SECTION 7

SANITARY SEWERS

CONTENTS **Page**

CONTENTS **Page**

SECTION 7
SANITARY SEWERS

7-1 DESIGN CRITERIA

These Improvement Standards shall only apply to sanitary sewer collection facilities to be maintained by a County Service Area or sewer maintenance district under control of the Board of Supervisors that provides extended sewer services. These Standards are minimum design criteria. The County Engineer may permit modifications or may require higher standards where unusual conditions are encountered. These Standards shall also apply to any privately owned and maintained sanitary sewer collection systems serving 4 or more residential units or any commercial or industrial uses. Where sanitary sewer facilities are to be maintained by a Community Service District or City, the standards of the District or City shall govern the design and construction of sanitary sewer facilities.

7-2 FLOW DETERMINATION

Flow determination shall be based upon the approved zoning, existing land uses or General Plan land use designations, whichever produces the greatest flow. The minimum population density used shall be based on the latest US Census Tract data for single-family residential housing. Design flows shall be calculated using Table 7-1.

TABLE 7-1 SANITARY SEWER DESIGN FLOWS

Land Use	**Unit**	**Minimum Average Daily Flow** (Gallons per Unit)	**Peaking Factors**[1]
Single Family Residential (3.5 persons per unit)	Residence	350	3
Multi-Family Residential (3.0 persons per unit)	Residence	300	3
Commercial, Office	Gross Acre [2]	2,500[2]	2-4[2]
Central Business District	Gross Acre [2]	3,500	2-4[2]
Light Industrial	Gross Acre [2]	2,000[2]	2-4[2]
Heavy Industrial	Gross Acre [2]	3,000 – 5,000[2]	2-4[2]
Recreation and Parks	Gross Acre	200	2
Elementary School	Student	50	3
Middle School	Student	50	3
High School	Student	60	3

1: Peaking Factors may be increased or decreased based on flow peaking studies for trunk mains and pumping stations.

2: Subject to review and confirmation of intended uses and waste generation rates. Industrial uses may require private pre-treatment and/or peak reduction facilities.

The infiltration and inflow allowance shall be 600 gallons per gross acre per day.

7-3 DESIGN FLOW

Design flow shall be calculated using the average daily flow for the upstream service area, as described in Section 7-2, unless more current design criteria is available in a Sewer System Master Plan.

The following formula shall be used to calculate the design flow:

$$Q_d = (Q_a \times PF) + I$$

Where: Q_d = Design Flow
Q_a = Minimum Average Daily Flow
PF = Peaking Factor
I = Infiltration/Inflow Allowance

7-4 PIPE CAPACITY, SLOPE, VELOCITY, SIZE, DEPTH AND MATERIAL

A **Size:** The minimum size sewer pipe shall be eight inches in diameter unless otherwise approved by the County Engineer. The minimum size sewer service lateral pipe shall be four inches.

B. **Slope and Velocity:** Minimum slopes of sewer pipes shall be such that the velocity of flow in the pipe when full shall not be less than two feet per second. Manning's formula shall be used to determine the relation of slope, design flow, velocity, and diameter. The Manning's "n" value shall be 0.013.

1. Table 7-2 shows the minimum slopes for various pipe diameters. Pipe slopes that are less than those listed in this table shall not be used without the approval of the County Engineer. Pipes shall not be artificially oversized to justify the use of a smaller slope. The slopes indicated are based on a velocity of two feet per second with the pipe flowing full, or half full.

TABLE 7-2 MINIMUM SLOPES

Inside Diameter (Inches)	Minimum Slope
8"	0.0035
10"	0.0025
12"	0.0020
15"	0.0015

2. The maximum depth of flow at design conditions in any collector (12-inch inside diameter or less) shall be 0.7 of the pipe diameter. Mains larger than 12-inches in inside diameter may be designed to flow full unless direct sewer service connections are planned; in which case the 0.7 diameter maximum depth shall govern.

C. **Capacity:** Pipe capacity and invert elevations, in all cases, shall be adequate to carry the design flow from the entire tributary area, even though said area may not be within the project boundaries.

D. **Depth:** In the design of a system, one of the controlling conditions shall be that the collector system shall be at sufficient depth to provide a minimum slope for the sewer services of 1/4 inch per foot (or 2%), at the same time maintaining a minimum cover of 12 inches at any buildable location within the properties to be served, and a minimum of four feet of cover at the back of sidewalk, except that the depth shall be increased to provide minimum 6 inch clearance from underground (dry) utilities installed at the back of the sidewalk.

Minimum depth of new sewer collectors or mains shall be 6 feet from finish grade to top of pipe. The maximum depth of sewer lines shall be 15 feet, unless approved by the County Engineer. A geotechnical study may be required to determine special backfill requirements for sewer pipelines exceeding 10 feet in depth.

E. Material:

1. Polyvinyl Chloride (PVC) C900 Class 200 DR 14 conforming to ASTM D1784 for pipes up to 12-inch, and AWWA C905 Class 200 DR14 for larger diameters.
2. Ceramic Epoxy lined Ductile Iron Pipe with a 40-mil-thick high build multi component lining materials consisting of Amine cured Novalac epoxy with at least 20% by volume ceramic quartz pigments. Protecto 401 Ceramic Lining, or equivalent. Encase ductile iron pipe in clear 4-mil HDPE wrapping tubes in accordance with ANSA/AWWA C105 standards. Secure wrap with three wraps of 10-mil HDPE tape, overlapping each wrap one-half tape width.
3. ABS pipe and fittings at service lateral cleanout assemblies shall be Schedule 40 conforming to ASTM F 628 and ASTM D 2661. All products shall bear the seal of a nationally recognized listing or certifying agency.

F. Testing: Sewer lines and laterals shall be air tested in accordance with ASTM F1417 "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air." Acceptance testing shall occur following completion of all trench backfill, and placement and compaction of aggregate base in streets.

Sewer lines and laterals shall be balled and flushed, and a TV inspection shall be made, following placement of aggregate base for street, and prior to paving, to allow defective work to be repaired prior to paving. Complete color recordings and logs of TV inspections shall be submitted to the County. Defective work includes but is not limited to:

Cracks or breaks in the pipe
Joint separations > ½"
Low spots (sags) > 1" depth
Chipped pipe ends > ¼"
Protruding, folded, or otherwise deformed gaskets or flexible connectors.

Sewer laterals shall be TV inspected prior to final building occupancy to ensure that the laterals are free of debris and damage.

7-5 GROUNDWATER REQUIREMENTS

Geotechnical Reports: A Geotechnical Investigation Report with groundwater handling or design recommendations shall be required for all plans where public or private sewer facilities are proposed for construction in high groundwater areas.

In areas where groundwater is expected to be encountered above the flow line of sanitary sewer pipe, cement slurry backfill, concrete dams, geotextile wrapping of bedding rock, or other approved methods shall be utilized in the trench to retard the movement of groundwater through trench bedding material and minimize the potential for subsurface erosion.

7-6 SEWER LOCATIONS AND ALIGNMENT REQUIREMENTS

A. General: All public sanitary sewers shall be placed within rights of way dedicated for public streets unless the County Engineer specifically approves the use of easements. In some streets, dual collectors may be required.

There shall be a minimum horizontal clearance of ten feet between parallel water and sanitary sewer mains and the water main shall be higher than the sewer. At crossings, the water main shall be at least 12 inches above the sewer main. If a sanitary sewer force main must cross a water main, the requirements of Section 8-15.B shall apply.

B. Location in New Subdivision: In new subdivisions, sewers shall be located six feet southerly or easterly of street centerlines.

C. Location in Existing Streets: The County Engineer shall determine where sanitary sewers shall be installed in an existing street, considering factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvements plans, and existing utilities.

D. Easements: Permanent easements shall be a minimum of 15 feet wide for sewers up to 18 inches in inside diameter and a minimum of 20 feet wide for larger diameter sewers. Widths shall be increased as required to provide for trench wall slopes of 1.5:1 (Horizontal:Vertical) unless flatter slopes are required by existing soil conditions.

Temporary working easements of adequate dimensions shall be provided to allow the construction within the permanent easement to be completed in a safe and reasonable manner.

E. Water Well Clearance: No sanitary sewer interceptor, trunk main, collector, or service shall be placed closer than 100 feet to any water well, public or private, unless the well has been abandoned in full accordance with Yolo County Environmental Health Department permit requirements, or the location otherwise approved, in writing, by the appropriate regulatory (State and/or County) agencies. If a clearance of less than 100 feet is approved, all pipe within that distance from the well shall be of material approved by the County Engineer. In no case shall a clearance of less than 50 feet be allowed.

F. Alignment: Alignment of all sewer pipe and structures shall be designed to provide a minimum 10 feet of clear separation from parallel existing or proposed water mains as a means of protecting the water main from contamination. Sanitary sewer lines shall pass beneath water mains at all transverse crossings and shall be placed to provide a vertical clearance of at least one foot between the respective pipes. A minimum of one-foot clearance from all other utilities and/or improvements shall be provided, in accordance with Department of Health Services requirements and California Waterworks Standards, unless otherwise approved by the County Engineer.

1. Horizontal alignment shall be parallel to the street centerline and straight between structures wherever possible. Minimum radius for sanitary sewers 8 inches through 12 inches in diameter shall be at least 140% of the pipe manufacturer's recommendation for minimum radius of curvature. A larger radius shall be used wherever practicable or where necessary to avoid joint deflection in excess of 80% of the pipe manufacturers' recommended maximum. Only factory joints will be allowed. Curve information shown on the plans shall include pipe radius (if not concentric with street centerline), sub-tended angle, length, and if needed, maximum pipe lengths.
2. Vertical alignment shall provide a constant slope between manholes. If a change in grade is necessary, construction of a manhole shall be required unless the County Engineer approves the use of a vertical curve. In such case, elevations shall be shown at ten-foot intervals throughout the length of the vertical curve. Joint deflections in excess of 80% of the pipe manufacturers' recommended maximum will not be allowed. Only factory joints will be allowed.

G. Upstream Uses: Each property owner is responsible for the installation of a collector sewer across their property and/or frontage that will serve all upstream uses within an upstream service area.

7-7 TRENCH LOADING CONDITIONS AND PIPE DESIGN

A. Conduit Loading: For rigid conduit, Marston's formula shall be used to determine the load placed on the pipe by backfill. The procedure for rigid pipe is described in the ASCE Manual and Report of Engineering Practice 60 and in similar handbooks. In the absence of specific soils data, as determined by a Geotechnical Engineer, a soil weight of 120 p.c.f. and a k_u factor of 0.110 shall be used.

For flexible conduits, Marston's formula for flexible conduits as shown in the ASCE Manual and Report of Engineering Practice No. 60 and in similar handbooks shall be used to determine the load placed on the pipe by the backfill. The maximum load allowable shall be determined by pipe deflections computed by the Iowa Deflection Formula (or Spangler's Formula.) The soils reaction modulus (E') shall be estimated using a method acceptable to the County Engineer, and shall consider the modulus values of both the native and the bedding materials (ATV method). The bedding soils reaction modulus (E') used in the deflection calculation shall be 1,000 psi for Type II bedding, utilizing imported material to twelve inches above the top of the pipe. Deflection lag factor shall be 1.5. In the absence of specific soils data, as determined by a soils engineer, a soil weight of 120 pcf, a k_u factor of 0.110, and a bedding constant of 0.110 shall be used. Placement of flexible conduits within soils equivalent to Class V and types MH and CH of Class IV ASTM D2321 material will not be permitted unless approved by the County Engineer.

B. Safety Factor: A safety factor of 1.25 shall be used for reinforced concrete pipe, and 1.5 for all other rigid pipe. Only the three edge bearing strength of the pipe shall be used in the computations for rigid pipe.

C. Bedding and Initial Backfill: Bedding types and factors shall conform to Standard Drawing 7-4. Bedding and initial backfill type shall be as necessitated by height of cover over the pipe, trench width, pipe strength, and other factors used to determine safe pipe loading.

Special attention shall be given to backfill requirements for deep trenches, pipes located in State rights-of-way and for pipes placed in areas where trench width is excessive, such as in the vicinity of bore pits. See Section 7-13 regarding this condition. Any special backfill requirements shall be noted on the plans.

Unless otherwise noted on the plans, bedding and initial backfill for all pipe sizes shall be Type II, with trench widths subject to limitations set forth in Standard Drawing 7-4. The minimum trench width for all rigid pipe shall be pipe O.D. plus 12 inches.

Type III bedding and initial backfill are intended primarily for emergency field conditions. Their use shall normally not be specified on the plans and shall require specific written approval of the County Engineer before use.

D. Special Pipe Strength Requirements: Ductile iron, or other high-strength pipe approved by the County Engineer, shall be used whenever cover is greater than 25 feet, or extra support strength is required (such as to resist traffic loading). Ductile iron pipe or other high-strength pipe approved by the County Engineer, shall be used whenever cover is less than four feet, or insufficient clearance exists between the sewer pipe and rigid or load transmitting structures.

7-8 MANHOLE CRITERIA

A. General: Manholes shall be placed at all intersections of sanitary sewer mains, at any change in pipe slope, at any angular or abrupt change in horizontal alignment, at the end of any main terminating in a cul-de-sac, at the end of all permanent mains 120 feet or more in length, and at the end of any temporary main more than 200 feet in length. All manholes from which sewer main extensions are anticipated shall have a pipe stub installed at the grade and in the direction of

the anticipated extension. Summit manholes connecting two sewer collectors are not acceptable. Manholes may be required on lateral lines serving industrial sites in accordance with Yolo County Code section 6-5.307.

B. **Spacing**: Maximum spacing of manholes shall be 400 feet for all straight sewer mains of ten-inch diameter or less. Where sewers are installed with curvilinear alignments, manholes shall be placed at the beginning or end of such curves, and the distance between manholes shall not exceed 300 feet. Where the length of the curve is in excess of 300 feet, manholes shall be placed at intermediate points along the curve. Reverse curves require a manhole at the point of tangency between the curves.

C. **Elevation Criteria:** When two mains of the same size enter a manhole such that the flow of one must change direction more than 20 degrees, or if flow in a single main must change direction more than that amount, the invert grade at the exit must be at least 0.10′ below that of the entrance pipe, but in no case shall the crown of the exit pipe be lower than the invert of the entrance pipe. If the pipes entering and exiting any manhole are not of the same size, the crown of the exit pipe shall never be higher than the crowns of pipes entering the manhole. Manholes not meeting these conditions shall be governed by inside drop connection requirements.

D. **Construction Requirements:** Manhole construction shall conform to the provisions of Standard Drawings 7-1 to 7-3. Lock-type or pressure-type manhole covers shall be used on manholes located in easements, and in areas subject to flooding.

If the distance from the crown of the pipe to the top of the rim is less than 6 feet 11 inches, 18-inch high cone shall be used. Manholes shall use flat slab tops that have through mains and less than 5 feet 8 inches from the crown of the pipe to the rim. The plans shall note that the frame on manholes located in unimproved areas shall be set 1.0′ above existing ground level, provided with a concrete collar and an object marker.

Manholes located outside of paved areas shall be provided with all-weather access, and shall be located in the center of a 10 foot diameter level all-weather pad, so that they are accessible to maintenance personnel and equipment.

E. **Vacuum Testing:** All manholes shall be vacuum tested in accordance ASTM C 1244. Acceptance testing shall occur following placement of aggregate base and prior to paving.

7-9 DROP CONNECTION

Drop connections are not allowed, but may be approved by the County Engineer. If approved, manholes containing drop connections shall be coated with a protective coating of either a) 40-mil T-lok PVC liner, Ameron Protective Coatings, b) CCS Coating, high build chemical resistance 40-mil epoxy coating by ChemCo Systems, c) Raven 405 epoxy, 60 mils, d) or equivalent. There shall be no more than one inside drop connection into a four-foot diameter manhole.

7-10 FLUSHING BRANCH

A flushing branch may only be used at the end of a collector less than 200 feet in length if the collector extends to a subdivision boundary and if there are definite plans for its extension. If a collector extends to a subdivision boundary, is planned for definite extension, and has no sewer service connections, it may be capped. Flushing branches shall conform to Standard Drawing 7-6.

7-11 SEWER SERVICES

A. **General:** Sewer service laterals shall conform to Standard Drawing 7-5 and shall be aligned at right angles to the main unless otherwise approved by the County Engineer. The sewer service shall extend from the collector sewer to the lot being served. Sewer services shall extend at least one foot beyond the edge of the pavement of any private road. Easements of adequate width to

accommodate the services shall be obtained. A plan and profile of any sewer service shall be supplied to the County Engineer upon request. Construction of the cleanout to grade for all sewer services is required. The cleanout location shall be accurately staked with a 4"x 4" post until final landscaping is completed and service connections are completed.

The location of all sanitary sewer services shall be permanently marked with a 2-inch tall "S" set in the top of concrete curb. Where curbs do not exist, a 2'x2' concrete pad shall be placed around the sewer cleanout box, and a permanent post (2" diameter, galvanized steel, painted white) shall also be installed to mark the location of the sewer cleanout box.

B. Sizing: Normal sewer service size is four inches for residential and six inches for multi-family or commercial. Six-inch or larger sewer services shall serve schools and other developments expected to contribute high sewage flows. In addition, sewer services shall be sized according to requirements of the Uniform Plumbing Code, and as determined by the Engineer. If the sewer service and collector are of the same size, a manhole must be constructed.

C. Connection Limitations: Sewer services shall not directly connect to sewer mains designed to flow full or to mains more than 16 feet in depth without the approval of the County Engineer.

D. Material: The "T" or wye and the sewer service shall be of the same material as the collector to which it connects.

E. Location: When sanitary sewers are constructed as part of new subdivision improvements, a separate sewer service shall be constructed between the main and each lot. In new subdivisions or developed areas, unless specifically requested otherwise in writing by the property owner or Design Engineer, sewer services shall be placed on the low side of any subdivision lot or similar parcel with two percent or greater slope across the front. Otherwise, the sewer service shall be placed in the center of said lot or parcel. Consideration shall be given to trees, improvements, proposed driveways etc., so as to minimize interference when the sewer service is extended to service the house. If the property is located such that sewer service is available both to a main located in an easement and also in right of way, sewer service shall be connected to the right of way location unless otherwise approved by the County Engineer. No sewer service shall be located such that future on site construction will result in the main being in such proximity to a water well or water main or water service that applicable health standards will be violated.

F. Depth: The Design Engineer shall verify the adequacy of the normal sewer service depth at the edge of easement or right of way to serve the intended parcel. A depth of four feet to crown of pipe, measured from the ground surface at the back of sidewalk shall be considered normal sewer service depth, except as allowed in the event of conflict with dry utilities, as provided for on Standard Drawing 7-5. Whenever greater depth is required, the Design Engineer shall designate the invert elevation of the sewer service at the edge of the right of way or easement on the construction plans. If a joint trench is being utilized for other utilities, the Design Engineer shall indicate on the plans that a Joint trench will exist and shall adjust service elevations as necessary. It shall be the responsibility of the Design Engineer to arrange for coordination of the grade of utilities located in the joint trench and the sewer services.

G. Service Requirements in Developed Areas: In developed areas, a sewer service shall be provided to each legal parcel containing a source of sewage and having a property line less than 200 feet from a collector. A property owner's request for sewer service location shall be honored whenever practicable. Parcels having two or more sources of sewage must have an independent sewer service provided to each sewage source. A sewer service shall be provided to each subdivision lot or lot similar as to size and possible development. At an early stage of design, the Design Engineer shall send every property owner affected by the proposed work a questionnaire requesting, in writing, the owner's preferred sewer service location. In absence of a response to this questionnaire, the Design Engineer shall provide a sewer service as required by this Section.

In addition, when sewer services are staked immediately prior to construction, each property owner shall be given notice that he should give consideration to the staked location of his sewer service and, if not satisfactory, immediately notify the Design Engineer. The date of notification, nature of change, and other pertinent information shall be recorded. Compilation of this information shall be the responsibility of the Design Engineer and the information shall be furnished to the County Engineer upon request.

7-12 CREEK OR CANAL CROSSING DESIGN

Advance approval of the County Engineer and of other appropriate agencies is necessary prior to initiating design. Copies of required permits shall be provided to the Department prior to approval of the plans.

A. General: In all cases, the proposed future creek or canal bed elevation shall be used for design purposes. Crossing details of pipe, piers, anchorage, transition couplings, etc., shall be shown on a detail sheet of the plans.

B. Design: Calculations shall be submitted which clearly indicate the design of the pipe and supports regarding impact, horizontal and vertical forces, overturning, pier and anchorage reactions, etc.

C. Construction and Material: For collector sizes ten inches and smaller, ductile iron pipe or other pipe material as approved by the County Engineer shall be used under the full channel width, plus ten feet each side, unless the pipe is four feet or more below the channel bed elevation. For main sizes twelve inches and larger, pipe used shall be as directed by the County Engineer. Special care shall be taken to provide a firm base for the pipe bedding. The plans shall specify that all soft or organic material within the channel banks shall be replaced with select imported backfill. In addition, the pipe shall be encased in concrete or soil cement shall be used to protect the pipe for the full width of the channel. Unless otherwise directed a clay soil plug shall be required at the top of the pipe at the downstream side of the crossing. The plug shall be a minimum of four feet in length, shall extend the full width of the trench, and shall extend twelve inches above and below the pipe or as approved by the County Engineer.

If the pipe must cross above the channel, ductile iron or welded steel pipe shall be used. Steel pipe may be cement lined and coated, fusion epoxy lined and coated, or glass lined; the County Engineer shall specify or approve the type of coating and lining specified, and the gauge, class, or thickness of the pipe.

Reinforced concrete piers of adequate depth shall be located as necessary for adequate support of the pipe. The pipe shall be held in cylindrical cradles, formed in the pier tops, by galvanized steel straps, with galvanized anchor bolts of adequate size. Cushion material shall be placed between the pipe, clamps, and support. The invert elevation at the point of maximum deflection of the suspended pipe shall be invert of the pipe at its downstream support.

7-13 JACK AND BORE REQUIREMENTS

Where use of conductor casing is specified, the casing shall be reinforced concrete pipe. The casing shall be of sufficient diameter to allow dry sand to be blown into the void between the carrier and the conductor and to allow adjustment of the carrier pipe to grade. Normally, an inside diameter six inches greater than the outside diameter of the couplings of the carrier pipe is sufficient. Reinforced concrete pipe conductors must be designed for the loading condition and, if jacked, the additional loading imposed by the jacking operation.

Direct dry boring of reinforced concrete pipe and of the portion of sewers and sewer services, which pass beneath curbs and gutter, sidewalks, and other obstructions, up to a maximum length of 15 feet, is

permissible. Six-inch and smaller pipelines may be installed by wet boring where approved by the County Engineer. Pipe material used in the small size dry and wet bores shall be ductile iron pipe, or Class 200 (DR-14) PVC pipe conforming to the requirements of AWWA C900.

Backfill in bore pits shall be given special attention with respect to preventing structural failure of the pipe entering or exiting the conductor, and adequate bedding and initial backfill shall be specified.

7-14 PUMP STATION AND FORCE MAIN REQUIREMENTS

Every phase of pump station design, including force mains, shall be closely coordinated with and shall be under the direction of the County Engineer. Pump station features shall include, but not be limited to, buried non-corrosive wet well, duplex (redundant) submersible pumps & motors, above ground weather proof enclosure for automated controls, telemetry, SCADA, remote dialing alarms, phone service, power supply, backup power generator powered by natural gas or propane (LPG), lighting, all weather access, sulfide related corrosion control or reduction, life cycle cost analysis of proposed features, etc. Force Main features shall include, but not be limited to, non-corrosive pipe materials, pipe routing, exit manhole sulfide related corrosion control or reduction, life cycle cost analysis of proposed features, etc.

A. Plans for Wastewater Pump Stations

1. General Layout:
   a. Plot plan showing layout of site and building(s), including driveway and number of parking stalls, exterior piping and appurtenances, fencing, and utilities. Property ties shall also be shown.
   b. Plans and details of grading, drainage, erosion control, landscaping, and sprinkler system.
   c. Show FEMA flood elevations if area is in a 100-year flood plain.
2. Detail Plans:
   a. Architectural plans, elevations, and details.
   b. Structural plans, elevations, sections, and details.
   c. Utility plans (electrical, mechanical, etc.) showing exact location and elevation 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 telemetering 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. Wastewater level control arrangement for operating pumps and alarms.
   g. Other plans, sections, elevations, schematics, details and notes, as required, to adequately show the proposed construction.

B. Specifications: All work shall be in accordance with these Improvement Standards. Special provisions shall supplement the Improvement Standards and shall specify in detail the construction of the wastewater pump station, and all appurtenances.

C. Other Requirements:

1. Design Calculations: Calculations pertinent to the design shall be submitted to the Planning and Public Works Department. Such calculations shall be used by the County for determining the adequacy and feasibility of the proposed facilities under review. Any failure on the part of the Developer or authorized representatives to submit such calculations will delay the review and approval of the desired project.
2. Revisions to Approved Plans and Specifications: Any deviations from these specifications shall be approved by the County Engineer in writing before such changes are made. 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.

3. Operation During Construction: Existing facilities and pump station units shall be kept in operation during construction.
4. Equipment Manuals: Equipment manuals shall be provided for each pump station. The manuals shall contain sufficient information on the installation, operation, maintenance, and repair of the pump station equipment. Manuals shall be bound in looseleaf "D" binders. Folders shall contain only the information in relation to the equipment furnished. Each binder shall be labeled on its front cover and spine with the name of the facility and subject matter. Two sets of manuals shall be provided to the County.
5. Facilities Operations and Maintenance Manual: A detailed operations and maintenance manual for the facilities to be constructed shall be required for all pump station projects. The manual shall give the operations and maintenance personnel the proper understanding, techniques, and any other information necessary to efficiently operate and maintain their facilities. Operations and maintenance manuals shall comply with all applicable State and Federal statutes, ordinances, and regulations. Two sets of manuals shall be provided to the County.
6. Initial Start-Up Procedure Training: Services of field engineers or qualified personnel for all equipment provided shall be required to assist and instruct the County's operating and maintenance personnel. Such services shall commence before final acceptance testing.
7. Spill Prevention Plan and Emergency Response Plan: The facility's O&M manual shall include sufficient operating instructions in the form of a spill prevention plan to prevent spills. The emergency response plan shall also provide instructions to the operator on how emergencies are to be handled. Two sets of manuals shall be provided to the County.
8. One Year Certification: A certification shall be prepared after one year of facility operation documenting the performance of the facility. This certification is intended to confirm that the facility is operating as planned and there are no problems with the equipment. The certification should be prepared by the facility designer, construction manager, or other registered engineer approved by the County.

D. Design Factors to be Considered:

1. Type of Station (Built-In-Place Wastewater Pump Station): All pump stations shall be built-in-place and may be either dry or wet well type. Premanufactured pump station systems may be considered upon review by the County Engineer.
2. Wastewater Flows and Design Capacity:
   a. *Wastewater Flows*. Wastewater flows shall be determined in accordance with County Improvement Standards.
   b. *Design Capacity*. Wastewater pump stations shall be designed to discharge design flows.
   c. *Location*: 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. Pump stations should not be subject to flooding and shall be readily accessible. Wastewater pump station sites shall be adequate to allow on-site parking of service trucks and equipment and to buffer adjoining properties from noise. Future modification and expansion requirements shall be given consideration.

E. Site Improvements:

1. Grading: 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. Adjacent properties shall not be jeopardized by such provisions.
2. Driveways and Parking Areas: Paved driveways and parking areas shall be provided for service trucks. Width of driveways shall be 12 feet minimum. Pavement shall be asphalt or Portland cement concrete. Concrete curbs shall be required for all pump stations. Entrance gates shall be set inward, toward the station, at least 18-feet to allow trucks entering or leaving the station to pull off the adjacent street.

3. Fencing: Pump station sites shall be fenced in with a six-foot (6') high fence or wall. Masonry walls or other approved types of enclosures are required if pump station is located adjacent to a residential project. Where chain link fences are used, wire fabric shall be nine gauge minimum, galvanized, and plastic coated with color determined by the County. In isolated areas, 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. 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.
4. Gates: Gates shall be provided with heavy duty padlock hasp fixtures and shall be designed for safe opening and closing during strong winds. At facilities where PG&E transformers and/or meters are installed within the station's perimeter, hasps shall be designed to accommodate two padlocks. Design shall allow access with either padlock removed.
5. Landscaping: Sites shall be landscaped to blend with the surrounding environment to render a pleasing overall appearance. Consideration shall be made to minimize groundskeeping maintenance. Chain link fencing shall be screened with landscaping.
6. Sprinkler System: Automatic sprinkler systems shall be installed for lawn/foliage irrigation.

F. Structures and Appurtenances:

1. Architectural Design: Wastewater pump stations shall be architecturally designed to be in harmony with surrounding development. Materials shall be selected to keep construction and maintenance cost at a practical level. As much as possible, non-corrosive materials shall be used. All architectural design shall be prepared by a Registered Architect.
2. Substructure: Built-in-place pump station substructures shall be reinforced concrete construction. All substructures shall be waterproof and watertight. 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. Consideration shall be given to flotation during construction and/or flooding condition. Ensure that NPSH requirements of pump are met. Structural backfill for the lift station shall be placed as engineered fill, in lifts not exceeding 12 inches in compacted thickness. Each layer shall be uniformly moisture conditioned to at least the optimum moisture condition and compacted to at least 95% of the maximum dry density per ASTM D1557-91 specifications.
3. Backfill: Backfill around the lift station well shall consist of clean crushed rock with 100% passing through a one inch (1") sieve and no appreciable amount passing through a #4 sieve. 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. In all areas the crushed rock shall be separated from the native material with an approved non-woven geotextile fabric. With approval of the County Engineer, excavated soils may be used for backfill, after required drying has occurred to allow the specified degree of compaction to be achieved. Imported soils must be free of organic concentrations, rubble or debris and must have approval of the County Engineer. The contractor may find it necessary to use deep wells to lower the water table in lieu of using sump construction and pumping. If sheet piling is used the contractor shall extend the tips to a sufficient depth to prevent “quick” conditions or sand “boils” from occurring. 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. The contractor shall submit to the County Engineer for review and approval all shop drawings and proposed methods of construction.
4. Dry Wells: Dry wells shall be sized to meet space requirements for equipment, piping and ease of maintenance. Adequate working space, at least two feet (2') clear, shall be provided between and around pumps and other equipment. Provide three feet (3') clearance for electrical equipment to comply with the National Electrical Code. Space and provisions for planned future pumps and equipment shall also be provided.

5. Wet Wells: Wet wells shall be designed on the basis of minimizing deposits of solids, preventing wastewater from becoming septic, and avoiding frequent starting of pumps. Minimum pump cycle (period from start to start) for any one pump shall be 5 minutes, but not less than the pump manufacturer's minimum pump cycle time rating. Maximum retention time of wastewater in wet wells shall be 30 minutes at average flow (total wet well wastewater volume shall be used in computing retention time). Wet wells shall have a minimum inside width of five feet (5') and shall be sized to keep wastewater levels within the following limits:
   a. High water level. Desired: at invert of incoming sewer. Maximum: at crown of incoming sewer.
   b. Low water level. Not lower than top of pump casing.
   c. Vertical distance between pump start and stop levels. Six inches (6") minimum.
   d. 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. Influent lines shall be designed without vertical drops into the wet well to minimize release of entrained air/gases. The wet well shall be divided into two or more sections, properly interconnected, to facilitate repairs and cleaning. Wet wells shall have a minimum 40-mil PVC 'T-lock' lining to protect against hydrogen sulfide corrosion.
6. Access. Reinforced concrete or structural steel stairways shall be provided for access to dry wells. Stairways shall have a clear passage of at least 30 inches. Stairs shall be provided with permanent non-slip treading. Access shall be provided to all wet well compartments. Access manholes shall be located to best facilitate maintenance operations.
7. Ventilation. Dry well shall be ventilated by a mechanical air exhaust system providing at least one air change every three (3) minutes. Outlets of exhaust system should not be located less than 12 feet from any opening except when exhausting through the roof. Ventilation exhaust shall be located downwind of any inlet openings. Velocity in air ducts shall not exceed 1500 fpm. When required fan capacity is large, the use of two fans shall be considered. Switches for the operation of the ventilation equipment shall be interlocked with the dry well light switch. Ventilation shafts shall be provided for wet well compartments with only one access opening.
8. Drainage. Dry well floors shall be constructed to drain by gravity into trench drains channeled to a sump. The sump pump shall be submersible. Minimum sump pump capacity shall be 25 gpm with exception of stations equipped with water seal systems, hydraulic operated cone-check valves, or similar type equipment. These stations shall be provided with duplex submersible pumps, each capable of pumping at least 50 gpm. A switch for lead/lag operations shall be provided at the Motor Control Center (MCC). Sump pump discharge shall enter the wet well adjacent to and as high as possible to the ground floor level. Trench drains shall be covered with corrosion resistant gratings. Floor framing and anchoring devices for gratings shall be 316L stainless steel.
9. Superstructure: All pump stations shall have a superstructure.
   a. *Floor Elevation and Area*. 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. Adequate working space, at least two feet (2') clear, shall be provided between and around all equipment. Provide three feet (3') clearance for electrical equipment to comply with the National Electrical Code.
   b. *Height*. Height of superstructure shall provide adequate working height. Whenever possible, height of superstructures shall be adequate to permit the removal of motor rotor from its stator or the removal of other equipment of larger size with the installed hoisting equipment.
   c. *Materials of Construction*. The following materials are acceptable for construction of superstructures:

i. Beams and Columns: reinforced concrete or structural steel.
ii. Roof: reinforced concrete.
iii. Wall: masonry or reinforced concrete.

d. *Insect Screens*. All structure openings for ventilation or light, except doorways, shall be equipped with removable stainless steel insect screens.

e. *Doors*. Doors shall be of adequate size to permit removal of pumps, motors, and other equipment. Locks shall be keyable to the Department of Planning and Public Works master key.

f. *Roofing*. Unless otherwise submitted and approved, roofing shall be pitched, standing seam metal.

g. *Railings and Stairways*. Railings and stairways shall conform to OSHA regulations and County-adopted Building Codes.

h. *Outdoor Enclosures*. Gages, meters, and control devices installed outdoors shall be mounted within weather protected enclosures. Gages integral of other devices such as bearing thermometer on motors are excepted. PG&E meter location shall permit easy PG&E viewing.

i. *Provision for Equipment Removal*: Provisions shall be made to facilitate removing pumps and other equipment for repair and maintenance.

j. *Openings*. Openings shall be provided in ground and intermediate level floors of pump stations. Ground level floor openings shall be covered with removable grates and have removable pipe posts and guard chains around its periphery. Stationary posts with removable pipe railing sections shall be provided around intermediate floor openings. All 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.

k. *Hoists*. Built-in-place pump stations shall be equipped with trolley type hoists traveling on steel beams or traveling bridge cranes. Traveling bridge cranes shall be provided for installations equipped with 6 mgd pumps and larger. Bridge cranes shall be electrically controlled. Hoists for station with a vertical lift of 25 feet or more (pump room floor to top floor) shall be electrically powered. Plug-in type hoists operating on single phase 120 volts may be allowed for small stations.

l. *Eye Bolts*. 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. The load rating of each eyebolt shall be shown on the plans.

m. *Headroom*. Sufficient headroom, including room for lifting device, shall be provided to allow pump rotating element to be removed without disturbing the pump volute.

10. Station Facilities: Depending on proximity of station to other available facilities, and on a case-by-case basis, pump stations may be required by the County Engineer to incorporate any or all of the following:

a. *Sanitary Fixtures and Accessories*.

i. Service sink shall be acid resistant, white enameled, cast iron body, stainless steel rim.
ii. Water closet shall be vitreous china, wall hung, close-coupled closet combination with open front, black closet seat without cover.
iii. Paper towel dispenser shall be chromium plated.
iv. Toilet paper holder shall be chromium plated.
v. Paper toilet seat cover dispenser shall be chromium plated.
vi. Soap dish shall be chromium plated.
vii Waste paper basket shall be plastic or noncorrosive material.
viii. Wall mirror shall be a minimum 12 in. x 24 in.
ix. Small storage cabinet for janitorial supplies shall be a minimum 12 in. wide, 18 in. high, and 8 in. deep.

b. *Light Fixtures and Receptacles*. Electrical systems shall conform to the National Electric Code.

i. Light Fixtures. Light fixtures shall be provided to supply adequate illumination within pump stations and shall be mounted where relamping can be accomplished with reasonable ease. 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 over the wet well cover manholes. Wet wells shall not require light fixtures. Light fixtures below ground level shall be vapor-tight. Fluorescent fixtures using 48 inch T-8 type tubes are preferred. High pressure sodium fixtures shall be used where appropriate.

ii. Night Lights. Night lights shall be provided above all building entrances and equipped with lamp shades to prevent glare beyond the perimeter fence line. Consideration shall be made for a night light at the perimeter entrance gate. Night lights shall be automatically controlled by photocells.

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

iv. Receptacles. Weather-proof receptacles shall be installed at all floor levels of pump station and outside the building, adjacent to the wetwell.

c. *Telephone*. Terminal cabinet and touch tone instrument shall be provided.

d. *Miscellaneous Equipment***.**

i. Fire Extinguishers. Fifteen lbs. CO2 for MCC room and generator area. Ten lbs. dry chemical for lower floors. All fire extinguishers shall be wall mounted.

ii. First aid kit.

iii. Eight inch electric clock.

iv. Plastic trash receptacle, thirty gallons capacity with cover.

v. Desk and chair.

vi. Storage cabinet for flammable materials.

vii. Legal size drawer file cabinet with lock.

G. Pumps, Motors, and Controls:

1. General. Major pump stations shall be equipped with a minimum of three pumps. Smaller pump stations may be equipped with two pumps. Pumps shall be capable of operating over the range of flows without excessive cycling and without long retention time. 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. Dual speed motors may be considered where appropriate. All pump stations shall be equipped with a standby pump equal in capacity to the largest of the main pumping units. The main pumping units shall be capable of handling the station's design flow without the use of the standby unit. 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. Speed of pumps shall not exceed 1200 rpm. 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. The brake horsepower required at full motor speed at any head along the curve shall not exceed the rated horsepower of the motors.

2. System Head-Capacity Curves. Pumps shall be selected so that the head-capacity characteristics correspond as nearly as possible to the overall station requirements. 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. 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. The equivalent length method using the Hazen-Williams formula is preferred.

Minimum and maximum head losses shall be determined using "C" values. The system head-capacity curves shall consist of the following:

a. System Curves. Curves showing total dynamic losses in the force main at varying pumping rates for minimum and maximum static heads.
b. Individual Pump Characteristic Curves. Curves furnished by pump manufacturer showing pump's head-capacity characteristics. Curves at minimum and maximum anticipated speeds shall be furnished for variable speed pumps.
c. Modified Pump Curves. Curves showing pump's 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.
d. Combined Modified Curves. Curves showing multiple pump operation, obtained by adding capacities at points of equal heads on the modified pump curves.
e. NPSH Curves. 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. The NPSHA and NPSHR curves shall include the operating conditions of minimum static suction head and maximum frictional loss (C=100) over the entire operating range of each pump. 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. All pumps shall be vertical units. Motors for stations with pump capacities greater than 2 mgd shall be installed on the ground level floor and connected to pumps with removable driveshafts, intermediate driveshafts, and equipped with removable and adjustable flexible couplings. For pumps of less than 2 mgd capacity, submersible pumps may be used for wet pit installation. Consideration for pump on/off cycling shall be made to avoid high motor temperature. Motors for stations with pump capacities less than 2 mgd may be pedestal mounted.
4. Dry Pit Pump Construction.
   a. Handholes shall be provided on the periphery of pump casings and suction elbows for purposes of inspection and removal of obstructions. Handhole covers shall be flanged and secured to bossed sections and shall have interior surfaces formed to match interior surfaces of casting to which attached. Pump casing handhole shall be located so that visual inspection can be made of the discharge end as well as the volute. Handholes shall be a minimum of four inches (4") or about half of the pump size.
   b. Pumps shall have flanged suction and discharge nozzles, faced and drilled to conform to ANSI Class 125 lb. standard. 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. Suction elbows shall be designed to prevent cavitation. Guide vanes shall not be used in suction nozzles.
   c. Pumps of sizes greater than five inches (5") shall be provided with either fabricated structural steel supports or cast iron ribbed supports. Cast iron supports shall be cast integral with the pump casing or suction nozzle.
   d. Base or sole plates shall be provided. Plates shall be anchored by stainless steel bolts with stainless steel lock washers and grouted to reinforced concrete pedestals. Hardened steel jacking screws for leveling and for aligning of pumps shall be provided. Mating surfaces shall be machined and all holes drilled and not be burned.
   e. Intermediate drive shaft sections should be not more than 12 feet in length. Where more than one drive shaft is required, self-aligning steady bearings shall be provided at each intermediate location. Bearings shall be equipped with mechanism to allow alignment adjustments. Bearing and shaft guards shall be provided. Safe access to bearing and

guards shall be provided. Grease fittings shall be equipped with extension tubing to facilitate lubrication.

f. Drain and air release lines shall be provided for all pumps. Drain lines shall be installed at the packing drip reservoir and at the centerline of the suction pipe. Air release line shall be installed at high point of pump casings. Connecting points shall be bossed, drilled, and tapped. Air release lines from pump to the first valve shall be brass. Provisions shall be made for a sampling tap for wastewater unless waived by City.

g. 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 excepted).
   vii. Taper Pins and Jacking Screws: On all machined joints and handholes.
   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.

h. Stock bronze fitted pumps with cast iron casings and bronze impellers are permitted for temporary installations. Impeller rings and shaft sleeve shall be bronze.

5. Wet Well Submersible Pump.

a. Handholes shall be provided on the periphery of pump casings and suction elbows for purposes of inspection and removal of obstructions. Handhole covers shall be flanged and secured to bossed sections and shall have interior surfaces formed to match interior surfaces of casting to which attached. Pump casing handhole shall be located so that visual inspection can be made of the discharge end as well as the volute. Handholes shall be a minimum of four inches (4") or about half of the pump size.

b. Pumps shall have flanged suction and discharge nozzles, faced and drilled to conform to ANSI Class 125 lb. standard. 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. Suction elbows shall be designed to prevent cavitation. Guide vanes shall not be used in suction nozzles.

c. Base sole plates shall be provided. Plates shall be anchored by stainless steel bolts with stainless steel lock washers and grouted to reinforced concrete pedestals. Hardened steel jacking screws for leveling and for aligning of pumps shall be provided. Mating surfaces shall be machined and all holes shall be drilled and shall not be burned.

d. Drain and air release lines shall be provided for all pumps. Drain lines shall be installed at the centerline of the suction pipe. Air release line shall be installed at high point of pump casings. Connecting points shall be bossed, drilled, and tapped. Minimum size shall be d inch. Air release lines from pump to the first valve shall be brass. Provisions shall be made for a sampling tap for wastewater unless waived by the County.

e. Other features of pumps shall be as follows:
   i. Pump shaft shall be stainless steel.
   ii. Bearings: Not less than two, sealed, and grease lubricated.
   iii. Seal: Tandem, double mechanical seal running in an oil reservoir. 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 springs. The compression spring shall be protected against exposure to the pump liquid.

iv. Casing and Impeller Wearing Rings: Stainless steel and "Z" or "L" shaped.

v. Suction plate: Separate from suction elbow (pumps five inches (5") and smaller may be excepted).

vi. Taper Pins and Jacking Screws: On all machined joints and handholes.

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.

x. Provide sensors and alarms for:
High temperature
Vibration
Seal leakage

6. Motor Construction.

a. Dry Pit Motor.

i. 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. Motors shall be capable of safely rotating in the reverse direction at runaway speed without damage to appurtenances under shutoff head. Motors shall operate pumps through flexible shafts and couplings. Vertical shaft motors mounted on floors shall be furnished with rugged cast iron or steel foundation rings. Motors shall be induction type, drip proof, and suitable for operation from 230/460 volts, 3 phase, 60 cycle A.C. power systems. Motors shall have a service factor of 1.15. All pump motors shall have running time meters installed at the starter. All pump motors above 20 HP shall have an ammeter installed at the starter. Dry pit sump pump motor shall have running time meters installed at the starter.

ii. Motors shall be grease lubricated. Motors 7 HP or larger shall be provided with space heaters. 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.

i. 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 the PG&E or as permitted by the emergency generator. Motors shall be capable of safely rotating in the reverse direction at runaway speed without damage to appurtenances under shutoff head. Motors shall be suitable for operation from 230/460 volts, 3 phase, 60 cycle A.C. power systems. Motors shall have a service factor of 1.15. All pump motors shall have running time meters installed at the starter. All pump motors above 20 HP shall have an ammeter installed at the starter. The motor power wiring shall be brought up directly to the level of the MCC.

ii. Pump motors shall be housed in a watertight casing and shall have moisture resistant insulated windings. Pump motors shall have cooling characteristics suitable to permit continuous operation in a non-submerged condition.

7. Indicating Pressure Gauges. Indicating pressure gauges shall be provided at discharge nozzle and suction plate of pumps. Indication shall be in feet. Isolation valves and stainless steel diaphragm seals shall be provided at gauges.
8. Testing. All wastewater pumps shall be factory tested in accordance with the ASME Power Test Codes or the Standards of the Hydraulic Institute. Five (5) certified copies of the pump curves and data shall be furnished with each pump requiring drive motors 40 HP or smaller. 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. Each pump casing shall be tested under a hydrostatic pressure of not less than 60 psi. All impellers, including spares, shall be statically and dynamically balanced. All electric motors shall be tested by the motor manufacturer. 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. Five (5) copies of the certified or witnessed test data shall be furnished for each motor. All pumps shall be field tested to demonstrate satisfactory operations.
9. Spare Parts. All installations shall be furnished with the following minimum spare parts:
   a. 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.
   b. 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)
      iv. One mechanical seal assembly (if applicable).
   c. For submersible pump:
      i. One complete pump unit with stand.
   d. 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).
   e. For generator:
      i. All parts recommended in the manufacturer's O&M manual.
      ii. One circuit board for the voltage regulator.
   f. For ventilation fan:
      i. One set of fan drive belts.
10. Starters and Controls:
    a. Liquid Level Controls. The operation of wastewater pump motors shall be automatically controlled by liquid level sensing devices, actuated by wastewater level fluctuations in the wet well. Ultra Sonic/Transducer type with a 4-20 MA output should be provided. Automatic control settings shall be manually adjustable. Duplicate control units shall be provided for all pump stations equipped with split wetwell chambers. Controlling devices should also be capable of alternating the lead pump and setting off high and low level alarm. The operating range of controlling devices shall conform with the requirements of minimum pump cycle and maximum detention time.
    b. Selector Switches. HAND-OFF-AUTO selector switches shall be provided to operate pumps. Selector switches shall be located at the motor control center and watertight switches next to pumps. Both selector switch settings must be the same in order for the pump to operate (Example: HAND-HAND or AUTO-AUTO). Automatic and manual

control for variable speed pumps shall be capable of being adjusted over the effective speed range.

c. Starters. Unless otherwise restricted by PG&E, starters shall be of the combination, magnetic, across-the-line type. Starters shall be solid-state.

d. Control Centers. Starters shall be mounted and wired as an integral part of free standing, unitized, enclosed control centers. Control centers shall be designed and constructed in accordance with the latest standards of the NEMA and the IEEE. Starters for temporary installations may be surface mounted. Control center cabinets shall be installed to permit full opening of doors without interference from adjoining cabinets, walls or other equipment. Split hinge doors may be used to prevent opening interference. All major components of control centers shall be by one manufacturer. If more than one control center 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. All panel units, devices, indicating lights, and instrumentation shall be identified by engraved nameplates or metal collars. All starters shall be of the draw out type whereby all control wiring and power conductors are automatically disconnected upon removal of the starter.

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

11. Instrumentation and SCADA System: SCADA software and PLC's shall conform to equipment as currently used by the County, or as approved by the County.
    a. Instrumentation. Pump stations shall be provided with instrumentation and SCADA systems which include the following:
        i. Telemeter.
        ii. Discharge flow.
        iii. Discharge pressure.
        iv. Wet well level.
        v. Run-time pump hours.
    b. Report-back of operational status:
        i. Sewage pumps.
        ii. Sump pumps.
        iii. Emergency generator.
        iv. Other items of importance to operations.
    c. Alarms:
        i. Normal power source failure (i.e. low voltage, high and low frequency, or phase reversal).
        ii. Alternate power source failure.
        iii. Generator operating.
        iv. Main buss power failure.
        v. Low level in wet well.
        vi. High level in wet well.
        vii. High level in pump room sump.
        viii. Other equipment failures which could endanger pump station operations.
        ix. Backup Generator Engine Supervision (i.e., starter failure, low speed, low oil pressure, high water temperature, etc.)
        x. Building intrusion.
12. Remote Controls. When conditions dictate that installations be remotely controlled from supervisory stations, the following additional functions shall be provided:
    a. Report-back:
        i. Operational status of each pump (running or not running).

ii. Operational status of any other item of importance to remote control operations.

b. Supervisory remote controls:
   i. Start and stop pumps.
   ii. Other functions of importance to remote control operations.

c. Alarms:
   i. Warning of transfer to supervisory remote control operations.
   ii. Other alarms of importance to remote control operations.

13. Relay to Department of Public Works. All readings, alarms, and indications, shall be relayed to supervisory stations designated by the County Engineer.
14. Suppliers. Instrumentation systems should be provided by one integrator with field and shop maintenance facilities and full time service engineers located in Northern California.
15. Flow Meters.
    a. Flow meter receiving instruments at the pump station shall be capable of totalizing, indicating, and recording of flows.
    b. Recorder shall be electronic type with a month duration, four inch (4") wide circular paper chart and a visible face of approximately four inches (4").
    c. Indicator shall be four inches (4") long or shall be digital with approximately one inch high numerals.
    d. Flow meter pressure differential producers shall be of the standard venturi type. Insert type differential producers or Dall tubes shall not be permitted.
    e. All sensors for temperature, pressure, flow, and all other measurement outputs must have 4-20 mA outputs if possible.
16. Level Meters.
    a. Wet well level meter receiving instruments at the pump station shall be capable of indicating and recording wet well levels.
    b. Recorder shall be electronic type with a month duration, four inch (4") wide circular paper chart and a visible face of approximately four inches (4").
    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 fuel tank systems.
17. Pressure Meters.
    a. Force main pressure meter receiving instruments at the pump station shall be capable of indicating and recording pressure.
    b. Recorder shall be electronic type with a month duration, and a visible face of approximately four inches (4").
    c. Indicator shall be four inches (4") long or shall be digital with approximately one inch high numerals.
    d. Single recorder with three (3) inputs may be used.
18. Instrumentation Panels. All pertinent receiving instruments, devices, alarms, indicating lights, and remote controls shall be mounted on centralized instrument panels. All items shall be identified with engraved nameplates. Electrical power to the panel and all instruments shall be through an uninterruptible power supply unit.
19. Indicating Lights. Appropriate indicating lights shall be provided to show the status of equipment operation, alarms, controls, etc. Indicating lights shall be of the push-to-test type or light emitting diodes (LED).
20. Amperage Meter. Provide an amperage meter for each sewage pump motor. Amperage metering to monitor all legs.

H. Piping and Valves:

1. Wastewater Pump Piping:
   a. Discharge and header (manifold) piping for wastewater pumps shall be not less than four inches (4") in diameter. Suction piping shall be not less than six inches (6") in diameter.

b. Velocities in wastewater pump piping shall be as follows:
   i. Suction from wet well 5 fps (desirable max.) 6 fps (absolute max.)
   ii. Discharge to header 7 fps (desirable max.) 8 fps (absolute max.)
   iii. Header (Manifold) 6 fps (desirable max.) 7 fps (absolute max.) 2 fps (desirable min.) 1.5 fps (absolute min.)
   iv. Discharge risers 3 fps (absolute min.)

c. Pipe and fittings shall be cast iron or ductile iron, cement lined and coated on the inside. Cast iron pipes shall be Class 150 and fittings ANSI Class 250. Ductile iron pipe shall be Class 52-minimum. Buried pipe and fittings shall be protected on the outside with an approved corrosion protection coating and cathodic protection. Zinc chromate primer shall be used on the outside for exposed piping to be painted with enamel. Joints shall be flanged with flanges faced and drilled to conform to ANSI Class 125 lb. standard with full face gaskets. 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. In permanent pump stations, discharge lines shall not enter headers perpendicularly. Base bends, properly supported on concrete pedestals, shall be provided at the bottom of vertical risers. Headers shall be properly blocked to resist water hammer.

e. Suction lines shall have turned-down bellmouth inlets. 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. Reducers used on the suction side of pumps shall be of the eccentric type to prevent air pockets.

f. Gate valves in suction lines, except for temporary pump stations and pump stations with capacity 1 mgd or smaller, shall be provided with extension stems to floor stand operators on the ground level floor. Gate valves shall be solid wedge, rising stem type with iron body, bronze trimmed, outside screw and yoke, and flanged ends. Flanges shall conform to ANSI Class 125 lb. standard except where high pressures are encountered. Valve operators for valves 16 inches or larger shall be electrically motorized. 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. Where damaging effects of water hammer are anticipated, valves with controlled rate of closure shall be installed. Swing check valves shall be iron bodied, bronze trimmed with outside lever and weight, and flanged ends. Flanges shall conform to ANSI Class 125 lb. standard except where high pressures are encountered.

2. Sump Pump Piping: All sump pump fixed piping in wetwells shall be schedule 80 PVC and in dry wells shall be brass. A gate valve and check valve shall be installed on the discharge line. Flanged joints or unions shall be provided on the discharge line to facilitate dismantling of the piping. Minimum diameter of the discharge line shall be two inches (2"). Velocity in discharge risers shall not be less than 3 fps. The discharge point shall be installed at the highest elevation possible to prevent reverse flow when the wet well is filled to capacity. Typical discharge elevation shall be under and close to the ground floor. The sump pump shall be fitted with a flexible PVC hose, minimum two inches (2") diameter. Camlock fittings shall be provided for the PVC hose connectors to the pump and fixed piping.

3. Waste, Drain, and Vent Lines: Pipe and fittings shall be extra heavy cast iron soil type, except piping installed above ground or inside pump stations and piping two and one-half inches (2 ½") in diameter or smaller, may be standard weight galvanized steel pipe with standard cast iron screwed, recessed drainage fittings. Clean-outs shall be provided as necessary and shall be solid cast brass, rough finish with square heads. Bronze access frames and covers shall be provided for finish floors and walls Frames and covers for wall

installation shall be square with polished finish. Those for floor installations shall be round with scoriated finish. Clean-outs shall be readily accessible.

4. Potable Water Piping: 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.
5. Sprinkler System Piping: Sprinkler system piping shall be solvent welded schedule 40 PVC. Lawn risers shall be PVC or polypropylene and shrubbery risers shall be galvanized steel.
6. Piping Between Flow Tube and Instruments: Piping between flow tube to flow transmitter shall be one inch (1") minimum diameter 316 stainless steel. Horizontal runs shall have a minimum declining slope of one-quarter inch (¼") 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. Piping shall be connected to the flow tube on a horizontal axis. 316 stainless steel valves, unions and necessary fittings shall be installed close to the flow tube to facilitate maintenance. 316 stainless steel ball valves, gate valves, unions, tees and elbows shall be used on the entire system. Flow transmitters and diaphragm seals shall be installed inside the pump station and mounted for easy maintenance access.
7. Pipe Sleeves: Pipe sleeves shall be provided whenever small piping passes through concrete walls. Wall pipe shall be used for larger piping.

I. 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.

1. Standby Electric Power Equipment: Stations shall be equipped with a natural gas or propane(LPG) powered generator(s) to provide electric power to pump the design flow. The generator's synchronous speed shall be 1800 RPM. The engine generator set shall be a new, standard, current model and in accordance with ANSI and NEMA standards. Provide vehicular access including a pad for a portable generator.
   a. Operation of the emergency facilities shall be automatic upon power failure. Power failure monitors shall monitor all three phases. Monitoring of one phase of a three-phase system is not adequate.
   b. Automatic load transfer switches shall conform to PG&E requirements. When possible, bypass of the automatic transfer switch and manual override of automatic functions shall be provided.
   c. A plug for connection of a portable load bank shall be provided to fully load the generator periodically. The connection shall be made to the generator side of the transfer switch via a circuit breaker. 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 uninterruptable power supply unit. The uninterruptable power supply shall be sized to furnish emergency power for 8-hours minimum.
2. Fuel Storage System: The system shall comply with Federal, State and County regulations. The fuel tank capacity shall be based on two (2) days at design sewage flow and five (5) days at the daily average flow. Underground fuel tank installation shall be designed to prevent surface water infiltration into the fuel tank system. A leak alert monitor shall be provided with capabilities to display fuel inventory, and with audio and visual leak alarms.
3. Portable Pump Facilities: Pump stations shall be equipped to pump wastewater from the wet well into the force main with a portable pump. 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. 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. The suction piping shall be connected to the wet well and shall include piping

with a 90° elbow and a blind flange. 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. Portable pumps shall be located near the wet well to minimize the possible occurrence of cavitation. Provide vehicular access including a pad for a portable engine-driven Pump.

J. Miscellaneous:

1. Potable Water Supply: All pump stations shall be provided with a potable water supply system for sanitary fixtures, lawn sprinkling, washdown, and other maintenance purposes, as required. Adequate and conveniently located water outlets shall be provided for flushing and washing purposes. Hose bibs shall be 3/4-inch with vacuum breakers at all floor levels and outside of pump station. Stop cock valves shall be provided immediately before each hose bibb located within the building. Two conveniently located 1-1/2 inch diameter standpipes shall be provided adjacent to the wetwell. The standpipes shall have 1-1/2 inch angle globe valves for National Standard fire hose thread and end cap with chain. A 3/4-inch hose bib with vacuum breakers shall be installed on the standpipe directly below the globe valve. The main water supply line shall be two inches (2") in diameter, metered and equipped with a master valve located within the station's perimeter fence. A two inch (2") reduced pressure backflow preventer shall also be provided and located within the station's perimeter fence. 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. The potable water supply system shall conform to County, State, and Federal codes and regulations.
2. Painting: Pump stations shall have maintenance-free colored exterior finish, subject to County Engineer approval. County may, at its own discretion, approve a painted exterior finish. Painting shall be in accordance with the best practice and in strict compliance with the paint manufacturer's instructions and recommendations. No lead-base primer or paint shall be used. A minimum of two (2) finish coats over one prime coat shall be required.
3. Corrosion Protection: All materials and equipment exposed to corrosive conditions shall be either corrosion resistant or protected with appropriate protective coatings or linings.
4. Odor Control: All stations shall be provided with a 6-inch wetwell vent pipe to be used for treatment of foul odors. The vent pipe shall be schedule 40, 316 stainless steel, permanently installed through the wetwell slab and covered with a blind flange. A receptacle, at appropriate voltage, shall be installed near the vent pipe.

K Force Mains:

1. Locations: Force mains shall be located in streets or along road rights-of-way. In locating force mains, ease of installation and maintenance and elimination of high points shall be considered. Air release valves shall be installed at high points.
2. Sizing:
   a. Force mains shall be sized not less than six inches (6") in diameter (four inches (4") upon approval of County Engineer).
   b. Velocities in force mains shall be as follows:
      i. Minimum: 3.0 fps
      ii. Maximum: 10.0 fps
      iii. Force mains shall be designed to carry the maximum rate of pumping without excessive frictional head loss. Total dynamic head should not exceed 100 feet.
3. Materials: 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. Corrosion resistant lining, coating, wrapping, and cathodic protection shall be used. Insulating flanges or fittings may be

required at entrance or exits from buildings. The following material is acceptable for force mains subject to the conditions indicated:

a. Ductile Iron Pipe (Cement or other approved lining and Coated). Ductile iron pipe shall be wrapped with HDPE plastic wrap and have cathodic protection.

4. Minimum and maximum Cover and Clearances: Shall conform to the requirements as set forth in other sections of these standards.

5. Alignment and Grade: Pipe shall be laid in a straight alignment and with constant grades. Force mains may be curved by deflecting the joints to eliminate the necessity for fittings. In no case shall the deflection exceed the maximum as set forth by the manufacturer for the type of pipe used.

7-15 SEWER IMPROVEMENT PLAN REQUIREMENTS

Plans for the construction of sanitary sewers whether in conjunction with other improvements or for a sewer project only, shall conform to the following standards, as well as other standards contained in the General Requirements and Improvement Plan Requirements of these Improvement Standards.

A. General Requirements: All information, which, in the opinion of the County Engineer, is necessary for the satisfactory design, review, construction, and maintenance of a project shall be provided and, where applicable, shall be shown on the plans.

A parcel or area which benefits from and financially participates in a sewer construction project, but is not included within the project boundaries, shall have a note to this effect placed on the layout map and on the plan and profile sheet if the parcel appears thereon. Parcels, which make use of those facilities, may be subject to additional fees at the time of connection, if the participation has not been so noted.

B. Plan and Profile Sheets: Sewers shall be shown on the Project Street Improvements Plan and Profile sheets. The following standards, with respect to drafting and the information to be included on the plan and profile sheets, generally apply to projects in developed areas. In new subdivisions, only the requirements that are applicable shall apply.

1. Sewer mains to be constructed shall be indicated on the profile by parallel lines spaced by one pipe diameter. Manholes shall also be indicated by parallel lines spaced according to scale. Pipe slope shall be printed immediately above, and preferably parallel to, the pipeline, or between the parallel lines. The length, size, and type of pipe material between each manhole shall be printed parallel to the horizontal grid lines between manholes. All pipe-inverts at manholes and other structures shall be indicated on the profile. All manholes, flushing branches, or other appurtenances shall be noted on the plan and profile with stationing. Cone heights other than standard, shall be clearly labeled for those manholes requiring the shorter cones due to lack of available depth. Existing facilities shall be shown in profile using dashed lines or shaded lines.

2. In improved areas, the location of each proposed sewer service shall be indicated on the plans by stationing, or by reference to a permanent, well-defined structure, if available. In new subdivisions, the sewer services shall be located by stationing unless the situation exists, such as at the end of a cul-de-sac, where stationing is not an adequate description of location. In such cases a dimension to a lot line may be used. The invert elevation of the sewer service at its upstream end shall be shown on the plans whenever the service is not at standard depth. Standard depth shall conform to the conditions set forth on Standard Drawing 7-5.

Improvements or lots shown on a plan sheet but served to a main shown on another plan sheet shall have the direction of service shown by a small triangle and letter "S".

3. Permanent and working (temporary construction) easements shall be shown to scale on the plans. Easement dimensions shall be shown and each easement shall be dimensioned to the property line and the sewer main. Each permanent easement shown on the plans shall be identified by a box or table, on the same plan sheet, which gives the property owner's name and the Recorder's book and page number in which the easement is recorded. The Design Engineer shall provide the book and page number.

4. Proposed sewer mains shall be adequately dimensioned from street centerline. If the sewer is to be located outside of the right of way, sufficient dimensions and bearings from an approved horizontal control shall be shown on the plans to locate the main in the field.

5. Any other existing or proposed gas, electric, water, storm drain, etc., shall be determined and accurately shown on the plans. The location of any utility line which is parallel to and within five feet of the sewer main or which crosses the sewer main at an angle of 30 degrees or less shall be determined with an accuracy of 1.0± foot and the clearance shown on the plans.

6. Trees, and other objects within 10 feet of construction centerline, shall have their correct location shown on the plans and the clearance from construction centerline shown. The diameter of tree trunks and interfering heavy tree branches shall be noted. Removal of a tree or object, or other special handling shall be noted on the plans. The Design Engineer shall assume full responsibility for such notes as it is the Design Engineer responsibility to make all necessary arrangements with the owner of the object to be handled. Written documentation of any special arrangements regarding preservation of property made between property owners and the Design Engineer shall be supplied to the County Engineer if no easement document is involved. If an easement is negotiated, all special arrangements are to be included in the easement document. The County Engineer must approve tree removal within public rights-of-way or easements.

7. Culverts shall be shown on both plan and profile when crossed by the construction or when parallel and within 20 feet of the construction line. The size and type of all such culverts shall be indicated and when the culvert crosses or is perpendicular or nearly so and within 20 feet of the construction line, the invert of the culvert end nearest the construction line shall be shown.

8. Addresses of buildings shall be shown on the plan view, within the outline of the building. Only the front line and indication of sidelines of buildings need be shown.

C. Detail Drawings: Items of a special nature should be shown with detail drawings, either on the plan sheets, or on a separate detail sheet.

D. Connection to existing facilities where bypassing or stoppage of existing flow will be required: When improvement plans require connection to an existing facility which will require bypassing or stopping existing flows, a note shall be placed on the plans which provides an estimate of the existing flow to be bypassed (in gpm), or the times between which the flow may be stopped. Where the operation will be accomplished on a major trunk or interceptor, submittal of a work plan for review may be required prior to initiation of the operation.

7-16 DESIGN OF ON-SITE SEWER SYSTEMS FOR PRIVATE MULTIPLE OWNERSHIP RESIDENTIAL DEVELOPMENTS

The following design requirements shall apply to that portion of the sanitary sewer within a privately owned multiple ownership development that is "on-site" and is not an outfall sewer for an upstream area, thereby being considered a private system and not subject to maintenance by a County Service Area. Discharge from such developments shall require an agreement between an owner's association and the sewage treatment provider regarding the operation and maintenance of the private sanitary sewer.

A. Planned Unit Developments and Townhouses: Residential developments where separate lots and structures are sold. These differ from usual subdivisions in that adjacent land is owned in common and a homeowner's association performs maintenance.

1. General - Sanitary sewers shall meet all requirements for public sewers contained in these Improvement Standards, except as specified below.
2. Manhole spacing - Maximum spacing of manholes on collectors shall be 300 feet for all straight runs of pipe.
3. Wyes - Wyes shall be used for all sewer services connecting to the "on-site" collectors.
4. Minimum Depth - All collectors located within vehicular traffic areas shall have a minimum cover of five feet to finish grade. Additionally, if the cover over the pipe at any location may be less than two feet at any time after the pipe is installed, ductile iron pipe or Class 200 (DR-14) PVC pipe conforming to the requirements of AWWA C900 shall be installed.
5. Plan and Profile Sheets - "On-site" improvement plans may be prepared without the sanitary sewer profile that is required by these Improvement Standards, unless otherwise instructed by the County Engineer. However, the final "on-site" grades and drainage facilities must be shown on the plans on the same sheet as the plan view of the sanitary sewers. Pipe dimensions shall be shown adjacent to the corresponding pipe section.
6. Location - Wherever possible, collectors shall be located in areas to be paved.
7. Review and Approval - Plans must be reviewed and approved by the County Engineer.

7-17 MULTI-STRUCTURAL COMMERCIAL AND INDUSTRIAL DEVELOPMENTS

The "on-site" sanitary sewers for all new commercial and industrial developments containing more than one structure shall be designed in accordance with the requirements contained in Section 7-16A of these standards unless otherwise specified by the County Engineer. Any separate building within a multi-building commercial or industrial development shall have its own separate connection to a sewer system designed to public standards.

Flow recording devices for the continuous measurement of discharge volumes may be required by the County Engineer. Grease, oil, and sand separators shall be provided as determined by the County Engineer.

7-18 SEWER SYSTEM MASTER PLAN (SSMP) FOR A SPECIFIC AREA

Submission of a Sewer System Master Plan (SSMP) for a specific area is required prior to review of the sewer design for new developments for which public sewer services are proposed, or if there is a possibility that upstream or adjacent areas might require service through the subject property. The plan will fully describe the area to be served by the local collection facilities and the facilities necessary to provide that service.

A. General Requirements: In order to develop a SSMP the following information must be accumulated:

1. Regional Setting
2. Topographic map of the area to be served
3. Any specific projects that precipitated the study
4. Relevant assumptions or special conditions
5. Existing and proposed development

6. Ultimate development within the SSMP area
7. Hydraulic grade line at point of discharge into major facilities

The flows generated within each sub-service area of the sub-area plan will be calculated in accordance with the procedures contained in these Standards unless otherwise specified by the County Engineer.

B. Study Map: The method of providing sewer service to the entire service area, including pipe sizes and slopes, shall be shown to the extent necessary to determine the requirements within the subject property.

C. Report Preparation: In order to insure that all SSMPs are compatible and understandable; they will all be published in the following format.

1. Section Headings - Each SSMP shall be written with the following sections entitled as follows:
   a. Executive Summary - A concise description of the recommended sewer system, the impacts upon adjacent or Regional systems, and any special design criteria necessary due to unusual local conditions, sealed by the responsible civil engineer.
   b. Introduction - A thorough background description of the sewer shed, any specific project(s) that precipitated the study, any special conditions, a vicinity map and a topographic map of the study area
   c. Criteria and Data - All of the information upon which the plan was based shall be delineated in this section in an easily readable manner.
   d. Plan description - A map showing the service area, the needed sewer facilities (pipes, slopes, flowlines, depths, and service areas), a spread sheet summary, and verbiage describing the collection system shall be included in this section
   e. Appendices - All of the backup information shall be included in an appropriate number of appendices
2. Report Format - The SSMP shall be bound as a single document with appropriate dividers between each section and pockets for all the required maps. The approval block shall be in a highly visible location at the end of the Executive Summary.

7-19 WASTEWATER TREATMENT SYSTEMS

Sanitary sewer collection systems shall be connected to existing wastewater treatment systems operated by a Community Service District, City, or other agency where feasible, as determined by the County Engineer. The connection shall be either by gravity flow, or by the installation of pump lift stations. The Developer shall be responsible for applying to the Yolo County Local Agency Formation Commission (LAFCO) for annexations or "out-of-service area" agreements required to accommodate such connections, and shall be responsible for complying with all standards and requirements of the entity that will provide services.

Where a County Service Area (CSA) is proposed to provide wastewater treatment services, the Developer shall be responsible for all costs to create the CSA, prepare an Engineer's Report to estimate assessments, and provide engineered plans for the wastewater treatment facilities. Such plans shall be prepared by an engineering firm retained by the Developer that 1.) has demonstrated expertise and experience designing municipal wastewater treatment systems, and 2.) is approved by the County Engineer prior to the commencement of design work.

The Developer shall be responsible for obtaining all State and local permits necessary to operate a new wastewater treatment system. The Developer shall be responsible for funding all ancillary equipment required to start-up and operate the treatment system, as determined by the County Engineer. The Developer shall deposit with the County a cash deposit ("Establishment Costs") to cover the costs to establish the CSA, and costs that may arise from unforeseen circumstances during operation of the facility for the first two years following County acceptance of the facilities, or full project build out, which ever comes later. Such costs may exceed assessments received, the assessment being based on the estimated costs for normal operations and maintenance services, as estimated in the approved Engineer's Report. Establishment Costs include, but are not limited to the following costs, and are subject to the approval of the County Engineer:

1. Legal and administrative costs incurred by County to establish the CSA, the CSA fund, the CSA budget, and the CSA advisory committee;
2. Administrative costs related to transferring permits into the County's name, soliciting proposals for third party operations and maintenance services, negotiating and awarding contracts and purchase orders necessary to assume operations and maintenance responsibilities;
3. Administrative and inspection costs related to warranty work that may occur following acceptance of the CSA Facilities, not covered under operation and maintenance contracts or warranty;
4. Materials, parts, and labor costs to refine operations of the CSA Facilities to operate at maximum efficiency, including, but not limited to, modifications to piping, valves, software, telemetry, and controls;
5. Added administrative, operational, or maintenance costs that may be incurred due to low or variable flows during build out of the project, or plant upsets due to construction activities;
6. Periodic maintenance costs (for example, sludge wasting), incurred by the County within one month of acceptance that result from the Developer's operation and maintenance of the CSA Facilities; and
7. Other unforeseen costs incurred by the CSA following acceptance of the CSA Facilities due to conditions beyond the Developer's or County's control, to the extent that the unforeseen costs cause a CSA expense.