes that may become restricted or blocked are unacceptable.

C. Fencing

- 1. Pump station sites shall be enclosed with a six foot (6') high perimeter fence or wall.

- a) Masonry walls or other approved types of enclosures are required if pump station is located adjacent to a residential project.
 2. Where chain link fences are used, wire fabric shall be nine gauge minimum.
 - a) In corrosive areas, corrosion protection or additional thickness shall be provided.
 - b) In isolated areas or at other areas as directed by the District, three strands of barbed wire should be installed along the top of the fence on an arm projecting outward at an angle of 45 degrees.
 3. Gates shall, at minimum, be 12-feet wide for vehicle gates and 3-feet wide for pedestrian gates and shall be provided with heavy duty padlock hasp fixtures and shall be designed for safe opening and closing during strong winds.
 - a) At facilities where PG&E transformers and/or meters are installed within the station's perimeter, hasps shall be provided to accommodate two padlocks.
 - b) Design shall allow access with either padlock removed.
 4. A one foot (1') wide gravel strip shall be provided under fencing. Gravel strip shall be contained with redwood or other approved durable material headers and shall have an approved fabric weed barrier installed prior to placement of gravel.
 5. Clear redwood slats or other material acceptable to the District, with a length equal to the designated fence height shall be inserted vertically in the mesh openings, so as to fit snugly, and fastened in a manner to prevent easy removal or displacement.
- D. Landscaping:
1. Sites shall be landscaped to blend with the surrounding environment to render a pleasing overall appearance. Consideration shall be made to minimize grounds-keeping maintenance.
 - a) Chain link fencing shall be screened with landscaping.
 - b) For grounds landscaping, crushed rock such as coral chips, red cinder stone or blue stone shall be used.
 - 1.) Approved fabric weed barrier shall be placed prior to placement of rock.

E. Sprinkler System:

1. Automatic irrigation systems shall be installed for irrigation as necessary for site conditions.

F. Signage:

1. Informational signage shall be provided and installed as required by state or local law and as required by the District.

Section 4.04 Structure and Appurtenances:

A. Architectural Design:

1. Wastewater pump stations shall be architecturally designed to be in harmony with surrounding development.
2. Materials shall be selected to keep construction and maintenance cost at a practical level.
3. As much as possible, non-corrosive materials shall be used.
4. All architectural design shall be prepared by a Registered Architect.

B. Substructure

1. Built-in-place pump station substructures shall be reinforced concrete construction.
 - a) All substructures shall be waterproof and watertight.
 - b) Test borings shall be made to determine the soil characteristics and ground water conditions at all pump station sites and foundations shall be suitably designed.
 - c) Consideration shall be given to flotation during construction and/or flooding condition.
 - d) Ensure that NPSH requirements of pump are met.
2. Structural backfill for the lift station shall be placed as engineered fill, in lifts not exceeding 12 inches in compacted thickness.
 - a) Each layer being of uniform moisture conditioned to at least the optimum moisture condition and compacted to at least 90% of the maximum dry density per ASTM D1557-91 specifications.
 - b) Where backfill will support pavements the upper 12 inches of backfill and base material shall be compacted to at least 95% relative compaction.

3. Backfill around the lift station well shall consist of clean crushed rock with 100% passing through a one inch (1") sieve and appreciable amount passing through a #4 sieve.
 - a) A minimum of 12 inches (12") of crushed rock shall be placed at the base of the sewer lift station footing for stabilization and extending a minimum of 12 inches (12") outside the edge of cast-in- place or pre-cast base.
 - b) In all areas the crushed rock shall be separated from the native material with an approved non-woven geo-textile fabric.
4. With approval of the District, excavated soils may be used for backfill, after required drying has occurred to allow the specified degree of compaction to be achieved.
 - a) Imported soils must be free of organic concentrations, rubble or debris and must have approval of the District.
5. The contractor may find it necessary to use deep wells to lower the water table in lieu of using sump construction and pumping.
 - a) If sheet piling is used the contractor shall extend the tips to a sufficient depth to prevent "quick" conditions or sand "boils" from occurring.
 - b) The excavation for the sewer lift station may require the contractor to use special construction techniques, which may include but not limited to, sloped excavation, shoring and/or sheet piling, or a combination of methods.
 - c) The contractor shall submit to the District for review and approval all shop drawings and proposed methods of construction.
6. Dry Wells:
 - a) Dry wells shall be sized to meet space requirements for equipment, piping and ease of maintenance.
 - b) Adequate working space, at least two feet (2') clear, shall be provided between and around pumps and other equipment.
 - c) Provide three feet (3') clearance for electrical equipment to comply with the National Electrical Code or local governing authority.
 - d) Space and provisions for planned future pumps and equipment shall also be provided.

7. Wet Wells:

- a) Wet wells shall be designed on the basis of minimizing deposits of solids, preventing wastewater from becoming septic, optimizing pump runtime and avoiding frequent starting of pumps.
 - b) Minimum pump cycle (period from start to stop) for any one pump shall be 5 minutes.
 - c) Maximum retention time of wastewater in wet wells shall be 60 minutes at average flow (total wet well wastewater volume shall be used in computing retention time).
 - d) Wet wells shall have a minimum inside width of five feet (5') and shall be sized to keep wastewater levels within the following limits:
 - 1) High water level
 - I. Desired: invert of incoming sewer
 - II. Maximum: crown of incoming sewer
 - 2) Low water level
 - I. Not lower than top of pump casing.
 - 3) Vertical distance between pump start and stop levels
 - I. Six inches (6") minimum
 - e) Floors shall have a slope of 1:1 minimum, sloping towards a hopper bottom. The hopper bottom shall be designed for proper installation and function of pump suction inlets.
 - f) Influent lines shall be designed without vertical drops into the wet well to minimize release of entrained air/gases.
 - g) The wet well shall be divided into two or more sections, properly interconnected, to facilitate repairs and cleaning.
 - h) Wet wells shall have a lining to protect against hydrogen sulfide corrosion in accordance with Section 2.11 of these specifications.
 - i) Mark calibration lines on the wet well wall for visual confirmation of level during start-up.
8. Access:
- a) Reinforced concrete or structural steel stairways shall be provided for access to dry wells.

- b) Stairways shall have a clear passage of at least 30 inches. Stairs shall be provided with permanent non-slip treading.
- c) Access shall be provided to all wet well compartments by means of manholes and 316 stainless steel or other approved ladder rungs.
- d) Access manholes shall be located to best facilitate maintenance operations.
- e) Manhole castings shall conform to Section 2.12 of these standards. For instances when hatch covers are called for, hatch shall, at a minimum, conform to the following:
 - 1) Material shall be aluminum, minimum $\frac{1}{4}$ " thick
 - 2) Designed to receive H-20 wheel loads
 - 3) Stainless Steel (S.S.), watertight Slamlock with S.S. Key and Plug
 - 4) S.S. Automatic Hold Open Arm
 - 5) S.S. Compression Springs for Lift Assist, or other mechanism approved by the District
 - 6) S.S. Hinges with Tamper-Proof Bolts
 - 7) Flush Cast Aluminum Drop Handle (recessed)

9. Ventilation:

- a) Dry well shall be ventilated by a mechanical air exhaust system providing at least one air change every three (3) minutes.
- b) Outlets of exhaust system should not be located less than 12 feet from any opening except when exhausting through the roof.
 - 1) Ventilation exhaust shall be located downwind of any inlet openings.
 - 2) Velocity in air ducts shall not exceed 1500 fpm.
 - 3) When required fan capacity is large, the use of two fans shall be considered.
 - 4) Switches for the operation of the ventilation equipment shall be interlocked with the dry well light switch.
 - 5) Ventilation shafts shall be provided for wet well compartments with only one access opening.

10. Drainage:

- a) Dry well floors shall be constructed to drain by gravity into trench drains channeled to a sump.
- b) The sump pump shall be submersible.
- c) Minimum sump pump capacity shall be 25 GPM with exception of stations equipped with water seal systems, hydraulic operated check valves, or similar type equipment.
 - 1) These stations shall be provided with duplex submersible pumps, each capable of pumping at least 50 gpm.
- d) A switch for lead/lag operations shall be provided at the MCC.
- e) Sump pump discharge shall enter the wet well adjacent to and as high as possible to the ground floor level.
- f) Trench drains shall be covered with corrosion resistant gratings.
- g) Floor framing and anchoring devices for gratings shall be 316L stainless steel.

C. Superstructure:

1. All pump stations shall have a superstructure.
 - a) Floor Elevation and Area:
 - 1) The latest flood zone map shall be consulted. Floor areas shall be adequate for mechanical equipment, electrical equipment and controls, sanitary facilities, storage, and future expansion.
 - 2) Additional buildings or rooms may be required by the District.
 - 3) Adequate working space, at least three feet (3') clear, shall be provided between and around all equipment.
 - 4) Provide a minimum of three feet (3') clearance for electrical equipment, or as required by the National Electrical Code.
 - b) Height:
 - 1) Height of superstructure shall provide adequate working height to accommodate maintenance personal.
 - 2) In addition, height of superstructure shall be adequate to permit the removal of all equipment and facilities contained within and to accommodate hoisting equipment.

c) Materials of Construction:

1) The following materials are acceptable for construction of superstructures:

- I. Beams and Columns: Reinforced concrete or structural steel.
- II. Roof: Wood truss and plywood.
- III. Wall: Masonry or reinforced concrete.

d) Insect Screens:

1) All structure openings for ventilation or light, except doorways, shall be equipped with removable stainless steel insect screens.

e) Doors:

- 1) Doors shall be of adequate size to permit removal of pumps, motors, and other equipment.
- 2) Locks shall be keyed to match the District master key.

f) Roofing:

1) Unless otherwise submitted and approved, roofing shall be pitched, standing seam metal.

g) Railings and Stairways:

1) Railings and stairways shall conform to OSHA regulations and local governing authority Building Codes.

h) Outdoor Enclosures:

- 1) Gages, meters, and control devices installed outdoors shall be mounted within NEMA-4 enclosures.
- 2) Gages integral of other devices such as bearing thermometer on motors will be considered exceptions.
- 3) PG&E facilities location shall be as approved by PG&E.

D. Provision for Equipment Removal:

Provisions shall be made to facilitate removing pumps and other equipment for repair and maintenance.

1. Openings:

- a) Openings shall be provided in ground and intermediate level floors of pump stations.
- b) Ground level floor openings shall be covered with removable grates and have removable pipe posts and guard chains around its periphery.
- c) Stationary posts with removable pipe railing sections shall be provided around intermediate floor openings.
- d) Manhole openings shall be provided with portable peripheral curbing and shall be large enough to provide ample room to install or remove pumps and other equipment.

2. Hoists:

- a) Built-in-place pump stations shall be equipped with trolley type hoists traveling on steel beams.
- b) Hoists for station shall be electrically powered.
- c) Plug-in type hoists operating on single phase 120 volts may be allowed for small stations.
- d) Hoists shall be designed for the application intended at ultimate build-out.

3. Eye Bolts:

- a) Eye bolts for block and tackle type hoist shall be provided over pumps, valves, header piping, and other locations to facilitate maintenance operations and equipment removal.
- b) The load rating of each eyebolt shall be shown on the plans.

4. Headroom:

- a) Sufficient headroom, including room for lifting device, shall be provided to allow pump rotating element to be removed without disturbing the pump volute.

E. Station Facilities:

Depending on proximity of station to other available District facilities, and on a case-by-case basis, built-in-place pump stations may be required by the District to incorporate any or all of the following:

- a) Sanitary Fixtures and Accessories:

- 1) Service sink shall be acid resistant, white enameled, cast iron body, stainless steel rim.
 - 2) Water closet shall be vitreous china, wall hung, close-coupled closet combination with open front, back closet seat without cover.
 - 3) Paper towel dispenser shall be chromium plated.
 - 4) Toilet paper holder shall be chromium plated.
 - 5) Paper toilet seat cover dispenser shall be chromium plated.
 - 6) Soap dish shall be chromium plated.
 - 7) Waste paper basket shall be plastic or non-corrosive material.
 - 8) Wall mirror shall be a minimum 12 in. x 24 in.
 - 9) Small storage cabinet for janitorial supplies shall be a minimum 24 in. wide, 24 in. high and 12 in. deep.
- b) Light Fixtures and Receptacles:
- 1) Light Fixtures:
 - I. Light fixtures shall be provided to supply adequate illumination within pump stations and shall be mounted where re-lamping can be accomplished with reasonable ease as determined by the District.
 - II. Light fixtures shall also be installed next to exterior doors on the outside and around the perimeter of the building with at least one light to illuminate the wet well as directed by the District.
 - III. Wet wells shall not require light fixtures. Light fixtures below ground level shall be vapor-tight.
 - IV. Fluorescent fixtures using 48 inch T-8 type tubes are preferred.
 - V. High pressure sodium fixtures shall be used where required by the District.
 - VI. Light fixtures shall be 120 Volt.
 - 2) Night Lights:

- I. Night lights shall be provided above all building entrances and equipped with lamp shades to prevent glare beyond the perimeter fence line.
- II. Provisions shall be made for a night light at the perimeter entrance gate as may be required by the District.
- III. Night lights shall be automatically controlled by photocells.

3) Emergency Lights:

- I. Battery-powered emergency lights shall be provided at all floor levels of the pump station and emergency generator location or building.
- II. Emergency lights shall be connected to the normal service via a receptacle, mounted adjacent to the emergency light.

4) Receptacles:

- I. Weather-proof GFCI receptacles shall be installed at all floor levels of pump station and outside the building, adjacent to the wet-well and at other locations as required by the District.

5) Electrical Code:

- I. Electrical system shall conform to the National Electric Code, and the Building Code of the local governing authority.

c) Telephone:

- 1) Terminal cabinet, telephone jacks, CAT5 cabling and touch tone handset shall be provided.
- 2) Provide an AC duplex receptacle.

d) Miscellaneous Equipment:

- 1) The following may be required:
 - I. Fire Extinguishers: Fifteen lbs., C02 for MCC room and generator area; Ten lbs. dry chemical for lower floors.
 - i. All fire extinguishers shall be wall mounted and properly labeled.
 - II. First aid kit, wall mounted

- III. Eight inch electric clock, wall mounted
- IV. Plastic trash receptacle, thirty gallons capacity with cover
- V. Desk and chair.
- VI. Storage cabinet for flammable materials, 36”H x 24”W x 12”D
- VII. Legal size, 4 drawer file cabinet with lock
- VIII. Storage cabinet and/or racks for spare parts, 72”H x 32”W x 12”D
- IX. Workbench 30”H x 60”W x 24”D

Section 4.05 Pumps, Motors and Controls:

A. Sewage Pumps and Motors:

1. General:

- a) Major pump stations shall be equipped with a minimum of three pumps.
 - 1) Smaller pump stations may be equipped with two pumps.
 - 2) Pumps shall be capable of operating over the range of flows without excessive cycling and without long retention time.
- b) Variable speed drives shall be utilized for wastewater pump stations and whenever conditions such as long retention periods or short pumping cycles cannot be avoided.
 - 1) Dual speed motors may be considered where appropriate.
- c) All pump stations shall be equipped with a standby pump equal in capacity to the largest of the main pumping units.
 - 1) The main pumping units shall be capable of handling the station’s design flow without the use of the standby unit.
- d) Pumps shall be capable of passing spheres of at least two inches (2”) and shall have a minimum discharge opening of four inches (4”) in diameter.
 - 1) Speed of pumps shall not exceed 1750 rpm unless approved by the District.

e) Pumps shall be capable of safely rotating in reverse direction at full runaway speed without damage to appurtenances under the shutoff head of the units.

1) The brake horsepower required at full motor speed at any head along the curve shall not exceed the rated horsepower of the motors.

f) Pumps shall be intrinsically safe and in accordance with Cal-OSHA, NEMA and IEEE requirements.

2. System Head-Capacity Curves:

a) Pumps shall be selected so that the head-capacity characteristics correspond as nearly as possible to the overall station requirements.

b) This shall be accomplished by the preparation of the system head-capacity curves showing all conditions of head and capacity under which the pumps will be required to operate.

c) The system head-capacity curves shall be developed using standard hydraulic methods for determining friction losses to show the minimum and maximum head losses that can be expected.

d) The equivalent length method using the Hazen-Williams formula is preferred.

e) Minimum and maximum head losses shall be determined using “C” values.

f) The system head-capacity curves shall consist of the following:

1) System Curves.

I. Curves showing total dynamic losses in the force main at varying pumping rates for minimum and maximum static heads.

II. Individual Pump Characteristic Curves.

i. Curves furnished by pump manufacturer showing pump’s head-capacity characteristics.

ii. Curves at minimum and maximum anticipated speeds shall be furnished for variable speed pumps.

III. Modified Pump Curves:

- i. Curves showing pumps head-capacity characteristics at the station header, obtained by deducting friction losses in the suction and discharge piping of each individual pump from their characteristic curves at corresponding pumping rates.
 - IV. Combined Modified Curves:
 - i. Curves showing multiple pump operation, obtained by adding capacities at points of equal heads on the modified pump curves.
 - v. NPSH Curves:
 - i. Curves showing the available system net positive suction head (NPSHA) and the pump's required net positive suction head (NPSHR) shall also be evaluated to minimize the occurrence of cavitation.
 - ii. The NPSHA and NPSHR curves shall include the operating conditions of minimum static suction head and maximum frictional loss over the entire operating range of each pump.
 - iii. For variable speed pumps where operation of a single pump at the maximum speed will result in cavitation, NPSHA and NPSHR curves shall also be evaluated at the highest variable speed that the pump will experience when it is operated alone or when operated simultaneously with other pumps.
- 3. Types of Pumps/Pump Construction:
 - a) All pumps shall be vertical units.
 - 1) Motors for stations with pump capacities greater than 2 MGD shall be installed on the ground level floor and connected to pumps with removable drive shafts, intermediate drive shafts, and equipped with removable and adjustable flexible couplings.
 - I. For pumps of less than 2 MGD capacity, submersible pumps may be used for wet pit installation.
 - II. Consideration for pump on/off cycling shall be made to avoid high motor temperature.
 - III. Motors for stations with pump capacities less than 2 MGD may be pedestal mounted.

b) Dry Pit Pump

- 1) Hand-holes shall be provided on the periphery of pump casings and suction elbows for purposes of inspection and removal of obstructions.
 - I. Hand-hole covers shall be flanged and secured to bossed sections and shall have interior surfaces formed to match interior surfaces of casting to which attached.
 - II. Pump casing hand-hole shall be located so that visual inspection can be made of the discharge end as well as the volute.
 - III. Hand-holes shall be a minimum of four inches (4") or about half of the pump size.
- 2) Pumps shall have flanged suction and discharge nozzles, faced and drilled to conform to ANSI Class 125 lb. standard.
 - I. Pumps of sizes greater than five inches (5") shall be furnished with suction elbows that are separate and not integrally cast with any other part of the pump.
 - II. Suction elbows shall be designed to prevent cavitation.
 - III. Guide vanes shall not be used in suction nozzles.
- 3) Pumps of sizes greater than five inches (5") shall be provided with either fabricated structural steel supports or cast iron ribbed supports.
 - I. Cast iron supports shall be cast integral with the pump casing or suction nozzle.
- 4) Base or sole plates shall be provided.
 - I. Plates shall be anchored by stainless steel bolts with stainless steel lock washers and grouted to reinforced concrete pedestals.
 - II. Hardened steel jacking screws for leveling and for aligning of pumps shall be provided.
 - III. Mating surfaces shall be machined and all holes drilled and not be burned.
- 5) Intermediate drive shaft sections should be not more than 12 feet in length.

- I. Where more than one drive shaft is required, self-aligning steady bearings shall be provided at each intermediate location.
 - II. Bearings shall be equipped with mechanism to allow alignment adjustments.
 - III. Bearing and shaft guards shall be provided. Safe access to bearing and guards shall be provided.
 - IV. Grease fittings shall be equipped with extension tubing to facilitate lubrication.
- 6) Drain and air release lines shall be provided for all pumps.
- I. Drain lines shall be installed at the packing drip reservoir and at the centerline of the suction pipe.
 - II. Air release line shall be installed at high point of pump casings.
 - III. Connecting points shall be bossed, drilled, and tapped.
 - IV. Minimum size shall be one (1) inch. Air release lines from pump to the first valve shall be brass.
 - V. Provisions shall be made for a sampling tap for wastewater unless waived by District.
- 7) Other features of pumps shall be as follows:
- I. Bearing Housing: Of single cast piece or fabricated structural steel.
 - II. Bearings: Not less than two.
 - III. Shaft Sleeve: Replaceable stainless steel sleeve, from the outside end of the seal gland to the impeller, and set screwed to the drive shaft.
 - IV. Sealing Gland: Double mechanical seal with suitable fluid sealing/lubrication system.
 - V. Casing and Impeller Wearing Rings: Stainless steel and “Z” or “L” shaped.
 - VI. Suction Plate: Separate from suction elbow (pumps five inches (5”) and smaller may be accepted).

- VII. Taper Pins and Jacking Screws: On all machined joints and hand-holes.
- VIII. Eyebolts or Other Provisions for Lifting: On volute and bearing housing.
- IX. Impeller Locknut: With smooth surface, no sharp corners and edges, and easily replaceable.
- X. Seals: On both the upper and lower sections of the bearing housing.
- XI. Tapered Shaft: Tapered for the full length of fit and keyed to the impeller. Exception may be made for four inch pumps.

c) Wet Well Submersible Pump:

- 1) Hand-holes shall be provided on the periphery of pump casings and suction elbows for purposes of inspection and removal of obstructions.
 - I. Hand-hole covers shall be flanged and secured to bossed sections and shall have interior surfaces formed to match interior surfaces of casting to which attached.
 - II. Pump casing hand-hole shall be located so that visual inspection can be made of the discharge end as well as the volute.
 - III. Hand-holes shall be a minimum of four inches (4") or about half of the pump size.
- 2) Pumps shall have flanged suction and discharge nozzles, faced and drilled to conform to ANSI Class 125 lb. standard.
 - I. Pumps of sizes greater than five inches (5") shall be furnished with suction elbows that are separate and not integrally cast with any other part of the pump.
 - II. Suction elbows shall be designed to prevent cavitation.
 - III. Guide vanes shall not be used in suction nozzles.
- 3) Base sole plates shall be provided.
 - I. Plates shall be anchored by stainless steel bolts with stainless steel lock washers and grouted to reinforced concrete pedestals.

- II. Hardened steel jacking screws for leveling and for aligning of pumps shall be provided.
 - III. Mating surfaces shall be machined and all holes shall be drilled and shall not be burned.
- 4) Drain and air release lines shall be provided for all pumps.
- I. Drain lines shall be installed at the centerline of the suction pipe.
 - II. Air release line shall be installed at high point of pump casings.
 - III. Connecting points shall be bossed, drilled, and tapped.
 - IV. Minimum size shall be one (1) inch.
 - V. Air release lines from pump to the first valve shall be brass.
 - VI. Provisions shall be made for a sampling tap for wastewater unless waived by the District.
- 5) Other features of pumps shall be as follows (all shall be non-corrosive):
- I. Pump shaft shall be stainless steel.
 - II. Bearings: Not less than two, sealed, and grease lubricated.
 - III. Seal:
 - i. Tandem, double mechanical seal running in an oil reservoir.
 - ii. It shall be composed of two separate lapped-face seals, each consisting of one stationary and one rotating tungsten- carbide ring; with each pair held in contact by a separate spring.
 - iii. The compression spring shall be protected against exposure to the pump liquid.
 - IV. Casing and Impeller Wearing Rings: Stainless steel and “Z” or “I” shaped.
 - V. Suction plate: Separate from suction elbow (pumps five inches (5”) and smaller may be accepted).

- VI. Taper Pins and Jacking Screws: On all machined joints and hand-holes.
 - VII. Eyebolts or Other Provisions for Lifting: On volute and bearing housing.
 - VIII. Impeller Locknut: With smooth surface, no sharp corners and edges, and easily removable and replaceable.
 - IX. Tapered Shaft: Tapered for the full length of fit and keyed to the impeller. Exception may be made for four inch (4") pumps.
- d) Provide pump and motor sensors and alarms for:
- 1) High temperature
 - 2) Vibration (non submersible only)
 - 3) Seal leakage (submersible only)
4. Motor Construction
- a) Dry Pit Motor:
- 1) Motors shall conform to the latest standards of the NEMA and the IEEE. Motors shall have ample capacity to operate the pumps under all head and discharge conditions without overloading. Starting current taken by the motors shall not exceed the values as regulated by PG&E or as permitted by the emergency generator.
 - I. Motors shall be capable of safely rotating in the reverse direction at runaway speed without damage to appurtenances under shutoff head.
 - II. Motors shall operate pumps through flexible shafts and couplings.
 - III. Vertical shaft motors mounted on floors shall be furnished with rugged cast iron or steel foundation rings.
 - IV. Motors shall be induction type, drip proof and suitable for operation from 230/460 volts, 3 phase, 60 cycle A.C. power systems.
 - V. Motors shall have a service factor of 1.15.
 - VI. All pump motors shall have running time meters installed at the starter.

- VII. All pump motors shall have an ammeter installed at the starter.
 - VIII. Dry pit sump pump motor shall have running time meters installed at the starter.
- 2) Motors shall be grease lubricated.
- I. Motors 7 HP or larger shall be provided with thermostatically-controlled space heaters.
 - II. Variable speed motors shall be provided with a RPM measuring device with a 4 to 20 milliamp output and a panel mounted digital RPM indicator.
- b) Submersible Motor:
- 1) Motors shall conform to the latest standards of the UL or FM approved for Class 1, Division 1, Groups C and D.
 - I. Motors shall have ample capacity to operate the pumps under all head and discharge conditions without overloading.
 - II. Starting current taken by the motors shall not exceed the values as regulated by PG&E or as permitted by the emergency generator.
 - III. Motors shall be capable of safely rotating in the reverse direction at runaway speed without damage to appurtenances under shutoff head.
 - IV. Motors shall be suitable for operation from 230 or 460 volts, 3 phase, 60 cycle A.C. power systems.
 - V. Motors shall have a service factor of 1.15.
 - VI. Motors shall be 1800 rpm or less.
 - VII. All pump motors shall have running time meters installed at the starter.
 - VIII. All pump motors shall have an ammeter installed at the starter.
 - IX. The motor power wiring shall be brought up into an intermediate termination box.
 - X. The seal-off fitting shall not be in the conduit with pump cable fill.

- 2) Pump motors shall be housed in a watertight casing and shall have moisture resistant insulated windings.
 - I. Pump motors shall have cooling characteristics suitable to permit continuous operation in a non-submerged condition.
 - 3) Provide pump motor monitoring relays if available.
5. Indicating Pressure Gauges:
- a) Indicating pressure gauges shall be provided at discharge nozzle and suction plate of pumps.
 - b) Indication shall be in feet. Isolation valves and stainless steel diaphragm seals or inline ring seals shall be provided at gauges.
6. Testing:
- a) All wastewater pumps shall be factory tested in accordance with the ASME Power Test Codes or the Standards of the Hydraulic Institute.
 - b) Five (5) certified copies of the pump curves and data shall be furnished with each pump requiring drive motors 40 HP or smaller.
 - c) For pumps requiring drive motors greater than 40 HP, a witness shop test shall be required and five (5) certified copies of the pump curves, data and report shall be furnished with each pump.
 - d) Each pump casing shall be tested under a hydrostatic pressure of not less than 60 psi.
 - e) All impellers, including spares, shall be statically and dynamically balanced.
 - f) All electric motors shall be tested by the motor manufacturer.
 - g) Routine tests are required for motors rated at 40 HP or less and Witnessed Complete Tests shall be required for motors larger than 40 HP.
 - h) Five (5) copies of the certified or witnessed test data shall be furnished for each motor.
 - i) All pumps operations shall be field tested to demonstrate satisfactory operation.
7. Spare Parts:
- a) Minimum spare parts:

- b) All installations shall be furnished with the following:
- 1) For each pump:
 - I. One set renewable sleeve for the pump shaft.
 - II. One set of gaskets for all pump casing joints.
 - III. One set of wearing rings, complete, for both pump casing and impeller.
 - IV. All parts recommended in the manufacturer's O&M manual.
 - 2) In addition to the above, provide for each different size pump:
 - I. One complete pump, including suction plate.
 - II. One set of each type of bearing used in the pump and shafting.
 - III. One packing gland complete with rings, nuts, bolts, and one box of coil packing (if applicable)
 - 3) For submersible pump:
 - I. One mechanical seal assembly (if applicable).
 - II. One complete pump unit with stand.
 - 4) For motor:
 - I. One set of bearings, complete for each size of motor 30 HP or larger.
 - II. One set of space heaters for each size of motor.
 - III. One set of brushes for each wound rotor motor.
 - IV. One brush holder assembly (for each size of wound rotor motor).
 - 5) For generator:
 - I. All parts recommended in the manufacturer's O&M manual.
 - II. One circuit board for the voltage regulator.
 - 6) For ventilation fan:

I. One set of fan drive belts.

B. Starters and controls:

1. Liquid Level Controls:

- a) The operation of wastewater pump motors shall be automatically controlled by liquid level sensing devices, actuated by wastewater level fluctuations in the wet well.
- b) Ultra Sonic/Transducer type with a 4-20 MA output should be provided.
- c) Automatic control settings shall be manually adjustable.
- d) See “Instrumentation” for acceptable ultrasonic level transmitter manufacture.
 - 1) Duplicate control units shall be provided for all pump stations equipped with split wet-well chambers.
 - I. Controlling devices should also be capable of alternating the lead pump and setting off high and low level alarm.
 - II. The operating range of controlling devices shall conform to the requirements of minimum pump cycle and maximum detention time.
 - 2) A spare controller, identical to the installed controllers, shall be provided to the District.
 - 3) Provide high and low level float level switches (Flygt or equal) for back-up (redundant) control.
 - I. Provide intrinsically safe relays (Gem or equal).
 - II. Provide a stainless steel float switch bracket.

2. Selector Switches:

- a) HAND-OFF-AUTO selector switches shall be provided to operate pumps.
- b) Selector switches shall be located at the motor control panel and watertight switches next to pumps (non-submersible only).
- c) Automatic and manual control for variable speed pumps shall be capable of being adjusted over the effective speed range.

3. Starters:

- a) Unless otherwise restricted by PG&E, starters shall be of the combination, magnetic, across-the-line (full size) NEMA rated (size 1 minimum) type. Starters shall be solid-state.
- b) A spare starter, identical to the installed starter, shall be provided to the District.

4. Motor Control Panels:

- a) Starters shall be mounted and wired as an integral part of free standing, unitized, enclosed control centers.
 - 1) Control panels shall be designed and constructed in accordance with the latest standards of the NEMA and the IEEE.
 - 2) Motor control panels shall be installed to permit full opening of doors without interference from adjoining cabinets, walls or other equipment.
 - 3) Split hinge doors may be used to prevent opening interference.
- b) All major components of motor control panels shall be by one manufacturer.
 - 1) If more than one control panel is to be installed it shall be of the same type and manufacturer who has a qualified electrical service engineer permanently assigned and residing in Northern California.
 - 2) All panel units, devices, indicating lights, and instrumentation shall be identified by engraved nameplates or metal collars.
 - 3) All starters shall be of the draw out type whereby all control wiring and power conductors are automatically disconnected upon removal of the starter.

5. Indicating Lights and Elapsed Time Meters:

- a) Appropriate indicating lights and elapsed time meters shall be installed for each starter.
- b) The running time meters shall be non-resetting, digital display, including a one-tenth hour feature.
- c) Indicating lights should be of the push-to-test type or light emitting diode (LED).

C. Miscellaneous Electrical Equipment:

- 1. Conduit shall be plastic coated rigid steel.

2. Conductors shall be THWN or XHHW.
 3. Seal-off fittings and termination boxes shall be provided.
 4. Enclosures shall be rated NEMA 1 or 12 where mounted indoors, NEMA 4X (Stainless Steel) where mounted outdoors.
 5. All equipment shall be labeled.
- D. Instrumentation, PLC, OIT and SCADA System:
1. SCADA software modifications Instrumentation, Operator Interface Terminals and Programmable Logic Controllers, when required by the District, shall conform to equipment as currently used by the District including Data Flow Systems TCU001 Telemetry Control Unit Pump Controllers, Data Flow Systems OCS RIO032 I/O Cards, Data Flow Systems TACII RTU Systems and Data Flow Systems HyperTACII Software.
 - a) All PLC or Pump Controller and SCADA interface control parameters and alarms shall contain adjustable setpoints, deadbands and timers, as applicable, and be easily modifiable.
 - b) All inputs, outputs, setpoints, timers and other control and monitoring parameters shall be viewable and modifiable at the central computer and locally by the OIT.
 - c) Implement a 20 character PLC tag system.
 - d) Provide five characters for facility location and area identification, ten characters for ISA (5.1)/Agency instrumentation tag description, two characters for the type of point and three characters for the point function description).
 2. Instrumentation:

Pump stations shall be provided with instrumentation, pump controller or PLC and SCADA systems which include the following:

 - a) Telemeter:
 - 1) Discharge flow
 - 2) Discharge pressure
 - 3) Wet well level
 - 4) Run-time pump hours
 - b) Run report-back of operational status:

- 1) Sewage pumps
 - 2) Sump pumps
 - 3) Emergency generator
 - 4) VFD speeds
 - 5) Other items of importance to operations
- c) Alarms:
- 1) Normal power source failure (i.e. low voltage, high and low frequency, or phase reversal)
 - 2) Alternate power source failure
 - 3) Generator operating
 - 4) Low level in wet well
 - 5) High level in wet well
 - 6) Pump Fail (for each pump)
 - 7) High level in pump room sump
 - 8) Other equipment failures which, in the opinion of the District, could endanger pump station operations
 - 9) Diesel Engine Supervision (i.e., starter failure, low speed, low oil pressure, high water temperature, low fuel level (25% capacity etc)
 - 10) Building/Site intrusion or security panel trouble
 - 11) Smoke detector (one for each room) or fire alarm panel
 - 12) Emergency Storage High Level
 - 13) VFD Fault
3. Remote Controls:
When conditions dictate that installations be remotely controlled from supervisory stations, the following additional functions shall be provided:
- a) Report-back:
- 1) Operational status of each pump (running or not running)

- 2) Operational status of any other item of importance to remote control operations
- b) Supervisory remote controls:
 - 1) Start and stop pumps
 - 2) Other functions of importance to remote control operations
- c) Alarms:
 - 1) Warning of transfer to supervisory remote control operations
 - 2) Other alarms of importance to remote control operations
4. Relay to District:
 - a) All readings, alarms, and indications, shall be relayed to supervisory stations designated by the District.
 - b) If a SCADA system is not being utilized, as determined by the District, an auto-dialer (RACO Verbatim - 8 Channel) shall be installed to provide for alarm relays.
5. Suppliers:
 - a) Instrumentation systems should be provided by one integrator with field and shop maintenance facilities and full time service engineers located in the Sacramento area.
6. Flow Meters:
 - a) Flow meter instruments at the pump station shall be capable of totalizing, indicating, and recording flows.
 - b) Record flows locally.
 - c) All sensors for temperature, pressure, flow, and all other dynamic measurement outputs must have 4-20 mA outputs.
 - 1) Provide dry contact flow totalization output.
 - d) Components mounted below grade shall be rated for submergence (NEMA 6P).
 - e) Flowmeters shall be intrinsically safe.
 - f) The Mag Flowmeter, carbon steel, flanged, shall be as manufactured by Siemens Magflo 3100 and 5100 with Mag 6000 Transmitter and

SENSORPROM to store calibration data, the programming and setup data entered during commissioning.

7. Level Meters:

- a) Wet well level meter receiving instruments at the pump station shall be capable of indicating and recording wet well levels.
 - 1) Ultra Sonic/Transducer type with a 4-20 MA output should be provided.
 - 2) Miltronics HydroRanger 200 Plus with appropriate depth sensor.
 - 3) Level sensors shall be intrinsically safe.
- b) Record level locally.
- c) Indicator shall be four inches (4") long or shall be digital with approximately one inch high numerals.
- d) Fuel level (inventory) meter shall be installed in the generator room for diesel fuel tank systems.
 - 1) The fuel level transmitter shall be Flowline with compact junction box or approved equal.

8. Pressure Meters:

- a) Force main pressure meter receiving instruments at the pump station shall be capable of indicating and recording pressure.
- b) Record Discharge pressure locally.
- c) Pressure transmitters shall be suitable for Class 1, Division 1 systems.
- d) Pressure transmitter with display shall be a Siemens Sitrans P300.

9. Electronic Recorder:

- a) Recorder shall be electronic type with month duration, five inch wide visible face of approximately five inches (5").
 - 1) The recorder shall accept up to 4 analog inputs and provide digital indications for each connected input.
- b) Recorder shall be electronic type with a data logger and remote interrogation capabilities acceptable to the District.

- c) Chart recorders shall be manufactured by Chessell Model 392 or equal.

10. Operator Interface Terminal:

- a) Provide programming of the pump controller LED display.
- b) Provide four to twelve different screens to monitor and control the pump station by interfacing with the pump controller or PLC.

- c) Screens:

- 1) Overview Screen

- I. Show the status of the Pumps and indicate alarms, pressures, flow, level, by alphanumeric characters.
 - II. Show process lines graphically.
 - III. Provide method to move to other screens.

- 2) Pumps Screens

- I. Provide all the controls and monitoring including provisions for entering set points and alternation mode for all pumps. Indicate run time, operational status and related alarms.

- 3) Alarm Screen

- I. List all recent alarms.
 - II. Provide provisions for acknowledgement, reset and silence of new alarms.

- 4) Setpoints Screen

- I. Provide a screen for input of all setpoints.
 - II. Include a numeric keypad and all functional requirements.

- 5) All pump controller or PLC information shall be available via the pump controller LED display or OIT.

11. Instrumentation Panels:

- a) All pertinent receiving instruments, devices, alarms, indicating lights, and remote controls shall be mounted on centralized instrument panels.
- b) All items shall be identified with engraved nameplates.

- c) Electrical power to the panel and all instruments shall be through an uninterruptible power supply unit.
12. Indicating Lights and Relays:
- a) Appropriate indicating lights shall be provided to show the status of equipment operation, alarms, controls, etc.
 - b) Indicating lights shall be of the push-to-test type or light emitting diodes (LED).
 - c) All relay types shall contain energized indication.
13. Amperage Meter:
- a) Provide an amperage meter for each sewage pump motor. Amperage metering to monitor all legs and shall monitor Run amps and Start Amps and record this data in a way acceptable to the District.
14. Integrator start-up services and witnessed factory acceptance test.
- a) Provide calibration documentation and set-up sheets on all programmable instruments.
15. Four hours of pump controller or PLC programming in the field during start-up.
16. UPS sized for instruments, pump controller or PLC, and all communications and network equipment.
17. Electronic versions of manuals, documentation and programming.
18. Attendance at a two hour pre-submittal meeting.
19. Provide four hours of training on the pump controller or PLC and OIT and instruments.

Section 4.06 Piping and Valves:

A. Wastewater Pump Piping:

- 1. Piping for wastewater pumps shall 4-inch in diameter minimum.
- 2. Suction piping shall 4-inch diameter minimum.
- 3. Piping shall be as follows:
 - a) Discharge piping shall not be less than four-inches (4") and header (manifold) shall not be less than four inches (4")

- b) . Velocities in wastewater pump:
 - 1) Suction from wet well:
 - I. 5 fps (desirable max.)
 - II. 6 fps (absolute max.)
 - 2) Discharge to header:
 - I. 7 fps (desirable max.)
 - II. 8 fps (absolute max.)
 - 3) Header (Manifold):
 - I. 6 fps (desirable max.)
 - II. 7 fps (absolute max.)
 - III. 2 fps (desirable min.)
 - IV. 1.5 fps (absolute min.)
 - 4) Discharge risers:
 - I. 3 fps (absolute min.)
- c) Pipe and fittings shall be ductile iron, ceramic coated on the inside.
 - 1) Ductile iron pipe shall be Class 52-minimum or equal AWWA rating.
 - 2) Buried pipe and fittings shall be protected on the outside with an approved corrosion protection coating and cathodic protection.
 - 3) Zinc cliomate primer shall be used on the outside for exposed piping to be painted with enamel.
 - 4) Joints shall be flanged with flanges faced and drilled to conform to ANSI Class 125 lb. standard with fill face gaskets.
 - 5) Adequate braces and supports shall be provided for piping to ensure no undue strains are induced.
- d) Piping shall be arranged so that all pumps discharge into a common header.
 - 1) Discharge lines shall not enter headers perpendicularly.

- 2) Base bends, properly supported on concrete pedestals, shall be provided at the bottom of vertical risers.
 - 3) Headers shall be properly blocked to resist water hammer.
- e) Suction lines shall have turned-down bellmouth inlets.
- 1) Bottom of the bellmouth shall not be more than $D/2$ nor less than $D/3$ (in which D is the diameter of the suction bell) above the floor of the wet well.
 - 2) Reducers used on the suction side of pumps shall be of the eccentric type to prevent air pockets.
- f) Gate valves in suction lines shall be provided with extension stems to floor stand operators on the ground level floor.
- 1) Gate valves shall be solid wedge, rising stem type with iron body, bronze trimmed, outside screw and yoke, and flanged ends.
 - 2) Flanges shall conform to ANSI Class 125 lb. standard except where high pressures are encountered.
 - 3) Valve operators for valves 16 inches or larger shall be electrically motorized.
 - 4) All motorized actuators shall have manual operation back-up provisions
- g) Swing check valves shall be provided on the discharge side of pumps and shall be placed horizontally between the gate valves and the pumps.
- 1) Where damaging effects of water hammer are anticipated, valves with controlled rate of closure shall be installed.
 - 2) Swing check valves shall be iron bodied; bronze trimmed with outside lever and weight, and flanged ends.
 - 3) Flanges shall conform to ANSI Class 125 lb. standard except where high pressures are encountered.

B. Sump Pump Piping:

1. All sump pump fixed piping in wet wells shall be schedule 80 PVC and in dry wells shall be brass.
2. A gate valve and check valve shall be installed on the discharge line.

3. Flanged joints or unions shall be provided on the discharge line to facilitate dismantling of the piping.
 4. Minimum diameter of the discharge line shall be two inches (2”).
 5. Velocity in discharge risers shall not be less than 3 fps.
 6. The discharge point shall be installed at the highest elevation possible to prevent reverse flow when the wet well is filled to capacity.
 7. Typical discharge elevation shall be under and close to the ground floor.
 8. The sump pump shall be fitted with a flexible PVC hose, minimum two inches (2”) diameter.
 9. Cam-lock fittings shall be provided for the PVC hose connectors to the pump and fixed piping.
- C. Waste, Drain, and Vent Lines:
1. Pipe and fittings shall conform to UPC standards or local governing authority.
 2. Clean-outs shall be provided as necessary and shall be solid cast brass, rough finish with square heads.
 3. Bronze access frames and covers shall be provided for finish floors and walls.
 4. Frames and covers for wall installation shall be square with polished finish.
 5. Those for floor installations shall be round with scoriated finish.
 6. Cleanouts shall be readily accessible.
- D. Potable Water Piping:
1. Water piping and fittings shall be copper except that water piping one inch (1”) in diameter and smaller within structures shall be Type 'K copper pipe with standard brass fittings.
- E. Sprinkler System Piping:
1. Sprinkler system piping shall be solvent welded schedule 40 PVC. Lawn risers shall be PVC or polypropylene and shrubbery risers shall be galvanized steel.
- F. Piping between Flow Tube and Instruments:

1. Piping between flow-tube to flow transmitter shall be one inch (1") minimum diameter 316 stainless steel.
 2. Horizontal runs shall have a minimum declining slope of one- quarter inch (1/4") per foot from the flow tube to the in-station equipment and shall be permanently supported and braced to prevent sediment traps and/or air pockets.
 3. Piping shall be connected to the flow tube on a horizontal axis.
 4. 316 stainless steel valves, unions and necessary fittings shall be installed close to the flow tube to facilitate maintenance.
 5. 316 stainless steel ball valves, gate valves, unions, tees and elbows shall be used on the entire system.
 6. Flow transmitters and diaphragm seals shall be installed inside the pump station and mounted for easy maintenance access.
- G. Pipe Sleeves:
1. Pipe sleeves shall be provided whenever small piping passes through concrete walls.
 2. Wall pipe shall be used for larger piping.

Section 4.07 Emergency Provisions:

Emergency facilities shall be provided to protect pump stations and the community from possible damages that may result from power failure, emergency maintenance shutdown, pumping capacity being exceeded, or other unforeseen circumstances.

- A. Standby Electric Power Equipment:
1. Stations shall be equipped with a generator(s) to provide electric power to pump the design flow.
 2. The generator shall be LPG, natural gas or diesel powered as approved by the District.
 3. The generator's synchronous speed shall be 1800 RPM.
 4. The engine- generator set shall be a new, standard, current model and in accordance with ANSI and NEMA standards.
 5. Provide hardwired and/or communication connections for telemetry status interface.
 6. The unit shall be manufactured by Onan, Kohler or Caterpillar.

7. Provide vehicular access including a pad for a portable generator.
8. If required the fuel day tank of approved capacity, shall be equipped with two fuel pumps with a manual feature for automatic primary and standby operations.
9. The generator may be housed in the superstructure if space permits or in a separate accessory building.
10. In all cases, noise levels shall comply with local governing authority.
 - a) Operation of the emergency facilities shall be automatic upon power failure.
 - 1) Power failure monitors shall monitor all three phases.
 - 2) Monitoring of one phase of a three-phase system is not permitted.
 - 3) Telemetry interface shall consist of hardwired and/or network communication connections.
 - b) Automatic transfer switches shall conform to PG&E requirements.
 - 1) When possible, bypass of the automatic transfer switch and manual override of automatic functions shall be provided.
 - 2) Telemetry interface shall consist of hardwired connection.
 - 3) Programmable exerciser feature shall be as approved by the District. Provide ASCO 7000 Series or equal.
 - c) A plug for connection of a portable load bank shall be provided to fully load the generator periodically.
 - 1) The connection shall be made to the generator side of the transfer switch via a circuit breaker.
 - 2) This connection can also be used to connect a portable generator when the installed generator is not available for service.
 - d) Telemetry and SCADA systems shall be powered through an uninterruptible power supply or battery backup unit.
 - 1) The uninterruptible power supply or battery backup system shall be sized to furnish emergency power for 30 minutes minimum when standby generator is present or 120 minutes minimum when no generator is present.

- e) All switches, plug connections, circuit breakers, etc. shall be properly, clearly and permanently identified in a manner acceptable to the District.
- f) Provide eight hours of start-up services and eight and four hours of training.

B. Fuel Storage System:

- 1. The system shall comply with Federal, State and District regulations.
- 2. The fuel tank capacity shall be based on two (2) days at design sewage flow and five (5) days at the daily average flow.
 - a) However, the fuel tank shall not be smaller than 100 gallons.
- 3. Underground fuel tank installation shall be designed to prevent surface water infiltration into the fuel tank system.
 - a) A leak alert monitor shall be provided with capabilities to display fuel inventory, and with audio and visual leak alarms.
- 4. Above ground fuel tanks shall have District-approved spill containment system with a capacity 10% greater than the capacity of the fuel tank.

C. Portable Pump Facilities:

- 1. Pump stations shall be equipped to pump wastewater from the wet well into the force main with a portable pump.
 - a) This shall be accomplished by providing fixed discharge and suction piping for the portable pump with connections to the force main and the wet well.
 - b) The portable pump discharge piping shall be connected to the downstream side of the flow meter tube and shall include a gate valve, 90-elbow, flanged reducer, and a blind flange.
 - c) The suction piping shall be connected to the wet well and shall include piping with a 90-elbow and a blind flange.
 - d) All piping for the portable pumps shall be sized with consideration to the capacity of the installed pumps and the operating characteristics of the available standby pumps.
 - e) Portable pumps shall be located near the wet well to minimize the possible occurrence of cavitations.
 - f) Provide vehicular access including a pad for a portable engine-driven Pump.

2. A bypass manifold shall be installed per Standard Drawing No. 19 and shall be constructed of the same type and size materials used for the station's discharge piping.
 - a) All cam and groove quick-connect couplers shall be interchangeable with all products produced to MIL-C 27487F specifications.
 - b) The District shall specify size, style and material of cam and groove coupling.
 - c) Discharge connection shall be located within the pump station fencing and be readily accessible.

D. Emergency Storage:

1. Emergency storage volumes shall be evaluated and approved by the District.
2. Emergency storage tanks shall be based on minimum 2-hour downtime at peak flow, or as required by the District.
3. An overflow basin may be required as determined by the District.

Section 4.08 Miscellaneous:

A. Potable Water Supply:

1. All pump stations shall be provided with a potable water supply system for sanitary fixtures, landscape irrigation, wash down, and other maintenance purposes, as required.
2. The main water supply line and meter shall be sized for the application intended at ultimate build out, as determined by the District, and shall be equipped with a master valve and RP device located within the station's perimeter fence.
 - a) All above-ground water facilities shall be protected by a properly sized water blanket.
3. Adequate and conveniently located water outlets shall be provided for flushing and washing purposes.
 - a) Hose bibs shall be 3/4-inch with vacuum breakers at all floor levels and outside of pump station.
 - b) Stop cock valves shall be provided immediately before each hose bib located within the building.
4. Two conveniently located 1-1/2 inch diameter standpipes shall be provided adjacent to the wet well.

- a) The standpipes shall have 1-1/2 inch angle globe valves for National Standard fire hose thread and end cap with chain.
 - b) A 3/4-inch hose bib with vacuum breakers shall be installed on the standpipe directly below the 1/2 inch globe valve.
5. Under no circumstances shall potable water supply be directly connected to sewage pumps or piping. Seal water, positive air gap and/or pneumatic water tanks shall be provided as necessary.
- a) The potable water supply system shall conform to District, State, and Federal codes and regulations.
- B. Building:
1. Pump station buildings shall have maintenance-free colored exterior finish, subject to District approval.
 2. District may, at its own discretion, approve a painted exterior finish.
 - a) Painting shall be in accordance with the best practice and in strict compliance with the paint manufacturer's instructions and recommendations.
 - b) No lead-based primer or paint shall be used.
 - c) A minimum of two (2) finish coats over one prime coat shall be required.
- C. Corrosion Protection:
1. All materials and equipment exposed to corrosive conditions shall be either corrosion resistant or protected with appropriate protective coatings or linings, as approved by the District.
- D. Odor Control:
1. At the direction of the District, a system will be required which will control odors generated as a result of the pump station installation and operation.
 2. Methods of odor control shall include but not be limited to, injection of enzymes, bacteria, aeration, hydrogen peroxide or odor stripping media.
 3. District approval is required for any and all method of proposed odor control.
 4. All stations shall be provided with a 6-inch wet well vent pipe to be used for treatment of odors.

- a) The vent pipe shall be schedule 40, 316 stainless steel, permanently installed through the wet well slab and covered with a blind flange.
5. A duplex electrical receptacle, GFCI, at appropriate voltage, shall be installed to operate odor control equipment.

Section 4.09 Other Requirements:

A. Labeling:

1. All station facilities shall be properly and permanently labeled in a manner acceptable to the District.

B. Revisions to Approved Plans and Specifications:

1. Any deviations from these specifications shall be approved in writing before such changes are made.
2. Any deviations shall be submitted well in advance of any construction work which will be affected by such changes to permit sufficient time for review and approval.

C. Operation during Construction:

1. Existing facilities and pump station units shall be kept in operation during construction.

D. Equipment Manuals:

1. Three (3) Equipment manuals shall be provided for each pump station.
2. The manuals shall contain sufficient information on the installation, operation, maintenance, and repair of the pump station equipment.
3. Manuals shall be bound in loose-leaf "D" binders.
4. Folders shall contain only the information in relation to the equipment furnished.
5. Each binder shall be labeled on its front cover and spine with the name of the facility and subject matter.

E. Facilities Operations and Maintenance Manual:

1. Three (3) detailed operations and maintenance manual for the facilities to be constructed shall be required for all pump station projects.
2. The manual shall give the operations and maintenance personnel the proper understanding, techniques, and any other information necessary to efficiently operate and maintain the facilities.

3. An emergency response plan, including a Spill Prevention Plan, shall also be provided to provide instructions to the operator on how emergencies are to be handled.
 4. Three (3) sets of manuals shall be provided to the District.
 5. Operations and maintenance manuals shall comply with all applicable State and Federal statutes, ordinances, and regulations.
- F. Initial Start-Up Procedure Training:
1. Services of field engineers or qualified personnel for all equipment provided shall be required to assist and instruct the District's operating and maintenance personnel.
 2. Such services shall commence before final acceptance testing.
 3. Three (3) sets of manuals shall be provided to the District.
- G. One Year Certification:
1. A certification shall be prepared after one year of facility operation documenting the performance of the facility.
 2. This certification is intended to confirm that the facility is operating as planned and there are no problems with the equipment.
 3. The certification shall be prepared by the facility designer, construction manager, or other qualified person approved by the District.
 4. Any deficiencies shall immediately be corrected by the developer, at his expense.
- H. Warranty:
1. Warranty for lift stations and all related appurtenances shall be for 18 months.

Section 4.10 Force Mains:

- A. Locations:
1. Force mains shall be located in streets and along road rights-of-way, or in separate dedicated sewer easements.
 2. In locating force mains, ease of installation and maintenance and elimination of high points shall be considered.
 - a) Air release valves shall be installed only as approved by the District.

b) Valves shall not be placed in such a way that access is hindered by traffic.

3. Dual force mains may be required by the District.

B. Sizing:

1. Force mains shall be sized not less than four inches (4") in diameter.

2. Velocities in force mains shall be as follows:

a) Minimum: 2.5 fps

b) Maximum: 10.0 fps

3. Force mains shall be designed to carry the maximum rate of pumping without excessive frictional head loss.

C. Materials:

1. The material selected shall be adapted to local conditions with special consideration given to the quality of wastewater, possible septic conditions, soil characteristics, internal pressure, abrasion, external loadings, foundations, necessity of reducing the number of joints and other similar problems.

2. Corrosion resistant lining, coating, wrapping, and cathodic protection shall be used when corrosion protection is required.

3. Insulating flanges or fittings may be required at entrance or exits from buildings.

4. The following material is acceptable for force mains subject to the conditions indicated:

a) Ductile Iron Pipe (Protecto 401 or other approved lining)

1) Ductile iron pipe shall be tape wrapped and have cathodic protection where the force main may be subjected to external corrosion.

b) PVC C-900

1) Pressure rating shall be 150 psi minimum.

D. Minimum and maximum Cover and Clearances:

1. Shall conform to the requirements as set forth in Section 3 of these Standards.

E. Alignment and Grade:

1. Pipe shall be laid in a straight alignment and with constant grades.
2. Force mains may be curved by deflecting the joints to eliminate the necessity for fittings.
3. In no case shall the deflection exceed the maximum as set forth by the manufacturer for the type of pipe used.
4. Fittings shall be used when alignment or grade changes cannot be accomplished by joint deflection.
5. Fittings shall be long sweep as approved by the District.

F. Appurtenances:

1. Air Bleeders:
 - a) Air bleeders and valves shall be provided at high points.
 - b) A corporation stop shall be provided at the force main connection.
 - c) Valves shall be non-corrosive.
2. Blow Offs:
 - a) Blow off valves and vaults may be required where sedimentation may occur.
3. Emergency By-Pass:
 - a) Emergency by-pass facilities shall be provided.
4. Force Main Valves:
 - a) The force main shall be provided with a means to drain the line into the wet well.
 - b) In-line shut off valves, or other valves may be required at the discretion of the District.
5. Pigging Stations:
 - a) Pigging Stations may be required to be installed at the station, intermediate locations and the discharge point.
6. Locating Cable:

- a) Direct burial locating cable shall be laid on top of and secured to force mains before backfilling as directed by the District.
- b) The cable shall be as described in Section 2 of these Standards and shall be tested for continuity before acceptance.
- c) Junction box(s) shall be placed at turns in the force main and, in no case shall cable extend beyond 500 feet without a junction.
- d) Junction box shall be Christy G-5, identified as "Sewer" and shall be located in accordance with local governing authority and approved by the District.

7. Marking Tape:

- a) Marking tape, identifying the facility as Sewer shall be placed one foot above and directly over all force main piping.

G. Structural Considerations:

1. Pipe Loads:

- a) Force mains shall be designed to withstand all internal and external forces to which they may be subjected.
- b) Internal forces will be the pressure from the wastewater and the water hammer effect.
- c) External forces shall consider loads due to Trench backfilling and superimposed uniform and concentrated loads.

2. Foundation:

- a) Soil conditions shall be determined by test borings.
- b) Beddings shall be designed to adequately support pipe and minimize settlement.
- c) Bedding shall be imported material of sand or decomposed granite with 90% passing $\frac{3}{4}$ sieve and 100% passing the 1" sieve.
- d) Free of vegetative material.
- e) 90% compaction.

3. Reaction Blocks and Anchorage:

- a) Reaction blocks and anchorage shall be provided at bends and fittings and may be required at joint deflections.

4. Restrained joints may be required as determined by the District.

H. Termination:

1. Force main discharge outlets shall be designed to minimize turbulence and sulfide release and be submerged at all times.
2. The interior surface of the outlet manhole and first downstream manhole shall, at a minimum, be protected with a lining as specified in Section 2 of these Standards.
3. The severity of odors at the discharge outlet and its treatment shall be considered.
 - a) A suitable odor control means shall be submitted to the District for approval.
4. Gravity connections to the force main discharge manhole and sewer service connections to the first leg of the gravity line exiting the discharge manhole will not be permitted unless approved by the District.

Section 4.11 Performance Requirements:

The work performance for the construction of wastewater pump stations designed under these Standards shall consist of furnishing all labor, materials, tools, equipment and incidentals in constructing a complete and operational sanitary sewer lift station as shown on the design plans and as required by these specifications, including but not limited to the following: wet well, pumps, piping, utilities, electrical wiring and control systems, dry pit, force main, force main discharge manhole, generator for backup electrical power, buildings and station facilities.