

GUIDELINES FOR WASTEWATER PUMP STATION DESIGN AND PLAN SUBMITTAL PROCEDURES



LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS
WATERWORKS AND SEWER MAINTENANCE DIVISION

JUNE 2005

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A. INTRODUCTION

The Los Angeles County Department of Public Works (Department) currently operates and maintains about 154 wastewater pump stations throughout the county. Pump station maintenance is handled by the Sewer Maintenance Branch of the Department's Waterworks and Sewer Maintenance Division (Sewer Maintenance). To minimize maintenance problems, it is the policy of Sewer Maintenance to review all plans for proposed pump stations and inspect the completed work prior to accepting the pump station for maintenance.

The purpose of this manual is to recommend the minimum acceptable design and plan submittal requirements for all wastewater pump stations to be maintained by Sewer Maintenance. Conformance to the recommendations set forth herein will expedite the processing and checking of plans.

These guidelines do not apply to proposed pump stations in incorporated cities that do not contract with the Department for maintenance or to regional pump stations that will be maintained by sewer outlet agencies such as the Los Angeles County Sanitation Districts or the Las Virgenes Municipal Water District.

Plans for pump stations located within the unincorporated portions of Los Angeles County or in cities that contract with the Department for engineering services shall be processed through the Land Development Division of the Department. Land Development will coordinate the plan review and approval with the appropriate Divisions within the Department (Land Development, Design, Operational Services, Building and Safety, Construction, and Sewer Maintenance). Plans for non-contract cities (cities that contract with the Department for sewer maintenance only) shall be checked and approved by the City's engineering staff for design and Sewer Maintenance will review plans from the standpoint of maintenance.

The design of any particular station depends on many parameters such as population being served, nature of waste being pumped, zoning, and other local conditions. Also due to new materials, equipment, safety, and environmental requirements, pump station design requirements are continually evolving. Therefore, the design engineer shall exercise caution and good professional judgment while using the information provided in this document and consult with the appropriate representatives of Sewer Maintenance, the Department, and non-contract cities on any recent changes in requirements.

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B. GENERAL PROVISIONS

1. Area Study

An area study in accordance with the Department or city requirements shall be prepared and approved by the Department or city. The area study must address drainage basins as a whole including existing, proposed, and future tributary areas, sewers, and pump stations. Information shall be provided verifying adequate downstream sewer capacity.

Due to the high cost associated with maintaining pump stations, Sewer Maintenance will only consider maintaining a new pump station when there is no other feasible gravity sewer option. The use of a pump station to serve a small number of homes, to serve fragmented development in lieu of extending a local/trunk sewer, or to otherwise circumvent orderly sewerage of a drainage area is not acceptable. The area study and other pertinent information must demonstrate the necessity of the pump station.

2. Required Permits

A sewer construction permit is required for the pump station and force main from either the Department or the city, depending on the location of the pump station. Other permits include, but are not limited to: building, electrical, and plumbing permits; Fire Department permit for an above ground storage tank, if applicable; Air Quality Management District (AQMD) permit to construct and operate an internal combustion engine for the diesel generator; Cal OSHA tank certification, if applicable; etc.

3. Codes and Requirements

- a. The preparation and processing of all plans and construction of wastewater facilities shall comply to the Title 20, Division 2, of the Los Angeles County Code and the Standard Plans and Specifications for Public Works Construction (latest edition).
- b. Buildings and canopies shall meet all Building, Electrical, Mechanical, and Fire Code requirements. All structures, equipment, and piping shall be designed to remain functional when subjected to the minimum earthquake forces prescribed for Essential Facilities by the Uniform Building Code and applicable supplements
- c. All electrical plans must show compliance with the National Electrical Code (NEC).
 - i. Wet wells shall comply to Class 1 Division 1 of the NEC Code.
 - ii. Valve vaults and dry wells shall comply to Class I Division 2 of the NEC Code.

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- iii. All pumps, motors, disconnect panels, control panels, sensors, and other electrical devices must be approved by a testing laboratory acceptable to and listed with the County, such as Underwriters Laboratory (U.L.) and Factory Mutual (F.M.). It is suggested that the design engineer contacts the Building and Safety Division-Electrical Section for current listings.
- d. All motors shall be of nationally known manufacturer and shall conform to National Electrical Manufacturers Association (NEMA) standards and specifications.
- e. All facilities are subject to the requirements of Electrical Safety Orders and General Industry Safety Orders (CCR, Title 8, Chapter 4), issued by the Division of Occupational Safety and Health, State of California (CAL- OSHA).
- f. Electrical panels, compressors, blowers, and other equipment shall be located inside an operations building. The emergency generator shall be located either inside the operations building or outside under a canopy. All buildings, canopies, vaults, wells, equipment, piping, controls, junction boxes, hatches, doors, and access shall be designed, sized, and located to facilitate the maintenance and removal of electrical and mechanical equipment and piping appurtenances.
- g. The pump station must be located on a dedicated lot/area with an easement to the county (unincorporated) or city (incorporated). Pump stations shall not be located in the street right of way. The facilities shall be secured by a minimum eight-foot high block wall and accessible by a lockable 20 foot wide gate of the same height. The site shall be sized and arranged to provide sufficient and easy access to equipment and facilities by large maintenance vehicles, including boom and sewage vacuum trucks. The site access must be designed to allow a maintenance vehicle to pull completely onto the site access road or site fronting area without impeding traffic and with the site gate closed. A minimum of one large parking space shall be provided on the site if street parking is available fronting the station, otherwise a minimum of two large parking spaces shall be provided on the site. The facilities shall be screened from public view to the greatest extent practicable by topographic and/or vegetative means. Vegetative screening must be on adjacent property and maintained by a landscape maintenance district, homeowners association, city department, or other entity acceptable to Sewer Maintenance. The facilities shall be located at least 50 feet from any residential or commercial property line.

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- h. Equipment and structures shall be designed to meet the following noise requirements:
 - i. The noise level inside buildings, vaults, dry pits, and other enclosed areas where workers have access shall not exceed 80 dBA with all equipment in operation and no more than three feet from the loudest equipment. A higher noise level may be allowed in the equipment room when the emergency generator is in operation.
 - ii. Exterior noise shall not exceed county (Title 12 of the County Code) or city standards, whichever is more restrictive. The nighttime standards, as measured at the surrounding property lines, must be met with all primary equipment in operation under load, including the emergency generator.
 - iii. Calculations regarding anticipated interior and exterior noise levels shall be provided with plans for review. The interior and exterior noise shall be tested to show compliance with these requirements. The tests shall be conducted and certified by an individual experienced in such testing. The certified tests must be provided to Sewer Maintenance prior to acceptance for maintenance.
- i. The pump station facilities and equipment shall be designed to remain operational and accessible during the 100 year storm/flood. Storm/flood elevations shall be shown on the grading and drainage plan.
- j. Materials of construction shall be utilized that are appropriate under conditions of exposure to hydrogen sulfide and other corrosive gasses, greases, oils, and other constituents frequently present in wastewater. Contact between dissimilar metals should be avoided or other provisions made to minimize galvanic corrosion. All anchor bolts/nuts/washers shall be type 316 stainless steel. Where stainless steel is specified in this manual it shall be type 316 or 316L unless otherwise approved by Sewer Maintenance.

4. Plan Preparation

- a. Pump station plans shall be prepared on a 32" x 22 ½" sheet including a ¼" border with a 1 ½" border at the left edge of the sheet. Each sheet shall contain the project identification number and station name. The station will generally be named after the street fronting the station. Consult Sewer Maintenance before naming station.
- b. Pump station and force main plans shall be submitted together as a single plan set. The force main plans shall comply with Department and city requirements and format and precede the pump station plans in the plan set. The force main plans will generally follow the same format as gravity sewer plans. The pump station plans shall also include the following items:

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- i. Index Map: An index map shall be provided showing and identifying the entire service area, tributary sewers, outlet sewers, pump station(s), force main(s), tract boundaries, city boundaries, and streets. A north arrow, map scale, and Thomas Guide page number(s) shall be included.
- ii. Area Map: An area map shall be provided for the site and neighboring properties showing: property identification/boundaries, land use type, topography, drainage, pad locations, existing/proposed structures, streets, walls, sewers, utilities, and any proposed topographic or vegetative site screening features. Map should be 1" = 20' scale or larger and include a north arrow.
- iii. Site Layout: The site layout shall show the site and facilities, including: wet well, dry well, valve vault, building, canopy, control panel, compressor, blowers, generator, transformer, junction/disconnect boxes, utilities, underground piping/conduit, force mains, thrust blocks, sewers, manholes, vents, hatches, doors, barrier posts, perimeter wall, access gate/road, parking, easements, property/subdivision lines, boring locations, and other pertinent site layout information. Provide dimensions and elevations to adequately locate all facilities. Easement boundaries shall be per metes and bounds. Underground piping and conduits should be shown on a separate Utility Plan if inclusion on the Site Plan would result in cluttered or illegible information. Layout should be 1" = 5' scale or larger and include a north arrow.
- iv. Drainage and Grading: A drainage and grading plan shall be provided including information on cut/fill, site drainage, outlet point for drainage, and showing elevations of site, facilities, and 100 year storm/flood lines.
- v. Details: Detailed civil, mechanical, structural, architectural, and electrical plans shall include plan views, elevations, sections, supplementary views, diagrams, dimensions, and other pertinent information which, together with the materials list and notes, fully describe the facilities to be constructed.
- vi. Materials List: This will constitute a list of all the equipment, piping, and materials to be used, specifying quantity and types.
- vii. Notes: Plans must show the general, civil, mechanical, structural, electrical, and construction notes, and the list of all applicable standard drawings.
- viii. The plan shall include a signature block for the Department of Public Works on the pump station title sheet. Signature block details will vary depending upon the jurisdictional location of the proposed pump station. Consult the Department for requirements.

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- ix. All plans must be signed by a registered civil engineer licensed to practice in the State of California. The electrical plans must also be signed by a registered electrical engineer licensed to practice in the State of California.

C. DESIGN DETAILS

Prefabricated package pump stations are not acceptable. Custom built or built-in-place stations are required. In this section, a check list of some design and construction considerations are presented.

1. Structural Design Calculations

- a. The recommended design stresses are as following:
 - i. Ultimate concrete stress f'_c equal to 4,000 psi.
 - ii. Allowable concrete stress f'_c equal to 1,350 psi with an 'n' value equal to 9.
- b. Bond and shear shall comply with the latest edition of the American Concrete Institute Code (ACI).
- c. All bar laps shall be 30-diameter minimum.
- d. Steel reinforcement adjacent to earth and wet well shall have minimum 3" cover of concrete. For all other reinforcements, a minimum 2" cover of concrete shall be required.
- e. Geological report and recommendations for the pump station and force main shall be provided. Report must also address corrosive soils and protective measures for concrete and underground piping.
- f. Results of test hole(s) at the pump station site and along the force main alignment reporting the soil and perched water conditions and the ground water elevations shall be submitted.
- g. The calculations for flotation, moment, and shear magnitudes and locations shall also be submitted.
- h. Force main load, surge, and restraint calculations shall be submitted.
- i. Structural and seismic calculations for all structures, buildings, canopies, equipment, and piping shall be provided.

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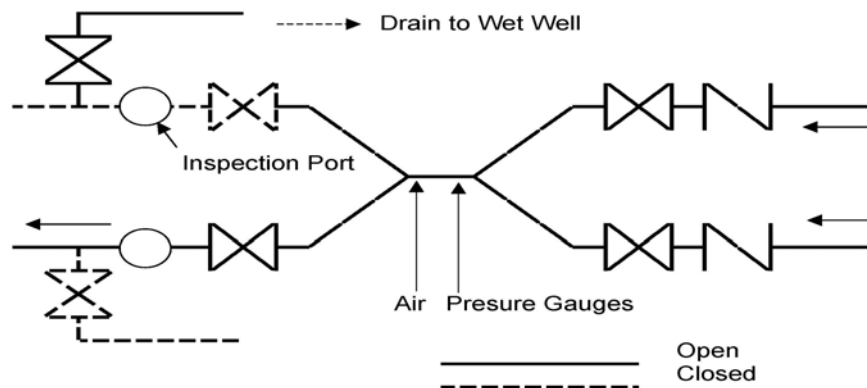
2. Other Calculations

- a. The anticipated quantity of wastewater and the tributary area being served or that could be served by the proposed station shall be submitted. Provisions for handling low-flow start-up conditions shall be addressed.
- b. Calculations showing the maximum and minimum static head, head loss due to friction in the force main and fittings, the total dynamic head, and water hammer/surge pressure shall be submitted.
- c. Calculations on the wet well design capacity, the high and low water levels, lead and lag pump start levels, pumping cycle, and emergency storage capacity shall be submitted.
- d. Peak gravity flow shall be calculated per Section 20.32.440, Title 20 Division 2 of the county code or by multiplying approved unit flow factors by 2.5, whichever is greater. The unit flow factor for single-family residences shall not be less than 300 gallons per day.
- e. The pumps and force main shall be designed for a minimum of 1.5 times the peak gravity flow. The wet well operating cycle volume and emergency holding capacity shall be designed using peak gravity flow.
- f. If one pump station and force main system discharge into a second pumping system, the second station shall be designed for 1.3 times the peak gravity flow from the first station plus any additional peak gravity flow to the second station. The 1.3 factor need not be used in sizing the emergency holding capacity.
- g. Calculations on sizing of safety ventilation equipment and ducting for valve vault and dry well shall be provided. Calculations on the sizing of control room, equipment room, and dry well temperature control ventilation shall also be provided.
- h. Calculations or other information regarding the anticipated interior and exterior noise levels of equipment.
- i. Calculations on the sizing of all major equipment shall be provided (pumps/motors, compressors, generator, odor control, etc.).
- j. Provide other calculations as required in these guidelines and as requested by the Department or city engineer.

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3. Force Main

- a. Force main shall be made of ductile iron. Pipe class shall be determined by design but shall not be less than class 52. The entire length of pipe shall be distinctively marked to identify it as carrying sewage.
- b. All buried pipe shall be designed for H-20 traffic load with minimum of 4-feet of cover. Only restrained mechanical joints and couplings are acceptable for buried pipe. There shall be no pulling of joints at angle points.
- c. The ductile iron pipe and fittings shall be asphaltic coated on the exterior and lined in the interior with factory-applied PROTECTO 401 ceramic epoxy or approved equal. Buried ductile iron pipe, fittings, and couplings shall be wrapped with polyethylene film in tube form.
- d. Dual force mains are required on all stations. Each force main shall be designed to carry the design pumped flow individually and be equipped with valves and piping to allow each force main to be isolated and drained back to the wet well. Inspection ports shall be provided for each force main. See diagram below for general piping/valve configuration concept. Force mains shall be bedded side-by-side with a minimum 2-foot horizontal separation.



DUAL FORCE MAIN PIPING/VALVE CONFIGURATION

- e. Thrust blocks, per Los Angeles County Department of Public Works Standard W-21, shall be provided at all changes in alignment of the force main.
- f. High points and points of slope change shall be eliminated to the greatest extent possible. Where high points can not be eliminated, they shall be vented with proper and adequate sewage air release/vacuum valves. The valves shall be made in cast iron with minimum of 2" NPT inlet. Air release valves shall be provided with activated carbon vent canisters. Vaults acceptable to Sewer Maintenance shall be provided for each air vent location. Design calculations on sizing of force main venting valves shall be provided.

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- g. Minimum force main diameter shall be 4-inch.
- h. The flow velocity in the force main shall be 3 feet to 6 feet per second.
- i. Provide water hammer analysis and protection when necessary. All piping in wet wells and vaults shall be properly supported and braced against surge pressures.
- j. A minimum 20-foot wide sewer easement, dedicated to the city or county shall be provided along the force mains. The force mains shall be centered in the easement. Permanent access for large maintenance vehicles shall be provided along the entire length of the force main and clearly identified on the plans.
- k. There shall be no direct house lateral connection to force mains.
- l. A minimum of 4-foot distance shall be maintained between force mains and gravity line.
- m. Sewer force mains shall not be located within 10-foot of any water main for parallel construction. Perpendicular construction of force mains in the vicinity of water main shall comply with Los Angeles County Department of Public Works-Standard Plans 2100-1.
- n. Separate air injection into each force main shall be provided at the beginning of the force main and at mid-point of force main, or approximately spaced at 2,000 feet. Vaults acceptable to Sewer Maintenance shall be provided for each air injection location.
- o. Force main discharge shall terminate in a manhole channel above the peak flow line in such a fashion as to merge smoothly with existing flows and to minimize turbulence. Details on the manhole channel and merge shall be provided on the force main plans. To the greatest extent possible, the termination manhole/structure should be located away from homes, businesses, and other areas where the public may object to odors.
- p. The force main header shall be provided with a pressure gauge and pressure transducer. Pressure gauge shall be glycerin-filled, 6-inch white dial, stainless steel type properly scaled for the expected pressure range. Pressure transducer shall be a Druck PTX 1225 pressure transmitter, or approved equal. Proper isolation valves and disconnects shall be provided to remove devices for repair or replacement. All instruments, gauges, piping, fittings, and valves shall be suitable for a wet corrosive atmosphere.

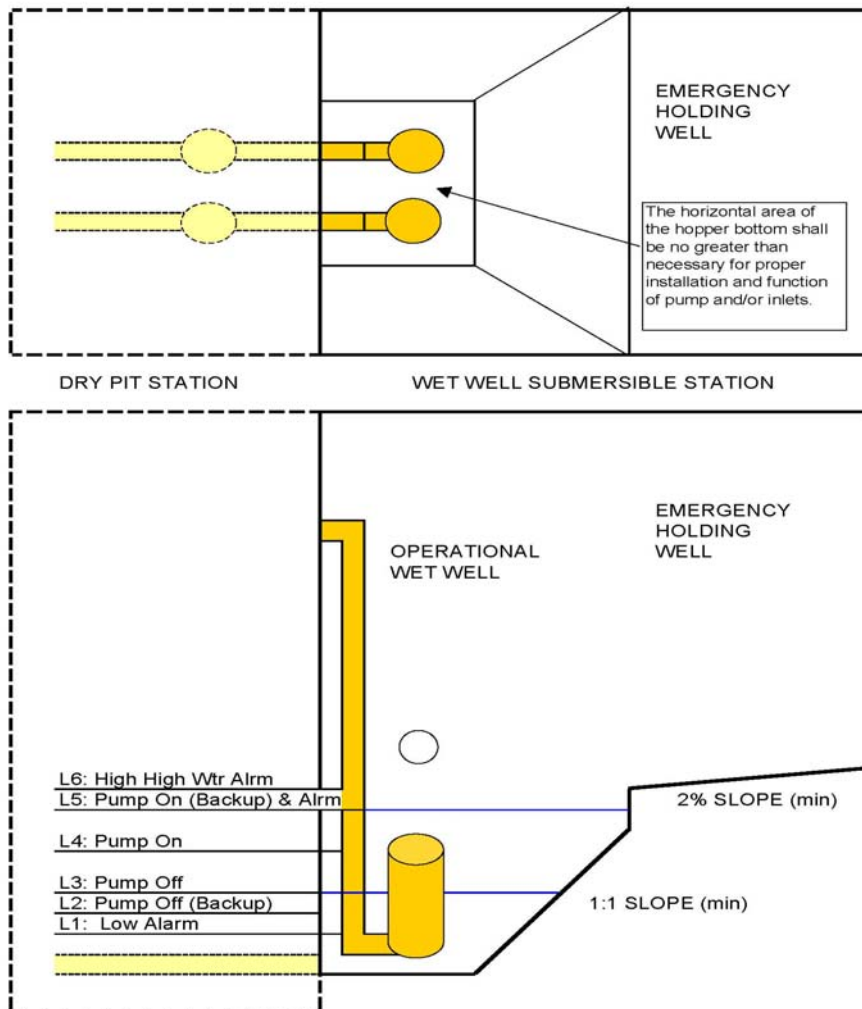
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4. Wet Well

- a. Wet well submersible pump stations are allowed for pumps below 40 horsepower (hp), if there is direct access to the wet well by a truck with a back-loading crane. If there is no direct access to the wet well for a back-loading crane, the maximum allowable pump size shall be 20 hp.
- b. Wet well submersible pump stations are not allowed for service areas or future service areas that would include any industrial zones, where the total dynamic head of the station is greater than 150 feet, or where the design flow is greater than 500 gallons per minute.
- c. Pump stations with design flows greater than 1,000 gallons per minute shall be provided with divided wet wells to facilitate repairs and cleaning. Divided wet wells shall include all necessary and convenient corrosion resistant diversion and interconnection provisions. On stations without a divided wet well, a 60-inch diameter manhole on the inlet sewer shall be provided within the site grounds or beside the access road that can be used as a temporary storage/haul point during wet well repairs. The manhole shall be located to allow unimpeded vehicle access into the station.
- d. The wet well operational area and distance between the lead pump start and stop elevations shall be sized to allow a minimum of 10 minutes between successive starts (6 starts per hour) at peak flow. Other levels should be established as follows for a standard duplex pump station. Additional levels will be necessary for larger pump stations with more than two pumps. All levels shall be shown on the wet well elevation view in plans. Intermediate levels for variable pump rates should be established in consultation with Sewer Maintenance.
 - i. L1 - Low Level Alarm: Based on pump manufacture's recommended minimum level for pump operation.
 - ii. L2 - Pump Off (Backup Control): The back-up float system Pump Off level should be established midway between L1 and L3.
 - iii. L3 - Pump Off: Based on submersible motor manufacture's minimum submergence for cooling, but not less than 6-inches above L1.
 - iv. L4 - Pump On: Based on level necessary to allow a minimum of 10 minutes between successive starts, but not less than 12-inches above L3.
 - v. L5 - Pump On (Backup Control) and Local High Water Alarm: Should be above L4 a distance of half of L3 to L4, but not less than 12-inches.
 - vi. L6 - Remote High Water Alarm: Should be a minimum of 6-inches above L5.

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- e. Wet well shall also be designed for a minimum 2 hours of emergency holding capacity at peak flow. Longer holding times may be necessary for remotely located stations and should be verified with Sewer Maintenance prior to design. The volume of emergency storage in the wet well shall be calculated from the level of the remote high water alarm (L6) to the wet well rim or lowest manhole top in the collection system, whichever is lower. The wet well rim or lowest manhole top shall be lower than the lowest structural pad elevation of any property connected to the sewer.
- f. If the required emergency storage volume would result in an oversized operational wet well area or a wet well depth exceeding 25 feet, the emergency holding capacity shall be provided in a raised extension of the wet well. The bottom of the emergency holding well shall be level with the High High Water Alarm (L6) at its lowest point and include a minimum slope of 2 percent draining back to the operational wet well. Refer to diagram below for general concept.



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- g. Wet well shall be a reinforced concrete structure for the containment of wastewater. The structure shall be watertight, lined/coated for corrosion prevention, and designed for H-20 loading. Provisions against floatation shall be evaluated and provided when necessary. Wet well lining/coating and leakage test requirements shall be included on plans. Wet well, as a minimum, shall be 60-inch inside diameter. Circular wet wells shall not exceed 108-inches inside diameter. Wet well depth shall not exceed 25 feet. The wet well floor shall have a minimum one to one slope to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the pump inlet(s).
- h. Adequate personnel and equipment removal access shall be provided to wet wells and emergency holding wells. Sufficiently sized and located access hatches shall be provided for the removal of all pumps, sensors, and equipment. Access hatches shall meet the requirements of Section 7. A minimum of two personnel entry points shall be provided unless the wet well is too small to feasibly include a second entry point. One of the entry points shall be located at the top of the emergency well slope and equidistantly spaced along the width of the well. Additional entry points shall be provided for large wet wells (>15' wide/long). It is recommended that the designer discuss access provisions with Sewer Maintenance prior to design of the wet well.
- i. The wet well shall be provided with 316 stainless ladder or steps at each entry point. Step spacing shall be 16 inches.
- j. Wet well shall be properly aerated. Aerated jet shall be sized to supply a minimum of 2 cubic feet per minute (CFM) per 1,000 gallons of standard operating volume and mounted 2 inches from the wet well bottom. The air for the wet well shall be supplied through a perforated stainless steel pipe with T-shaped header.
- k. The wet well shall be provided with a vent line located away from electrical equipment and drivable access and in a position that would facilitate the addition of air extraction/treatment equipment. The vent line shall terminate above ground with a flanged connection and screened vent dome.
- l. Additional odor control provisions, besides wet well/force main aeration, may be required depending on various factors. It is recommended that odor control provisions be discussed with Sewer Maintenance during preliminary design.

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- m. A 1½" or 2" diameter water service line with backflow prevention device shall be provided within the fenced site. Automatic wet well wash down piping complete with solenoid valve, air-gap, and U-trap shall be installed to flush the wet well using potable water. The wash down piping shall be connected to the wet well or the upper end of the emergency holding well if an emergency well is provided. Hose bibb connection shall also be provided on site.
- n. Wet well submersible pump stations shall be equipped with a heavy duty 316 stainless steel slide rail system for surface removal/replacement of pumps. The pump seating shall be of a non-sparking type and shall provide a positive seal that will not leak. The entire slide rail and mating assembly shall be U.L. approved. Each pump/motor shall be provided with a Flygt-Lift Grip Eye lifting system or equal designed to lift a minimum of twice the pump/motor unit weight. Lifting chains, cables, and connections shall be stainless steel. Any leader cables shall also be capable of lifting entire load. Nylon rope shall not be allowed. Equipment hatch must be correctly sized and centered over the slide rails to allow removal of equipment.
- o. A 1-foot minimum clear distance shall be provided between the inlet pipe invert and high water alarm level (L6).
- p. The wet well(s) shall be equipped with a submersible pressure transducer capable of 4-20 ma output to be used in conjunction with a PLC as the primary pump control system. The submersible pressure transducer shall be Druck PTX 1290, or approved equal. In addition, mercury free floats shall be installed in the wet well for use with a standard control system as an independent backup control system. The floats shall be installed in such a manner as to allow the back-up control system to automatically assume control if the primary system fails. The pressure transducer and floats shall be so located as not to be unduly affected by turbulent flow and shall be securely mounted in a manner to allow devices to be removed from the surface without personnel entry into the wet well. Devices and cables shall be approved for use in a wastewater environment and provided with strain relief attached near the entry point.
- q. Unless otherwise allowed, all piping, conduit, bolts/nuts/washers, and hardware located inside the wet well or exiting the wet well shall be stainless steel.

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- r. All piping and conduit penetrations through wet well walls shall be watertight. Pump inlet/outlet piping and piping/conduit passing through any common wall between wet well and dry well/valve vault shall be made by cast-in-place flanged stainless steel wall pipe with integral water stop. Penetrations through other walls may use the same method or may be made with a cast-in-place wall sleeve with water stop and mechanical seal such as Link-Seal, or approved equal. Mechanical seal and wall sleeve shall be suitable for use in a corrosive environment. The exterior side of penetrations shall also be provided with a neoprene boot clamped to wall sleeve and pipe with stainless steel straps.

5. Valve Vault

All valves, piping sensors/gauges, air injection points, or other special piping assemblies shall be accessibly located within a dry well or valve vault. No valves shall be located in the wet well or buried. The vault shall be located within the walled site and where a maintenance vehicle with a back-mounted hoist has complete access. Valve vaults shall meet the following requirements.

- a. The minimum clearance between pumps, pipes, valves, flanges, walls, stairs, and other equipment shall be 2-feet. The minimum clearance between piping and floor shall be 1-foot.
- b. The vault shall be a reinforced concrete structure designed for H-20 traffic loading. The structure shall be watertight and have a gas-tight separation from the wet well. Provisions against floatation shall be evaluated and provided when necessary. Valve vault depth shall be as shallow as possible to provide the minimum force main cover and pipe clearance requirements.
- c. Vault access hatch(s) shall be sized to allow direct overhead access to all removable parts. Access hatches shall meet the requirements of Section 7.
- d. The vault shall be placed on a 6-inch minimum crushed rock base.
- e. Dewatering of the valve vault shall be provided by a sump pump or, at the discretion of Sewer Maintenance, with a gravity drain back to the wet well. A sump pump is always required for vaults greater than 7-feet deep. The vault floor shall be adequately sloped to the point of drainage. Sump pumps shall be equipped with double check valves and discharge to a high point in the wet well. Gravity drain, if allowed, shall be provided with cast iron floor drain with backflow prevention insert in the valve vault and an ultra low head Tideflex type elastomeric check valve located inside the wet well. The drain cover and backflow insert shall be easily removed for clean-out or replacement. The drainpipe shall be 4-inch minimum with U-trap to prevent gas release from the wet well to the valve vault. Valve vault shall be equipped with a float or other approved device to signal a flooded valve vault alarm.

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- f. The valve vault shall be provided with mechanical forced ventilation designed to automatically operate when hatch doors are opened. At least 30 complete air changes per hour shall be provided. Clean air shall be drawn into the bottom of the valve vault. In valve vaults over 15-feet deep, multiple inlets and outlets are desirable. Ventilation equipment and ducting shall be corrosion resistant and non-sparking. Equipment shall not be located inside the valve vault or dry well. Equipment shall meet all noise level requirements or additional sound attenuation provisions shall be provided. Forced air ventilation lines shall be provided with flow sensors and audible alarm to sound if insufficient ventilation is detected when system is active.
 - g. Access to the vault shall be provided by a ladder, manhole steps, or stairs. Manhole steps or ladder shall be stainless steel, have a minimum spacing of 16-inches, and included at least three steps. If the vault is greater than 7-feet deep, stairs shall be provided in accordance with dry well requirements.
 - h. All piping and conduit penetrations through valve vault walls shall be watertight. Penetration holes shall be performed or cored out smooth without damaging the structure and a mechanical seal such as Link-Seal, or approved equal, shall be installed. Mechanical seal shall be suitable for use in a potentially corrosive environment.
6. Dry Well
- a. Dry well pump stations are required for pumps of 40 hp and above, for service areas or future service areas that may include any industrial zones, where the total dynamic head of the station is greater than 150 feet, or where the design flow is greater than 500 gallons per minute.
 - b. Dry well submersible pumps with motor close-coupled to the pump suitable for operation in totally dry or totally submerged condition are required.
 - c. The dry well shall be a reinforced concrete structure designed for H-20 loading. The structure shall be watertight and have gas-tight separation from the wet well. Provisions against floatation shall be evaluated and provided when necessary. Dry well depth shall not exceed 27 feet.
 - d. Dry well access for equipment and appurtenance removal shall be provided to the satisfaction of Sewer Maintenance. Overhead hatch access shall be provided for crane removal of all pumps. If valves and other appurtenances weighting over 100 pounds cannot also be provided direct lifting access through the pump access hatch(s), then additional provisions for the lifting and extraction of these items shall be provided to the satisfaction of Sewer Maintenance. Access hatches shall meet the requirements of Section 7.

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- e. Personnel access shall be provided by hatch and stairs. Stairs and handrails shall meet the following requirements as a minimum:
 - i. A maximum allowable slope of 40 degrees.
 - ii. A minimum head room of 6 ½ feet.
 - iii. A minimum stair width of 2 feet.
 - iv. The stairs and handrails shall be aluminum or hot dip galvanized after fabrication.
 - v. The stairs shall be designed for 100 lb/ft² on stairway and 125 lb/ft² on landing with 1,000 lb concentrated load on the edge. Handrails, railing, and attachments shall be designed to resist a lateral force of 200 pounds minimum at any point without damage or permanent set.
 - vi. Landings shall be provided at vertical intervals not to exceed 12-feet.
 - vii. Stairs and landing shall have non-slip surfaces.
- f. Dewatering of the dry well shall be provided by a sump pump. The dry well floor shall be adequately sloped to the sump. Sump pump shall be equipped with double check valves and discharge to a high point in the wet well. Dry well shall be equipped with a float or other approved device to signal a flooded dry well alarm.
- g. The dry well shall comply with valve vault requirements for mechanical forced ventilation. In addition, cooling requirements for dry well pumps shall be assessed and where necessary continuous or temperature controlled ventilation provided.
- h. All valves shall be installed in the horizontal position and less than 5-feet above floor level. The minimum clearance between pumps, pipes, valves, flanges, and other equipment shall be 3-feet. The minimum clearance between pumps, pipes, valves, flanges, and walls or stairs shall be 5-feet. The minimum clearance between piping and floor shall be 1-foot. Greater clearances may be required for large pumps, motors, and piping appurtenances.
- i. All piping and conduit penetrations shall be made in accordance with wet well requirements.

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7. Access Hatches

- a. Access hatches shall be adequately sized and properly located for personnel access and equipment/appurtenance removal. The minimum clear opening for access hatches shall be 48" x 48".
- b. Access hatches shall be aluminum with spring-assisted double-hatch doors. All hardware, springs, and other non-aluminum items shall be stainless steel or other acceptable corrosion resistant material. Aluminum in contact with concrete shall be properly coated to prevent corrosion. The hatch frame shall be provided with a trough and drain to the wet well or valve vault/dry well sump.
- c. The hatch door shall have latch and lock keyed to Sewer Maintenance standards and include fall protection chains, bars, or other acceptable provisions.
- d. Hatch shall be rated for H-20 loading, should be slightly raised above the surrounding area, and include a mild slope away from the hatch to minimize rainwater entry. However, the slope shall not create a potential trip hazard or prevent drive-over by vehicles.

8. Electrical and Control Panel

- a. All electrical equipment and devices in the wet well including pumps and sensors shall comply to Class I Division 1 of the NEC code. In addition, all electrical devices and components shall be vapor-tight, watertight assuming submergence of the entire well, and suitable for use under highly corrosive conditions.
- b. All electrical devices in valve vault or dry well including sump pumps, sensors, and lighting shall comply to Class I Division 2 of the NEC code. In addition, all electrical devices and components located in the dry well shall be vapor-tight, watertight assuming submergence of the entire vault/well, and suitable for use under corrosive conditions.
- c. All power, control, and signal cables leaving wet wells, dry wells, and valve vaults shall be provided with above-ground means for easy field disconnect and removal of equipment/device. Engineer should consult with Sewer Maintenance regarding acceptable means for field disconnect/removal. Field disconnect method details shall be shown and specified on plans.
- d. All electrical conduit, fittings, and hardware located inside the wet well or exiting the wet well shall be stainless steel. All electrical conduit, fittings, and hardware located inside the valve vault/dry pit or exiting the valve vault/dry pit shall be stainless steel or PVC coated rigid galvanized steel.

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- e. Pump station shall be provided with three phase power, unless otherwise approved by Sewer Maintenance.
- f. Control panel, motor control center, automatic transfer switch, switchboards, and panel boards shall be located inside the control room of the building. Enclosures shall be NEMA 12 and be adequately sized to comfortably accommodate all electrical devices, allow easy reach access for maintenance and repair, and provide for a minimum of 20 percent spare space.
- g. Controls shall be mounted no more than 10-inches from the front opening.
- h. Variable frequency drives (VFD) shall be provided for each pump motor. The VFD shall be made by GE/FUJI Model AF-300 P11 or approved equal. The VFD shall be one size above the motor horsepower rating.
- i. Provide a programmable logic controller (PLC), panel mounted MMI, submersible pressure transducer, and other components as the primary control system for the pumps. The PLC shall be the SCADAPack series made by Control Microsystems with manufacturer recommended power supply to provide intrinsically safe ratings of sensors. The MMI shall be an Optimate KM620 or touch screen control panel approved by Sewer Maintenance. The panel integrator shall consult with Sewer Maintenance regarding current hardware and programming requirements.
- j. Provide a laptop computer and all hardware/software necessary to program and control the pump station, including software licenses. The engineer should contact Sewer Maintenance regarding latest requirements. The following general items will be necessary: "Telepace" and "SCADA Server" by Control Microsystems, "Lookout" by National Instruments, Sierra Wireless Aircard (wireless GPRS modem) for laptop, and any laptop/PLC interface cable.
- k. A back-up control system (Floats, control relays, etc.) shall be installed to automatically assume pump station operation if the primary control system fails. Floats shall be mercury free.
- l. Signal and power conduits and conductors shall be properly separated, grounded, and isolated to eliminate potential signal noise.
- m. A minimum of one spare power, control, and instrumentation conduit shall be provided from each area (wet well, dry well, vault, etc.) through any intermediate junction boxes to final termination point. Spare conduits shall be capped.
- n. Wiring markers shall be provided to identify each conductor at panel terminals and in intermediate junction boxes. Wiring numbering shall be included in As-Built information.

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- o. Furnish Ademco alarm system and working touch-tone telephone line with single touch-tone instrument and jack for Ademco. Refer to Appendix A for partial listing of Ademco vendors. The latest Ademco model shall be used. All pump stations shall be furnished with a functioning touch-tone telephone service prior to acceptance for maintenance.
- p. Incoming electrical service meter socket and main switch shall be located outside the equipment building in a Hoffman enclosure or approved equal. Furnish a hasp for Edison Company lock. The enclosure shall have a viewing window for meter reading.
- q. Building, canopy, valve vault, and dry well shall be well lighted. Site lighting shall also be provided for emergencies with switch located inside building. Plans must show all lighting and switches.

9. Pump and Motor

- a. Pump capacity calculation and performance curves shall be submitted with the plans.
- b. A minimum of one backup pump, or pump set for pumps in series, shall be provided for stations with a design flow less than 500 gpm. For larger stations, two or more backup pumps shall be provided.
- c. Pumps shall be wet pit submersible or dry pit submersible manufactured by Essco, or approved equal.
- d. Pumps shall have fully recessed impeller to allow passage of 3-inch minimum large solids. Pump suction and discharge opening shall be at least 4-inches. Other impeller types may be considered in certain high flow and/or high head situations.
- e. Pump shall also have double mechanical seals with moisture sensing probe. The mechanical seals shall be carbon-ceramic.
- f. Minimum of 5-horsepower pumps are required.
- g. Pump motor must be U.L. or F.M. listed for Class 1 Division 1 conditions.
- h. Hour meters shall be installed for all pumps.
- i. Pump motors shall be rated for VFD use.

10. Valves

- a. For dry well stations, the inlet to each pump shall be equipped with a gate valve.

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- b. The discharge line for each pump shall be equipped with a swing check valve and gate valve.
- c. Gate valves and related return piping shall be provided to allow the isolation and draining of each force main back to the wet well.
- d. Gate valves shall be resilient-wedge type with non-rising stem and hand wheel. Gate valves shall be made by Kennedy, Clow, or approved equal.
- e. Swing check valves shall include outside lever and weight. The need for valve closure damping shall be evaluated and damping provisions shall be provided if necessary. The valve shall be Crispin series SWC, APCO, or approved equal.
- f. All valves shall be flanged and installed in a horizontal position. The valves shall be stainless steel or cast/ductile iron body with fusion bonded coating and lining. Valve materials and coatings shall be suitable for use with raw sewage and in a corrosive environment. The valves shall also have 316 stainless steel nuts and bolts.
- g. All valves shall be rated for the maximum service and surge pressure expected. However, gate and check valves shall be rated for non-shock service pressures of at least 200 psi and 175 psi, respectively. Provide calculations on maximum possible service and surge pressure with plan submittal.

11. Emergency Generator

- a. An emergency generator with automatic transfer switch is required for all pump stations. Generators above 60 kw shall be provided with a permanent load bank or a portable load bank with adequate quick-disconnect SO cord and connections.
- b. The generator size shall be adequate to provide power for pump motor starting current limited by VFD to 125 percent of running current and for control, lighting, ventilation, and other auxiliary equipment necessary for safe and proper operation of the pump station. The air compressor should be excluded from the sizing of the generator. The automatic transfer switch should not power the air compressor or a control scheme should be employed to disconnect the air compressor during power outages. On generators of 60 kW and below, the compressor should be connected in a manner that allows it to be used as a load bank for testing. Provide calculations on generator sizing.

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- c. Emergency generator shall have a remote or skid mounted base fuel tank with secondary containment adequate for 24-hour continuous operation. Underground fuel storage tank and piping is not allowed. Above ground storage tank shall comply with all Fire Department requirements. Fuel tanks located outside shall be provided with noncombustible rain canopy and secondary containment.
- d. Depending on the location, emergency generator must meet the regulations for South Coast Air Quality Management District (AQMD) or Antelope Valley AQMD. The AQMD permit to operate shall be acquired and transferred to the Department prior to acceptance for maintenance.
- e. The generator shall be located either in the equipment room of the building or outside under a canopy. The equipment room shall be provided with adequate ventilation and sound attenuating provisions to meet all exterior noise level requirements. Generators installed outdoors under a canopy shall be provided with a concrete maintenance pad and an outdoor type weatherproof sound attenuation enclosure to meet all exterior noise level requirements. Adequate maintenance and generator replacement access shall be provided.

12. Air Compressor

- a. Air Compressor for aerating the force main and wet well shall be designed to deliver a minimum of 2 CFM free air per inch of force main diameter at each injection point and minimum 2 CFM per 1,000 gallons of normal operation volume for the wet well. Provide calculations on the sizing of the compressor. Force main air line shall be equipped with an automatic shut-off valve interlocked with pumps or other acceptable means shall be provided to halt aeration of the force main during pumping.
- b. A rotary screw type compressor made by Kaeser or approved equal is required for all pump stations.
- c. The air compressor shall be housed in the equipment room of the building. Adequate maintenance access, cooling ventilation, and interior/exterior noise attenuation shall be provided.
- d. An air manifold receiving air from the air compressor and distributing air to force mains and wet well shall be installed in the valve vault or dry well. The air manifold shall be complete with pressure regulators, pressure gauges and flow meters. Proper isolation valves and piping disconnects shall be provided to remove devices for replacement. All valves, gauges, meters, and hardware shall be suitable for a potentially corrosive atmosphere.
- e. All aeration piping, fittings, and hardware shall be 316 stainless steel.

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- f. Aeration line to force main shall be connected to the force main by a stainless steel service saddle with isolation valve and double air check valves.

13. Building and Canopy

- a. Electrical panels, controls, and instruments shall be located in the control room of the building. Compressor, ventilation blowers, and generator shall be located in the equipment room of the building. The emergency generator may alternately be located outside on a maintenance pad located under a canopy.
- b. Building locks shall be per Sewer Maintenance standards.
- c. Building pad shall be higher than the pump station overflow elevation.
- d. Building shall be provided with a restroom and outdoor safety shower.
- e. Adequate maintenance access shall be provided around all panels and equipment. Access routes and door(s) sufficient to allow the replacement of all equipment shall be provided.
- f. Adequate ventilation facilities shall be provided to maintain electrical and mechanical equipment within required operating temperature ranges.
- g. Building and canopy shall meet all Building, Electrical, Mechanical, and Fire Code requirements.
- h. Buildings and canopies shall be constructed of non-combustible materials.
- i. County or city planning departments should be consulted regarding exterior aesthetic requirements for the building and canopy.
- j. The building may be located over the dry well provided issues are satisfactorily addressed regarding flooding, vapor separation, hoist removal of equipment, etc. It is recommended that the engineer discuss proposed building options with Sewer Maintenance prior to beginning design work.

14. Coatings

Coatings shall be applied and tested by skilled individuals with a minimum of three years experience applying similar coatings. A one-year guarantee against failure of all coatings shall be provided. As part of the guarantee, the contractor shall perform an inspection at 11 months from date of acceptance. All coating failures shall be repaired at the contractor's expense.

Surfaces shall be prepared, primed, and coated in accordance with the coating manufactures instructions. The paint products mentioned hereafter are manufactured by Tnemec Company Incorporated. However, products of other paint manufacturers, if approved equal, are acceptable.

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- a. All metal and exposed PVC surfaces, except stainless steel, aluminum, and valves/pumps/panels/equipment with a superior corrosion resistant factory coating, shall be coated as follows. All metal surfaces, including aluminum, in contact with bare concrete shall also be coated.
 - i. Surface Preparation: Per coating manufacture's recommendation for material type.
 - ii. Primer: No. V69 Hi-Build Expoxoline @ 3-5 MDT.
 - iii. Finish: No. V69 Hi-Build Expoxoline @ 4-6 MDT (1709 Dawn Mist).
 - iv. Exterior exposed surfaces shall receive an additional coat of No. 1075 Enduro-Shield @ 2-5 MDT (1709 Dawn Mist).
- b. Interior of the wet well and emergency holding well shall be provided with a T-Lock liner system or coated as follows:
 - i. Surface Preparation: SSPC-SP13, ICRI CSP 5.
 - ii. Filler & Surfacer: 218 Mortarclad.
 - iii. Epoxy Mortar: 434 Perma-Shield H2S @ 125 mils DFT.
 - iv. Gel Coat: 435 Perma-Glaze @ 15 mils DFT.
- c. Interior concrete floors of valve vault, dry well, and building shall be coated as follows (non-slip surface shall be provided):
 - i. Surface Preparation: acid etch/clean & dry, shot blast, or mechanically abrade.
 - ii. Primer: No. 287 Enviro-Tread @ 3-4 DFT.
 - iii. Finish: No. 287 Enviro-Tread @ 3-4 DFT (1709 Dawn mist).
- d. All coating information and requirements shall be included on the plans and/or the specifications.

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D. PLAN SUBMITTAL

1. A complete plan submittal for Sewer Maintenance review of a proposed wastewater pump station shall include the following. Additional submittal requirements by other divisions of the Department or cities shall also be complied with. Engineer/owner should check with the Land Development Division of the Department (unincorporated and contract cities) or cities regarding submittal requirements for design and building/mechanical/electrical code review.
 - a. Four sets of plans and specifications.
 - b. Three sets of all engineering calculations required per these guidelines.
 - c. Copy of geology report with recommendations.
 - d. Copies of sewer, tract, and grading plans.
 - e. Three sets of manufacturer's manuals, catalog cut sheets, and technical information for valves, meters, pumping, electrical, and mechanical equipment. The model, size, style, features, etc. of the equipment or device to be provided shall be clearly indicated in the information provided.
2. The engineer/owner shall allow a minimum of six weeks for submittal review from the time a complete submittal is received by Sewer Maintenance.

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E. SEWER MAINTENANCE NEW PUMP STATION ACCEPTANCE PROCEDURE

The contractor/owner shall be responsible for proper operation, maintenance, and all utility/permit costs for a completed pump station until formal acceptance of the station by the Department. The contractor/owner shall also be responsible for damages caused by malfunctions or utility disconnections until the station is accepted by the Department. Sewer Maintenance will not accept a new pump station for maintenance until the outlet sewer has been formally accepted for public use by the city or county and the sewers tributary to the pump station have been constructed and are ready for formal acceptance for public use.

All permits necessary to operate equipment shall be obtained and transferred to Sewer Maintenance, such as South Coast AQMD permit to operate internal combustion engine for emergency generator, air tank certification from CAL OSHA, etc.

Prior to acceptance for maintenance by Sewer Maintenance, the following items must be satisfactorily completed:

1. Proof that all necessary operating permits have been acquired and are paid through the date of transfer.
2. The station shall be inspected and found satisfactorily completed by the city engineer or the county, for compliance with building, plumbing, mechanical, and electrical codes and the approved plans and specifications.
3. Five sets of the following information shall be provided by the engineer and found acceptable by Sewer Maintenance. Information must be received at least two weeks prior to demonstration testing. Failure to submit information on time may result in postponement of testing.
 - a. "As-Built" plans for the pump station and force main. Plans must accurately show actual depth, horizontal and vertical location of underground raceways, cables, pipes, conduits, utilities, and appurtenances.
 - b. Detailed "As-Built" wiring diagrams of all electrical systems and special equipment, including all conductor wiring numbers.
 - c. Detailed shop drawings supplied by the manufacturers and corrected to comply with "As-Built" conditions of all mechanical equipment.
 - d. Manufacturers' technical literature for all components of the installation applying to operation and maintenance.
 - e. Parts catalog showing manufacturers' part numbers for procuring replacements with a list of local vendors, addresses, and telephone numbers.

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- f. Complete operation, maintenance, and repair manuals for the station and all electrical, instrumentation, and mechanical equipment. Items b through e above would generally be included in this manual. Manual should begin with a summary of the service area, facilities, and equipment including design and operational parameters. Safety procedures and a detailed lock-out block-out plan shall be prepared by a qualified specialist and include as an appendix to the manual in both written and electronic format in Word.
 - g. Digital photographic history of pump station construction provided on CD. Photographs shall focus primarily on excavations, reinforcing, buried structures/pipes/conduits, and other non-visible improvements.
 - h. Certified report on required noise testing.
 - i. Summary report on factory, installed, preoperational, and functional testing of piping, coatings, wet well leak test, instrumentation, electrical, and mechanical equipment. Testing and performance requirements shall be included by the engineer in the plans or specifications and shall require the signoff by contractor/equipment manufacturer representative and county/city construction inspector. The summary report shall be prepared and signed by the design engineer certifying compliance with design requirements.
 - j. Demonstration testing plan and signoff forms. The engineer together with the contractor and equipment manufacturer representatives shall provide a demonstration testing plan and signoff forms to the satisfaction of Sewer Maintenance. This information should be forwarded to Sewer Maintenance well in advance of proposed demonstration testing to assure no delays. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall as a minimum include all testing require in Appendix B. Signoff forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed and shall contain provisions for recording relevant testing parameters and performance data for original testing and not less than three retests. The forms shall provide for signoff by the design engineer, contractor, equipment manufacturer representative, county/city inspector, and Sewer Maintenance.
4. Demonstration testing of the station shall be overseen by the engineer and performed by the contractor and/or equipment manufacturer representatives in the presence of the Electro-Mechanic Supervisor for Sewer Maintenance and the county/city inspector (Refer to Appendix B).

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5. Following demonstration testing, the design engineer shall prepare a summary report. The summary report shall include signoff forms, tabulated testing results, performance requirements, and a signed statement by the design engineer that all requirements have been met. The report shall also include a notarized written report/statement from each equipment manufacturer, or his authorized representative, certifying that (1) the equipment has been properly installed, connected, and lubricated under his supervision, (2) the equipment is in accurate alignment, (3) he was present when the equipment was placed in operation, (4) he has checked, inspected, and adjusted the equipment as necessary, (5) the equipment is free from any undue stress imposed by connecting piping or anchor bolts, (6) has been satisfactorily operated under full load conditions, (7) he has inspected his equipment during the operational demonstration tests, and (8) is fully covered under the terms of the equipment warrantee.
6. Training of Sewer Maintenance personnel shall be provided for each major piece of electrical or mechanical equipment. Refer to Appendix C.
7. For pump stations in the unincorporated county or in contract cities, the notice of completion formally accepting the pump station shall be processed by Construction Division and forwarded to Land Development Division following completion of items 1 through 6.
8. For pump stations in non-contract cities, the city shall submit a written request to Sewer Maintenance to accept operation and maintenance services after items 1 through 6 have been satisfied and the city has formally accepted the station for public use. The request should be addressed to:

Mr. Manuel Del Real
Assistant Deputy Director
Los Angeles County Department of Public Works
Waterworks and Sewer Maintenance Division
900 South Fremont Avenue
P.O. Box 1460
Alhambra, California 91802-1460

Upon acceptance by Sewer Maintenance, the Electro-Mechanic Supervisor shall arrange for all utility transfers to Sewer Maintenance. The contractor/owner shall furnish the necessary current records for utility transfers. These include, account numbers for the station, and evidence of payment of all past bills.

The above procedures shall be included in the plans and specifications of all proposed wastewater pump stations.

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APPENDIX A

ADEMCO ALARM SYSTEM Model 5130 XM

Partial list of vendors of Ademco components

Attn: John Ivins
Engineers Sales and Service Co.
4935 Telegraph Road
Los Angeles, Ca 90022
(213) 261-2181

Ademco Pro
1007 Dominguez, Suite E & F
Carson, Ca 90745
(310) 523-2840

Ademco Pro
7260 Radford Street
North Hollywood, CA 91600
(818) 764-4202

Check local Telephone Directory for Ademco vendors.

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APPENDIX B

DEMONSTRATION TESTING FOR NEW SEWAGE PUMP STATIONS LOS ANGELES COUNTY SEWER MAINTENANCE

Demonstration testing shall comply with the approved demonstration testing plan required in the Guidelines.

1. Information required under Section E3 of the Guidelines shall be provided and found satisfactory prior to demonstration testing.
2. Provide a minimum of 150 gallons of water per minute to the wet well for the purpose of the test. Wet well shall be filled to capacity and may be required for three or more tests. Garden hose type of fill is not acceptable.
3. Contractor shall provide all tools and properly calibrated test instruments to perform all testing.
4. Test that are to be performed by the contractor, include as a minimum:
 - a. Manufacturer recommended start-up tests.
 - b. Show that all short circuit devices are properly rated.
 - c. Supply power from utility line and generator shall be tested for voltage and amperage at no-load, normal-load, and peak-load.
 - d. For each pump demonstrate/show:
 - i. Pump is free of cavitation and vibration.
 - ii. Pumping rate.
 - iii. Correct phase rotation.
 - iv. Insulation resistance of motor.
 - v. Running voltage and amperage at each operational level/speed.
 - vi. Lift and reseal each submersible pump.
 - e. Correct operation of primary and backup control systems.
 - f. Correct activation of local and remote alarm signals.
 - g. Generator:
 - i. Demonstrate proper operation of all systems and safety devices.
 - ii. Simulate power failure and demonstrate complete manual and automatic start, load, unload, and stop sequence.
 - iii. Perform a load test with station load, 75% load, and 100% load.

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- iv. Provide initial start-up and frequent load test measurements of: water temperature, oil pressure, ambient air temperature, voltage, amperage, frequency, and kilowatts.
- h. Ventilation systems shall be tested to show:
 - i. Correct manual and automatic control.
 - ii. Correct flow rates.
 - iii. Running voltage and amperage at normal and peak demands.
 - iv. Record exterior, interior, and equipment temperatures.
- i. Compressor:
 - i. Correct manual and automatic control.
 - ii. Correct flow rates and pressures.
 - iii. Running voltage and amperage at normal and peak demands.
- j. Lighting and receptacles, including GFI tests.
- k. Show proper calibration and full range function of all sensors and measurement instruments.
- l. Record static, operating, and peak pressures in the force main.
- m. Demonstrate no leak operation of all valves.
- n. Each component of the system shall be tested for proper operation.

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APPENDIX C

SEWER MAINTENANCE PERSONNEL TRAINING NEW PUMP STATIONS

Training of Sewer Maintenance personnel shall be provided for each major piece of electrical or mechanical equipment (i.e. pumps, compressors, controls, generator, etc.). Training requirements shall be included in the plans/specifications. Engineer should check with Sewer Maintenance to determine items to provide training on. Training shall be done by experienced technical manufacturers' representatives. These representatives shall follow the general outline presented here:

1. Familiarization.
 - a. Show catalog, parts lists, drawings, etc. and O&M manuals.
 - b. Check out the installation of the specific equipment items.
 - c. Demonstrate the unit and show that all parts of the specifications are met.
 - d. Answer questions.

2. Safety.
 - a. Point out safety references.
 - c. Discuss proper precautions around equipment.
 - d. Discuss lock-out/block-out provisions.

3. Operation.
 - a. Point out reference literature.
 - b. Explain all modes of operation (including emergency).
 - c. Check out Sewer Maintenance personnel on proper use of the equipment.

4. Preventive Maintenance (PM)
 - a. Pass out PM list including:
 - i. Reference material.
 - ii. Daily, weekly, monthly, quarterly, semi-annual and annual jobs.
 - b. Show how to perform PM jobs.
 - c. Show Agency's personnel what to look for as indicators of equipment problems.

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5. Corrective Maintenance
 - a. List possible problems.
 - b. Discuss repairs - point out special problems.
 - c. Open up equipment and demonstrate procedures, where practical.

6. Parts
 - a. Show how to use parts list and order parts.
 - b. Check over spare parts on hand. Make recommendations.

7. Local Representatives
 - a. Where to order parts: Name, address, and telephone.
 - b. Service problems.

8. Who to call.

9. How to get emergency help.