

## SECTION 9: SANITARY SEWER DESIGN

### 9-1 DESIGN CRITERIA

These criteria shall apply to the engineering design of any sanitary sewer system to be maintained by the City of Roseville, or with those exceptions as noted, within private multiple ownership residential or multi-parcel commercial and industrial developments. Private onsite sewer systems are only allowed on sites that have shared sewer mains within commercial and multifamily developments and that are owned and maintained by an association. Shared sewer mains that serve more than one property owner are required to be public mains.

The following requirements apply to all private onsite sewer systems:

- The onsite sewer system must be designed to the City of Roseville design standards pertaining to pipe sizing and slope.
- In the event a public utility easement is granted within the site that contains a private onsite sewer system, a note is required on the easement noting the easement does not apply to the sewer system.
- The delineation between the Public and private onsite sewer systems shall be a standard City sewer manhole that will be part of the public sewer system. Normally the first manhole on the site that is within the public utility easement.
- Applicants may choose to keep the onsite sewer system public if all standards are met regarding design and construction of the onsite sewer system including the dedication of a public utility easement.

Sites that do not clearly meet the conditions described above will be evaluated on a case by case basis by the City Wastewater Utility.

### 9-2 AVERAGE FLOW DETERMINATION

The determination of average dry weather flows for design purposes shall be based upon the best available information concerning land use and density as determined by the Environmental Utilities Director. This information may include approved land use and density in accordance with current zoning in the absence of more specific information pertaining to expected development. Average dry weather flow factors are listed in Table 1.

**Table 1 – Average Dry Weather Unit Flow Factors**

<b>Land Use Designation</b>	<b>Units</b>	<b>Flow Factor (gpd/unit)<sup>1,3</sup></b>
Commercial	gpd per acre	850
Heavy Industrial	gpd per acre	850
Light Industrial	gpd per acre	850
Mixed Use	gpd per acre	2,300
Public/Quasi-Public	gpd per acre	660
Schools	gpd per acre	170
Residential 1 DU	gpd per DU	190
Residential 2 DU	gpd per DU	190
Residential 3 DU	gpd per DU	190

Residential Multiple DU <sup>2</sup>	gpd per acre <i>or</i> gpd per DU	2,040 <i>or</i> 130
Open Space	gpd per acre	0
Parks > 10 Acres	gpd per acre	10
Vacant	gpd per acre	0

<sup>1</sup>Includes allowances for dry season groundwater infiltration (GWI)

<sup>2</sup>Future development projects should use the factor that results in the highest flow.

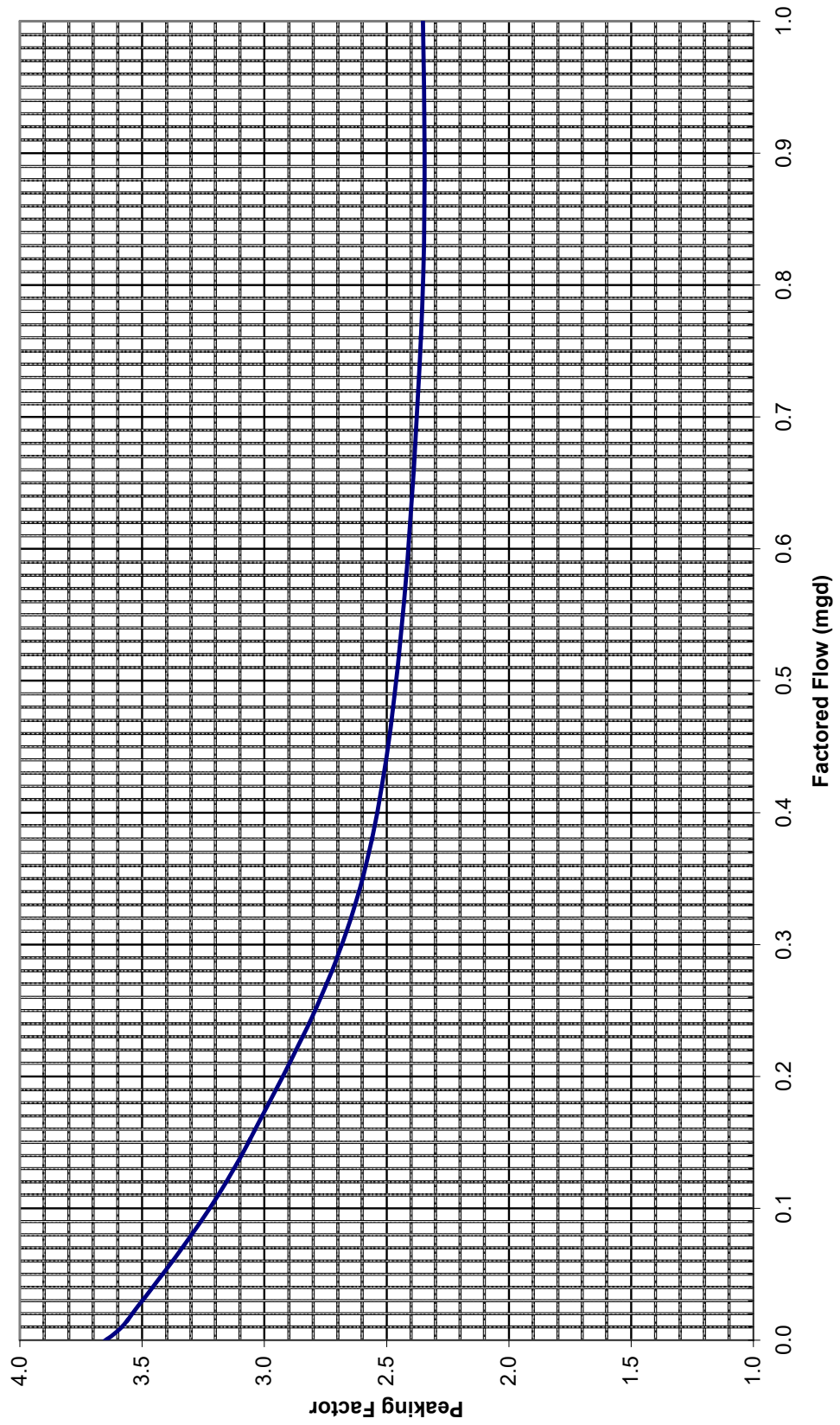
<sup>3</sup>factor flow assumes a 30% F.A.R. 50% for senior living

### **9-3 DESIGN FLOW**

Design flow sizing of infrastructure 15 inches in diameter and smaller shall be calculated by using the average dry weather unit flow factor(s) listed in Table 1 for the upstream service area along with a safety factor of 2.0 and the appropriate peaking factor listed on Figure SS-1. Attachment A located at the end of this section provides a sample calculation. For sizing trunk sewers 18 inches in diameter and larger, utilize the hydraulic model of the collection and conveyance system and consult with Environmental Utilities Department staff.

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**Figure SS-1  
Peaking Factor Curve**



**9-4 PIPE CAPACITY, SLOPE, VELOCITY, SIZE, DEPTH AND MATERIAL** Design criteria for the pipe system are as follows:

**A. Main Sizes:** The minimum size sewer main within a residential development shall be 8 inches in diameter. The minimum size sewer main for commercial and industrial developments shall be 8 inches in diameter.

**B. Slope and Velocity:** Manning’s formula shall be used to determine the relation of slope, design flow, velocity, diameter, and “n” value. The “n” value shall not be less than 0.013 for all pipe materials.

1. Table 2 provides minimum slopes and design flow capacities for various pipe diameters. Pipe slopes less than those listed in this table shall not be used without the approval of the Environmental Utilities Director. The slopes indicated are based on a velocity of two feet per second with the pipe flowing full.

**Table 2 – Minimum Slopes and Flow Capacities**

PIPE DIAMETER (IN)	SLOPE (ft/ft)	CAPACITY AT 0.7 DEPTH	CAPACITY FLOWING FULL
6	0.0050	0.22 MGD	
8	0.0035	0.38 MGD	
10	0.0025	0.58 MGD	
12	0.0020	0.85 MGD	1.00 MGD
15	0.0015	1.32 MGD	1.60 MGD
18	0.0012	1.95 MGD	2.35 MGD

2. The maximum depth of flow at design conditions in any lateral 10 inches in diameter or less shall be 70 percent of pipe diameter. Lines 12 inches in diameter or larger may be designed to flow full unless direct sewer connections are planned, in which case the 70 percent pipe diameter maximum depth of flow shall govern.
3. All sanitary sewer pipe shall be designed for a minimum scour velocity of 2 feet per second at peak flows. The volume of wastewater within the pipe system as determined above shall be used when designing pipe slopes.
4. Maximum design velocity shall not exceed 10 feet per second.

**C. Capacity:** Pipe capacity, in all cases, shall be adequate to carry the Peak Wet Weather Flow (PWWF) from the entire tributary shed area even though said area may not be within the project boundaries.

**D. Hydraulic Grade Line:** The hydraulic grade line shall be determined from the design flows, based upon 100 percent development of the tributary area. Hydraulic grade line calculations must be submitted for the design of all lines 12 inches in diameter or larger.

**E. Depth:** Sewer mains with service lateral shall not exceed a depth of 15 feet. The system shall be designed to provide a minimum slope for sewer services of  $\frac{1}{4}$  inch per foot with a minimum cover of 12 inches at any buildable location within the properties to be served. Proposed building pad elevations shall be a minimum six inches above the lowest upstream manhole rim. Where the building pad does not meet the elevation requirement, a backwater valve for the building shall be required. The backwater valve shall be noted on the improvement plans and building plans. Installation shall be made during construction of the underground improvements. Deed restrictions shall be put in place which hold the City harmless for failure of the backwater valves on such lots.

### **9-5 SEWER LOCATION AND ALIGNMENT REQUIREMENTS**

Location and alignment criteria are as follows:

**A. General:** All sanitary sewers shall be placed in rights-of-way dedicated for public streets or within easements approved by the Environmental Utilities Director. Developments with deep sewer mains or with trunk mains may require dual sewer mains. There shall be a minimum horizontal clearance of 10 feet between parallel water, recycled water, and sanitary sewer mains. A minimum horizontal clearance of 5 feet shall be maintained between sewer mains, parallel storm drains, and other utilities. On crossings, water and recycled water lines shall be a minimum of 12 inches above the sewer line. If a sanitary sewer force main must cross a water or recycled water line, refer to sections 8 (Domestic Water Supply System) and 14 (Recycled Water Supply System) of these standards.

**B. Location in New Subdivisions :** In new subdivisions, sewers shall be located 5 feet south or east of street centerlines within minor and primary residential streets, or as approved by the Environmental Utilities Director.

**C. Location in Existing Streets:** When sanitary sewers are to be installed in an existing street, factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvement plans, and existing utilities shall be considered. The approval of the Environmental Utilities Director and City Engineer shall be obtained in every instance.

**D. Location in Unpaved Area:** All mains in unpaved areas shall be marked every 125 lineal feet maximum between manholes with a green 5-foot 6-inch composite utility marker. A decal shall be placed on marker stating "CAUTION SEWER PIPE." Utility marker shall be Carsonite or approved equal with anchor barb kit.

**E. Easement Sewer Lines:** Easement sewer lines outside of the public right-of-way, or within a narrow right- of-way shall require an easement dedication to the City. Sewer lines shall be

centered within their easement. Easements shall be completely on one side of the property line of fence. The easement shall be clear of permanent structures, building eaves, roof lines, and the future trunk of large tree species. Temporary construction easements of adequate size shall also be provided. The proposed easement shall be the greater of the following:

1. Minimum width of easement shall be 15 feet.
2. All easements shall have a minimum width equal to the required trench width according to the standard detail for trench backfill, plus 2 additional feet for every 1 foot of depth of the pipe as measured from the bottom of the pipe to finished grade. All sewer lines shall be centered within their easement.
3. No trees or permanent structures are allowed within the sewer easement except with the approval of the Environmental Utilities Director.

**F. Public Lines in Commercial Developments:** Sewer mains shall be located within drive aisles unless otherwise approved by the Environmental Utilities Director.

**G. Water Well Clearance:** Sewer lines shall maintain a minimum 100-foot separation from all public or private wells. (Properly abandoned wells are not included.) If a clearance of less than 100 feet is approved, the pipe material shall be approved by the Environmental Utilities Director. In no case shall the clearance be less than 50 feet.

**H. Lines in Drainage Swales:** Sewer lines, public or private, shall not be located within a drainage swale. The horizontal distance between the sewer line and the top of the bank shall be sufficient to maintain the integrity of the drainage swale and provide access for maintenance to the sewer line.

**I. Alignment:** Sewer lines and structures shall be designed to provide a minimum 12-inch vertical clearance from all utilities and/or improvements, unless otherwise approved by the Environmental Utilities Director.

1. Horizontal alignment shall be parallel to the street centerline. Minimum radius for sanitary sewers 6 inches through 12 inches in diameter shall be 200 feet. For pipe 27 inches in diameter or larger, mitered joints, fittings, or other methods as specified in the Standard Construction Specifications may be utilized to accomplish alignment changes.
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 use of a vertical curve is approved by the Environmental Utilities Director. In such case, elevations shall be shown at 10-foot intervals throughout the length of the vertical curve. The maximum deflection permitted shall be two percent for each 10-foot interval.

- J. Sewer Main Stub:** Sewer main stubs for future development which are perpendicular to the sewer main shall be vitrified clay pipe (VCP) originating from the manhole. The stub shall be within 150 feet of the manhole and terminate 5 feet into the future development. Green Carsonite marker shall be installed at the end of the stub.

#### **9-6 TRENCH LOADING CONDITIONS AND PIPE DESIGN**

The loading condition and pipe design criteria for conduits are as follows:

- A. Rigid Conduit Loading:** On rigid conduits, 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 No. 60, the Clay Pipe Engineering Manual, and in similar handbooks. In the absence of specific soils data, as determined by the soils engineer, a soil weight of 120 p.c.f. and a Ku factor of 0.110 shall be used. Minimum strength requirements for vitrified clay pipe shall be as specified per ASTM C-700 "extra strength" VCP.
- B. Safety Factor:** On rigid conduits, a safety factor of 1.5 shall be used for all pipe. The three edge bearing strength of the pipe shall be used in the computation for rigid pipe.
- C. Bedding and Initial Backfill:** Unless otherwise noted on the plans, bedding and initial backfill shall be per the Construction Standards. Special backfill requirements shall be noted on the plans.
- D. Special Pipe Strength Requirements:** For sewer mains greater than 20 feet deep or mains requiring extra support strength, pipe material shall be approved by the Environmental Utilities Director. Ductile iron pipe shall be used if cover is less than three feet or insufficient clearance exists between the sewer pipe and the rigid load transmitting structures. Such structures include large diameter storm drains and other structures subject to settlement. The ductile iron pipe shall extend 5 feet each side of the structure crossing.

#### **9-7 MANHOLE CRITERIA**

The design criteria for manholes are as follows:

- A. General:** Manholes shall be placed at the intersection of all sanitary sewer lines, at the upstream end of a pipe run, and at the end of any temporary line more than 200 feet in length. No more than three lines may enter a manhole with one line exiting. Medium-density single-family subdivisions may enter a manhole with up to 4 services with one exiting main line upon approval of the Environmental Utilities Director. Summit manholes are not permitted.
- B. Spacing:** Maximum spacing of manholes shall be 500 feet for all straight lines of 10 inches in diameter or less. Manhole spacing for mains 12 inches and larger shall be considered on a case by case basis. A line with a radius greater than 400 feet shall be considered as straight for purposes of this section. Manhole spacing on curved lines of 200-foot radius (minimum allowable) shall be 200 feet. Manhole spacing on curved lines of radii between 200 and 400

feet, or where only a portion of the line is curved, shall be adjusted proportionately. Reverse curves require a manhole at the point of tangency of the curves or as determined by the Environmental Utilities Director. A manhole shall be required at any change in vertical alignment unless use of a vertical curve is approved by the Environmental Utilities Director.

**C. Invert Elevations:** The invert elevation for pipe of the same diameter entering a manhole shall have a 0.10-foot drop between the entering and exiting pipe. Under special circumstances, the 0.10-foot drop may be waived with the approval of the Environmental Utilities Director. Invert elevations for pipe of different diameters shall match crown of exiting pipe. The crown of the entering pipe shall be at the same elevation or higher than the exit pipe. Mains with 10 or fewer services shall enter manholes at an invert to crown match with the exit pipe. Lateral mains entering trunk mains, as defined by the Environmental Utilities Director, shall enter manholes at an invert to crown match with the exit pipe.

**D. Manhole Sizing:** A standard 48 inch manhole with a 24 inch access opening shall be used for sewer mains 12 inches and smaller, and not exceeding 20 feet depth. A 60 inch manhole with a 36 inch opening shall be used for sewer trunk mains 15 inches to 36 inches in diameter. The design of larger trunk mains shall be approved on a case-by-case basis.

**E. Manhole Coatings:** Manholes coatings shall be required in areas determined to have a potential of generating excessive sulfide gases. Such manholes shall include, but are not limited to, all manholes on trunk mains 15" in diameter or larger, the first manhole originating from a sewer trunk main 15 inches in diameter or larger, force main transition manholes, manholes designed with inside drops, or as determined by the Environmental Utilities Director.

**F. Manhole Access:** Provisions must be made to prevent vegetation from overgrowing the manholes. An all-weather 10-ton vehicular access shall be provided to each manhole as required by the Environmental Utilities Department. Turning radii of 30 feet inside and 45 feet outside, and a vertical clearance of 14 feet are required.

**G. Connection to City Mains:** Improvement plans which require a connection to an existing City of Roseville sewer main or structure shall specify that such connection be performed by City forces on a time and materials basis.

#### **9-8 DROP CONNECTION CRITERIA**

Drop connections shall be permitted under special conditions and with the approval of the Environmental Utilities Director. There shall be no more than two inside drop connections into a 4-foot diameter manhole. If an elevation difference of at least 3 feet is not available, the slope of the incoming line shall be increased to eliminate the need for the drop.

#### **9-9 MAINLINE AND DIP TRANSITIONS**

Mainline transitions shall be made at a sewer manhole. Transitions for services may be made at a manhole or with the use of a specially fitted DIP piece with a VCP "speed seal" spigot.



Arrangements for the special spigot shall be coordinated with the Environmental Utilities Department.

### **9-10 SEWER SERVICE DESIGN**

The design criteria for sewer services are as follows:

**A. General:** Services shall be designed and constructed perpendicular to the main or as approved by the Environmental Utilities Director. The service shall extend from the main to the edge of the public right-of-way or easement. The cleanout shall be constructed per the Construction Standards 2' outside of the sewer easement. The cleanout indicates the separation between private and public for the purpose of maintenance. In cases where there is no cleanout, the sewer service is considered private all the way to the main. Services shall extend two feet beyond edge of pavement of private roads. Easements of adequate width to accommodate the service shall be obtained. A plan and profile of services shall be supplied to the Environmental Utilities Director on request.

1. Cleanouts shall be designed and constructed to grade with subdivision improvements or at the time connection is made to the building sewer. Unless otherwise noted on the plans, construction of the cleanout to grade is the responsibility of the contractor for the subdivision improvements. If installation of the cleanout is deferred, the plans shall call for the placement of a 4-inch by 4-inch post at the end of the service sewer extending from the flow line to not less than 12 inches above ground surface.

**B. Sizing:** The minimum size service for single-family developments shall be 4 inches in diameter. Services greater than 100 feet in length shall be 6 inches in diameter. Schools, commercial, industrial and multiple residential properties shall be served by a minimum 6-inch diameter service.

1. **Connection to Sewer Mains:** Residential services shall connect to the sewer main by means of a factory fitting. Properties with services located at the end of cul-de-sacs shall enter a manhole. A 6-inch service shall enter a 6-inch main by means of a manhole. A 6-inch service entering an 8-inch or larger main must either be connected with a manhole or by means of a factory fitting with a manhole placed at the property line. Services 8 inches in diameter and larger shall be connected to the main by use of a manhole. Connection to trunk mains shall be approved by the Environmental Utilities Director. In no case shall a service connection be made with the use of a tee.

2. **Connection to Existing Sewer Mains:** The Environmental Utilities Department reserves the right to make all sewer service taps onto existing mains upon completing an application for a permit and payment of the required connection fees. Proposed work by the City shall be performed by City forces and payment made to the City for such work will be on a time and materials basis. A note to this effect shall be placed on the plan sheet which shows a detail for the area that requires such tapping. The application shall be made to the Environmental Utilities Department. Connection fees shall be paid prior to

submittal of the application. All excavation, backfill, and the installation of the remainder of the sewer service or stub shall be performed by the Contractor.

- 3. Connection Limitations:** Sewer services shall connect to 12-inch diameter and larger pipe or to lines more than 15-feet in depth at a manhole. Direct connection to trunk mains shall only be with the approval of the Environmental Utilities Director.
- 4. Material:** The service shall be of the same material as the lateral to which it connects or as specified by these standards.
- 5. Location:** A sewer service shall be constructed to each lot. In new subdivisions or developed areas, unless specifically requested otherwise in writing, sewer services shall be placed on the low side of a typical subdivision lot or similar parcel with 2 percent or greater slope across the front, or shall be placed in the center of lots of lesser slope. Under no circumstances shall a sewer service be placed less than 14' from the property line. Trees, improvements, etc., are to maintain a minimum of 5' from the sewer service, including the cleanout and where the sewer service is extended to service the house.

If the property is located such that service is available both to a line located in an easement and also in a right-of-way, service shall be at the latter location unless otherwise approved by the Environmental Utilities Director. No sewer service shall be located such that future on-site construction will result in the line being in such proximity to a water well or water main or service that applicable health standards will be violated.

- C. Depth:** Adequate depth of sewer service at the edge of easement or right-of-way to service the intended parcel shall be verified. A depth of 3 to 4 feet to crown of pipe, measured from existing ground surface or edge of adjacent roadway, whichever is lower, shall be considered the standard for service sewer depth, except where the water main is to be installed at back of sidewalk as part of the subdivision improvements. In such cases, service shall have a minimum depth of cover of 4-feet 6-inches at the property line and the service shall be extended to a minimum of 7 feet back of sidewalk with the cleanout to grade remaining within 2 feet of back of sidewalk. When greater depth is required, the invert elevation of the service sewer at the edge of the right-of-way or easement shall be noted on the improvement plans. If a joint trench is being utilized for other utilities, the plans shall indicate that a joint trench will exist and service elevations shall be adjusted accordingly.

Sewer service connection to the main 14 feet or deeper, shall place concrete around the haunch of the "wye". Sewer service connection to the main shall not exceed 15 feet.

- D. Special Requirements in Developed Areas:** In developed areas, a sewer service shall be provided to each parcel participating in the project which contains a source of sewage less than 200 feet from a lateral. A property owner's request for service location shall be honored whenever practical. Parcels which have two or more sources of sewage must have an independent sewer service provided for each sewage source which can be separated from the

rest of the parcel and sold. A service shall be provided to each lot. During the design period, each property owner affected by the proposed work shall be contacted in writing to determine the preferred sewer service location. In absence of a response, a sewer service shall be provided in accordance with these standards. In addition, upon staking the location of the proposed sewer services prior to construction, each property owner shall be given a final opportunity to approve the proposed sewer service location. Compilation of this information shall be furnished to the Environmental Utilities Director.

**E. Warranty Inspection of Sewer Main Stubs:** As a requirement, sewer stubs are provided to subdivisions as a courtesy by developers during the construction of backbone infrastructures in streets to prevent cutting up the newly paved streets when the subdivisions are ready to develop. These stubs become an integral part of the sewer system of the subdivisions and subsequently the responsibility of the developers of the subdivisions and are therefore imperiled to both **construction and warranty inspections**. This practice saves future developers construction time and cost that would have otherwise been spent on tie-ins and street repairs and in some instances prevents delays in the event a street has a moratorium. Since these stubs are provided at no cost to future developers, it is our position, hence our policy, that it is the responsibility of contractors to test and repair these stubs, if found damage, prior to tie-ins. A note to this effect shall be placed on the improvement plans.

**F. Abandoning Existing Sewer Stubs:** Existing sewer stubs to be abandoned shall be abandoned per Section 91 of the Construction Standards.

**G. Grease Interceptor:** A grease interceptor shall be required for any business having the potential of producing grease as specified in the Roseville Municipal Code. Minimum size of the interceptor shall be 1000 gallons for concrete pre cast tanks, buried outside. Sizing of the interceptor shall be based on the current edition of the California Plumbing Code adopted by the City.

1. General Commercial/Retail buildings shall require dedicated grease lines for future use. A location for the future grease interceptor shall be identified on the improvement plans.
2. Automatic grease removal devices and hydromechanical grease interceptors shall comply with the requirements of the City of Roseville.
3. Automatic grease removal devices shall be designed, tested, and certified in accordance with ASME A112.14.4 and/or CSA B481.5.
4. Hydromechanical grease interceptors shall be designed, tested, and certified in accordance with ASME A112.14.3, CSA B481.1, or PDI G101.
5. Automatic grease removal devices and Hydromechanical grease interceptors shall be made from materials that are compatible with a low pH environment. Thermoplastic construction or lined stainless steel are allowed. Metal is not allowed. Acid Resistant Enamel (A.R.E.) coatings are not allowed.
6. Existing hydromechanical grease interceptors shall be maintained in efficient operating condition.

7. Automatic grease removal devices and Hydromechanical grease interceptors shall be maintained free of all food residues and any FOG waste removed during the cleaning and scraping process.
8. Automatic grease removal devices and Hydromechanical grease interceptors shall be inspected periodically to check for leaking seams and pipes, and for effective operation of any baffles and/or flow regulating device (if required). Automatic grease removal devices and Hydromechanical grease interceptors shall be maintained free of all caked-on FOG and waste including on any internal baffling and/or inlet/outlet fittings. Removable baffles shall be removed and cleaned during the maintenance process.

**H. Oil/Sand Interceptor:** An oil/sand interceptor shall be installed for any business having the potential of producing oil and sand waste resulting from routine maintenance as specified in the Roseville Municipal code. Minimum size shall be 450 gallons. Sizing of the interceptor shall be based on the current edition of the California Plumbing Code adopted by the City.

**I. Automatic Car Wash:** An oil/sand interceptor or an approved clarifier shall be installed for an automatic car wash as specified in the Roseville Municipal Code. The car wash shall recycle a minimum of 75% of the water used prior to discharging into the City's sewer system. Minimum size of oil/sand interceptor shall be 450 gallons. Sizing of the oil/sand interceptor shall be based on the current edition of the California Plumbing Code adopted by the City.

### **9-11 SIPHON AND CREEK CROSSING DESIGN**

Advance approval of the Environmental Utilities Director, City Engineer, and other appropriate agencies is necessary to initiate design. The criteria for creek crossings are as follows:

- A. General:** In all cases, the proposed future creek 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. The top of pipe shall have a minimum 3 feet of cover at the shallowest point of the crossing.
  
- B. Gravity mains:** For line sizes 10 inches and smaller, ductile iron pipe shall be used under the full creek width plus 10 feet each side. For line sizes 12 inches and larger, pipe used shall be as determined by the Environmental Utilities Director. The ductile iron pipe shall be supported by steel I-beam piles. The steel I-beam pile shall be installed to a yielding depth as recommended by the soils engineer. Each stick of pipe shall be supported by a least one pile or as approved by the Environmental Utilities Director. A steel plate shall be welded on top of the I-beam. A ½-inch thick polyethylene plane shall be installed on top of the steel plate for the pipe to rest on. The pipe shall be held by two 2-inch wide galvanized steel straps, with galvanized bolts attached through the steel plate and polyethylene plate. An insulating material shall be used between the pipe and the section of strap coming into contact with the pipe. All exposed surfaces shall be coated with coal tar epoxy. A layer of 4-inch to 8-inch cobbles shall be placed and compacted on the top surface of the trench area for the full width of the creek. A trench plug shall be required at the top of the pipe at the downstream side of the crossing. The plug shall be a minimum of 4 feet in length, and shall extend 24 inches beyond the width and depth of the trench.
  
- C. 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.
  
- D. Siphon:** ductile iron pipe shall be used under the full creek width plus 10 feet each side. Pipe shall be concrete encased per detail W-24. A layer of 4-inch to 8-inch cobbles shall be placed and compacted on the top surface of the trench area for the full width of the creek. A trench plug shall be required at the top of the pipe at the downstream side of the crossing. The plug shall be a minimum of 4 feet in length, and shall extend 24 inches beyond the width and depth of the trench.
  - 1.** Condensate Stations for air jumpers shall be designed per the City Process Control Standards.

### **9-12 BORING AND JACKING REQUIREMENTS**

The requirements outlined in the Construction Standards shall be followed.

**9-13 PUMP STATION AND FORCE MAIN REQUIREMENTS**

Every phase of pump station design, including force main design, shall be closely coordinated under the direction of the Environmental Utilities Director. The pump station and force main shall be designed and submitted concurrently. The plan sheets will show the general layout and control system required for a typical acceptable sewage pump station. The plans shall call out the testing required for acceptance of the pump station. The lift station shall be designed per the City Process Control Standards.

- A. Location:** The pump station and facilities shall maintain a minimum 100-foot separation from existing and proposed residential and commercial structures. Adequate maintenance access shall be provided to the pump station. The access design shall consider requirements for the removal of pump station equipment.
- B. Capacity:** The pump station shall be designed to accommodate ultimate buildout flows as well as initial flows. Allowances for larger or additional pumping equipment must be made for future requirements. If the design capacity is in excess of anticipated initial flow, the effects of the minimum flow condition must be estimated to prevent excessive retention of sewage in the wet well, to prevent septic conditions, and to determine whether the pumping equipment will operate within the manufacturer’s guidelines. Table 3 provides planning level criteria for sizing and configuration of pump station and force main facilities.

**Table 3 – Planning Level Criteria for Pump Stations and Force Mains**

<b>Pump Stations</b>	
Capacity	PWWF (hydraulic modeling required for pipes 18 inches and larger)
Storage	4 hours
Operation	Lead/lag for duty pump(s), plus 1 standby pump
Maximum Pump Cycles	6 cycles/hour (3 cycles per pump)
<b>Force Mains</b>	
Headloss	Hazen-Williams roughness coefficient (C-factor) of 120
Maximum Velocity	7-10 feet per second
Minimum Velocity	3.0 feet per second

- C. Wet Well:** The wet well design and detention time shall be such that the deposition of solids is minimized and the sewage does not become septic. Provisions for 4 hour storage capacity shall be provided. Wet well material shall be Armorock Polymer Concrete or approved equal. Maximum depth of wet well shall not exceed 35’.
- D. Pumps:** Pumping equipment shall consist of centrifugal pumps. Pump suction and discharge size shall be a minimum of 4 inches in diameter. Pump drive units shall be electric. A sufficient number of pumping units shall be installed such that station capacity can be maintained with any one unit out of service. Pump manufacture is to be Flygt or approved equal. Provisions for telemetry shall be included in the station control system as directed by the Environmental Utilities Director.

**E. Station Piping:** Suction, discharge, and header piping within the station shall be sized to adequately handle flows. Piping less than 4 inches in diameter shall not be used for conveying sewage. Valves shall be located to allow proper equipment maintenance and operation. The design shall provide a bypass configuration back to the wet well.

**F. Odor Control:** If required, the station shall have equipment and/or space provided for the purpose of introducing odor control chemicals into the wet well, upstream gravity line, and/or force main. Adequate provisions shall be made for the safe handling and storage of chemical containers. The force main shall be designed to maintain a continuous uphill grade, or, as a minimum be level. All force mains shall have provisions for introduction of either air or odor control chemicals.

**G. Force Mains:** Force Mains: Force mains shall be designed such that velocities normally fall within a range from 3 to 5 feet per second.

For larger capacity Lift Stations, force main designs may consider velocities up to 7 feet per second. This will be handled on a case-by-case basis. The project applicant should submit the request, along with the justification, for the higher velocity criteria this criteria to EU staff for review and approval prior to proceeding with the higher velocity range design.

The design shall consider the feasibility of installing dual force mains to address the following:

- If initial capacity of the station is considerably less than ultimate, consideration should be given to the prevention of septic conditions due to extensive detention time within the force main. The design approach shall utilize dual force mains to accommodate initial and ultimate flows.
- Provide redundancy for the system by utilizing adequately sized dual force mains where one main can serve as a backup in the event that the other main is taken out of service.

Provisions shall be made introducing a “cleaning pig” into all force mains. The design shall also include facilities to eliminate or sufficiently dampen transient forces and/or surging in the event of an immediate station shutdown. Details shall be included in the improvement plans. The maximum angle allowed on force mains is 22.5 degrees.

A corrosion protection study shall be included with the improvement plan submittals. Corrosion protection facilities for the force main shall be identified from the roadway with a curb stamp labeled “CP – FM”.

**H. S.C.A.D.A.:** SCADA requirements for pump stations shall be provided by the Environmental Utilities Department. The submittal shall be included along with the improvement plans for such facilities.

**I. Valves:** Valves on pressurized sewer systems shall be Crispin plug valves.

#### **9-14 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 these standards, the Construction Standards, and meet the following requirements.

**A. Sewer Study:** A sewer study or sewer master plan as determined by the Environmental Utilities Director may be required prior to review of the sewer design if there is a possibility that upstream or adjacent areas might require service through the subject property. The map shall show the entire area including upstream tributary and adjacent areas, and all other data necessary to determine anticipated sewage flows. The method of providing 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.

**B. General Requirements:** Plans for sewer improvement projects shall include a layout sheet, plan and profile of each public sewer line, and necessary detail drawings. Reference to the Construction Standards shall be made for all standard details.

**C. Layout Sheet:** Improvement plans shall include an overall map which shows the project boundaries, sewer lines, manholes, backwater valves, and other important items of the work.

1. A parcel 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.

**D. Plan and Profile Sheets:** Sewer lines to be owned and maintained by the City of Roseville shall be shown on both plan and profile. 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.

1. Sewer lines to be constructed shall be indicated on profile by parallel lines spaced to show the pipe diameter to scale. Manholes shall also be indicated by parallel lines spaced according to scale. Slope shall be printed 1/8-inch above, and preferably parallel to, the pipe line, 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 and approximately halfway between the ground surface and pipe line. Pipe inverts, "IN and OUT," at manholes and other structures shall be indicated on the profile. The invert elevations shall be printed parallel to the horizontal grid lines and shall be underscored by a line which then runs at a 45-degree angle to the corresponding pipe invert. Rim elevation for all manholes shall be labeled. The profile shall note all proposed manholes, special connections, and other appurtenances. Existing facilities shown on the profile shall be dashed or distinguishable from proposed improvements. Manhole identification on the



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plan view may be oblique. Stationing shall appear at the lower edge of the profile grid directly under the manhole. Each manhole shall be assigned a number that will appear in both plan/profile and the cover sheet.

2. Proposed sewer services shall be indicated on the plans by stationing, or an approved reference point such as a property line. The invert elevation of the service at its upstream end shall be shown on the plans whenever the standard depth is inadequate to serve the property. Standard depth shall conform to the conditions set forth in the Construction Standards.
3. Improvements or lots shown on a plan sheet but served to a line shown on another plan sheet shall have the direction of service shown by a small triangle and letter "S." "As Built" plans shall also show the service sewer location measured from the nearest downstream manhole.
4. Both permanent and working easements shall be shown to scale and dimensioned on the plans.
5. Proposed sewer lines shall be adequately dimensioned from street centerline. If the sewer is to be located in an easement, sufficient dimensions and bearings from physical features to locate the line in the field shall be shown on the plans.
6. Existing gas, water, storm drains, and all other utility lines above or below ground shall be shown on the plans.
7. Trees and other objects within 10 feet of the construction centerline shall be dimensioned on the plans relative to the construction centerline. 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. Written documentation of any special arrangements regarding preservation of property shall be provided to the Environmental Utilities Director if no easement document is involved. If an easement is negotiated, all special arrangements shall be included in the easement document. Tree removal must be approved by the Planning Department.
8. 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. Type, size, and invert elevations shall be called out.
9. No trees or permanent structures shall be placed within sewer easements without the approval of the Environmental Utilities Director.

**E. Detail Drawings:** Details not covered by the Construction Standard Detail sheets shall be shown on the plans.

**F. Connection to Existing Facilities Where Bypassing or Stoppage of Existing Flow Will be Required:** Upon approval of the application to connect to an existing sewer main by the Environmental Utilities Department, a coordination meeting to discuss the work plan shall be organized by the contractor a minimum of seven days prior to the proposed connection or as permitted by the City’s work schedule. Should the Environmental Utilities Director determine that such work be performed by City forces, the work shall be performed on a time and material basis.

### **9-15 MULTI-PARCEL COMMERCIAL AND INDUSTRIAL DEVELOPMENTS**

“On-site” sewer mains for new commercial and industrial developments containing more than one parcel, shall be designed in accordance with the requirements contained in these standards or as approved by the Environmental Utilities Director. The sewer main shall be installed within a dedicated public sewer easement in accordance with these standards. Each separate parcel within a multi-parcel commercial or industrial development shall have a separate connection to the public sewer line(s).

### **9-16 RECORD (AS-BUILT) PLANS**

The Contractor/Developer shall keep an accurate record of all approved deviations from plans and shall provide a PDF electronic, full size bond and 11 x 17 copy of the as-built plans prior to final acceptance of the completes improvements. Each sheet of the plans shall be marked “AS-BUILT” or “RECORD DRAWING”. “AS-BUILT” or “RECORD DRAWING” of signal plans, water, sewer and storm drain composite in plan view only, and parcel and final maps shall also be submitted on computer disk in DXF or DWG format.

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## **ATTACHMENT A**

### **Example Design Flow Analysis for Sewers 15 Inches and Smaller**

**Example calculation for application of safety factor and peaking factor curve for 400-unit single family subdivisions:**

$$ADWF^i: (400\text{ DUs}) \times (190\text{ gpd/DU}) = 76,000\text{ gpd} = ADWF$$

$$Factored\ Flow: (ADWF) \times (2.0) = (76,000\text{ gpd}) \times (2.0) = 152,000\text{ gpd} = Factored\ Flow$$

$$PWWF: (Factored\ flow) \times (3.05^{ii}) = (152,000) \times (3.05) = 464,000\text{ gpd} = PWWF$$

**Size sewer for this flow based on Section 9-4.**

**For example, per City of Roseville Improvement Standards, Section 9-4, a 10-inch sewer line at minimum slope is adequate for this PWWF.**

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<sup>a</sup> Based on ADWF unit flow factors shown in Table 1

<sup>b</sup> From Figure SS-1