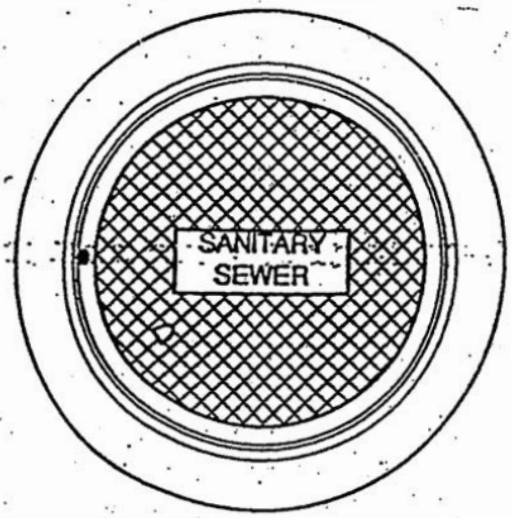
CITY OF SAN JOSE

DESIGN

FOR

SANITARY SEWERS



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CITY OF SAN JOSE
DESIGN GUIDELINES FOR SANITARY SEWERS

The following has been prepared by the City of San Jose to aid Consulting Engineers and others doing work in the City on projects that include the construction of public sanitary sewers. Criteria as presented represent minimum standards acceptable to the City.

1. SANITARY SEWER DESIGN CALCULATIONS

1.01 Sewers shall be designed for peak flow rate not to exceed 2/3 full pipe.

1.02 Peak flow rate (Q_p) shall be determined by the following formulas (Appendix Figure 1):

PF = peak factor (dimentionless)
Q_{ai} = average flow rate in million gallons per day (mgd)
Q_p = peak flow rate in million gallons per day (mgd)

$$PF = 2.5\,(Q_a)^{-0.1}$$

$$Q_p = PF\,i\,(Q_a)$$

$$= \frac{(Q_a)^{0.9}}{2.5}$$

1.03 Average flow rate for a standard residential unit shall be calculated as 240 gallons per day.

1.04 Flow rates for proposed industrial and commercial development shall be submitted by the consulting engineer.

1.05 1/2 full pipe velocity shall not be less than 2.5 feet per second. Note: Increasing the pipe size without the appropriate flow rate increase, will not resultiin an increase in velocity.

1.06 Minimum roughness coefficienti(Manning formula) for vitrified clay pipe shall be 0.013 for a full pipe and adjusted for depth of flow (Appendix Figure 2).

2.0 SEWER MAINS AND LATERALS

2.01 All sanitary sewer mains and laterals shall be extra strength vitrified clay pipe. Joints and fittings shall conform to City Standard Specifications for Public Works Construction. Use of plain end pipe with band seal joints shall be limited toisizes 4 through 8 inches.

2.02 Ductile iron pipe shall be used where cover from top of pipe to bottom of subgrade is less than 3.5 feet for mains and 3.0 feet for laterals.

2.03 Use of alternate pipe material (PVC, composite pipe, high density polyethelyne, etc.) shall only be considered to solve specialized problems and only on a case by case basis.

2.04 Vertical and horizontal curve pipe alignments shall not be used.

2.05 Minimum spacing(pipe centline to pipe centerline) between a sewer main and other proposed or existing pipe (except a water pipe) shall allow for 4.0 feet of undisturbed earth between the edges of the two pipe trenches.

2.06 Minimum spacing (edge of pipe to edge of pipe) between a sewer main and a water pipe shall be 10.0 feet. Minimum vertical clearance shall be 1.0 feet.

2.07 Minimum distance from a sewer main to the face of curb shall be 7.0 feet.

2.08 Minimum pipe crossing vertical clearance (except a water line crossing) shall be 0.5 feet. If the minimum cannot be provided, a special crossing shall be designed for the approval by Public Works.

2.09 If the project site borders an undeveloped area, sewer mains shall extend to the site's project limits to provide for future surrounding development.

2.10 Sewer mains shall be cross connectedato proposed or existing sewer mains where feasible.

2.11 Minimum slope for the starting run of a 6-inch sewer main (e.g. sewer serving a cul-de-sac) shall be 0.010.

2.12 Minimum lateral size is 4 inches; minimum residential sewer main size is 6 inches; minimum industrial sewer main size is 8 inches.

2.13 Minimum slope for a 4 inch lateral is 0.020; for a 6 inch lateral is 0.010. 8" lateral = 0.005

2.14 All laterals shall have profiles locating utility crossings. Depths of utilities shall be shown.

2.15 Laterals shall be constructed to property line to provide for future development where applicable.

2.16 A pipe bedding detail shall be shown as depicted in Appendix Figure 3.

3.0 MANHOLES AND FLUSHING INLETS

3.01 Maximum manhole spacing shall bei450 feet.

3.02 Manholes shall be used whereithe sewer main:

a. Intersects with another sewer main

b. Changes horizontal and/or vertical direction

c. Changes pipe size.

3.03 Change in flow direction in a manhole shall not exceed 90 degreesi

3.04 If fall is available, a 0.10 foot drop shall be built across a manhole in which change in flow direction is 90 degrees.

3.05 Sewer main connections to a manhole shall be made a minimum 0.20 foot above the invert of the through pipe.

3.06 A sewer main or lateral which connects to a manhole 2.5 feet or more above the manhole invert shall require an outside drop connection.

3.07 Flushing inlets shall be allowed in lieu of a manhole only at the high end of a sewer main and only if the main is to be extended in the future.

3.08 No lateral connections shall be made to the vertical riser of a flushing inlet.

3.09 When a flushing inlet is removed and the project does not call for a new flushing inlet to be installed, state that the cover and frame shall be delivered to the City Main Yard.

4. CONNECTIONS

4.01 All sanitary sewer connections shall be subject to approval of Public Works, and shall be in accordance with applicable provisions of the City Code and the City standard Specifications for Public Works Construction.

4.02 Connections to an existing sewer main shall be in accordance with Detail D-3 of the City Standard Plan Details for Public Works Construction.

4.03 Lateral connections to a sewer main under construction shall be made with wye fittings.

4.04 A lateral which serves multiple lots shall make connection to a sewer main at a manhole.

4.05 Lateral connections to a manhole located at the end (bulb) of a cul-de-sac shall be made a minimum 0.50 feet above the manhole invert.

4.06 Laterals for future on-site connecton shall be plugged at the property line.

4.07 Laterals shall be identified with the letter "S" on top of the curb.

4.08 Invert of the lateral at property line shall be shown.

4.09 No public or private storm drain shall be connected to a sanitary sewer.

5.0 SITE PLANNING

5.01 Site planning shall take into consideration street patterns and slopes which will accomodate a satisfactory sanitary sewer plan with sewer mains located in public streets or equivalent pathways.

5.02 If the site borders an undeveloped area, depth, size and slope of the sewer mains shall be designed to provide future service for the surrounding development.

5.03 If no sewer main or insufficient capacity is available at the site, a new sanitary sewer must be constructed by the developer as a condition of the site development.

5.04 Sanitary sewer easements:

a. Easement for a public sewer shall be a minimum 20 feet wide and located within one property. (Appendix Figure 4)

b. Depth of sewer in the easement may require restrictions on landscape planting within the easement.

c. Locating a manhole within the easement will require an all-weather pathway to permit a public maintenance truck to access the manhole.

d. When one parcel sewers though an adjacent parcel to reach a public sewer, the pipe and easement shall be private

6. REQUIRED SUBMITTALS

6.01 General - The following requirements pertain to all submittals:

a. Plan and profile of all public sewer constructon is required.

b. A list of all City plan references shall appear on the plan.

c. The plan shall clearly differentiate between existing facilities and proposed construction.

d. All easements and agreements shall be recorded; book and page shall appear on the plan. Easements shall be shown and agreements shall be referred to by note.

6.02 Planning Department Permit Plans shall show at least the information required by the "General Development Plan Requirement" document distributed by the Planning Department, and shall conform to the following requirements:

a. Planned development zoning shall include a conceptual "master plan" if non exists for the sanitary sewer drainage shed. Proposed adjacent street adn lotting patterns shall be shown.

b. Planned development zoning applications shall include a conceptual sanitary sewer plan.

c. Planned development zoning applications shall supply topography on and around the project site.

d. Planned development permit shall show the sanitary sewer drainage shed if not previously required in the Planned Development zoning stage.

APPENDIX

FIGURE	DESCRIPTION
1	Peak Flow Factor
2	Roughness Coefficient and Depth of Flow
3	Bedding Detail
4	Width of Sanitary Sewer Easement
5	Lateral Pipe Matrix

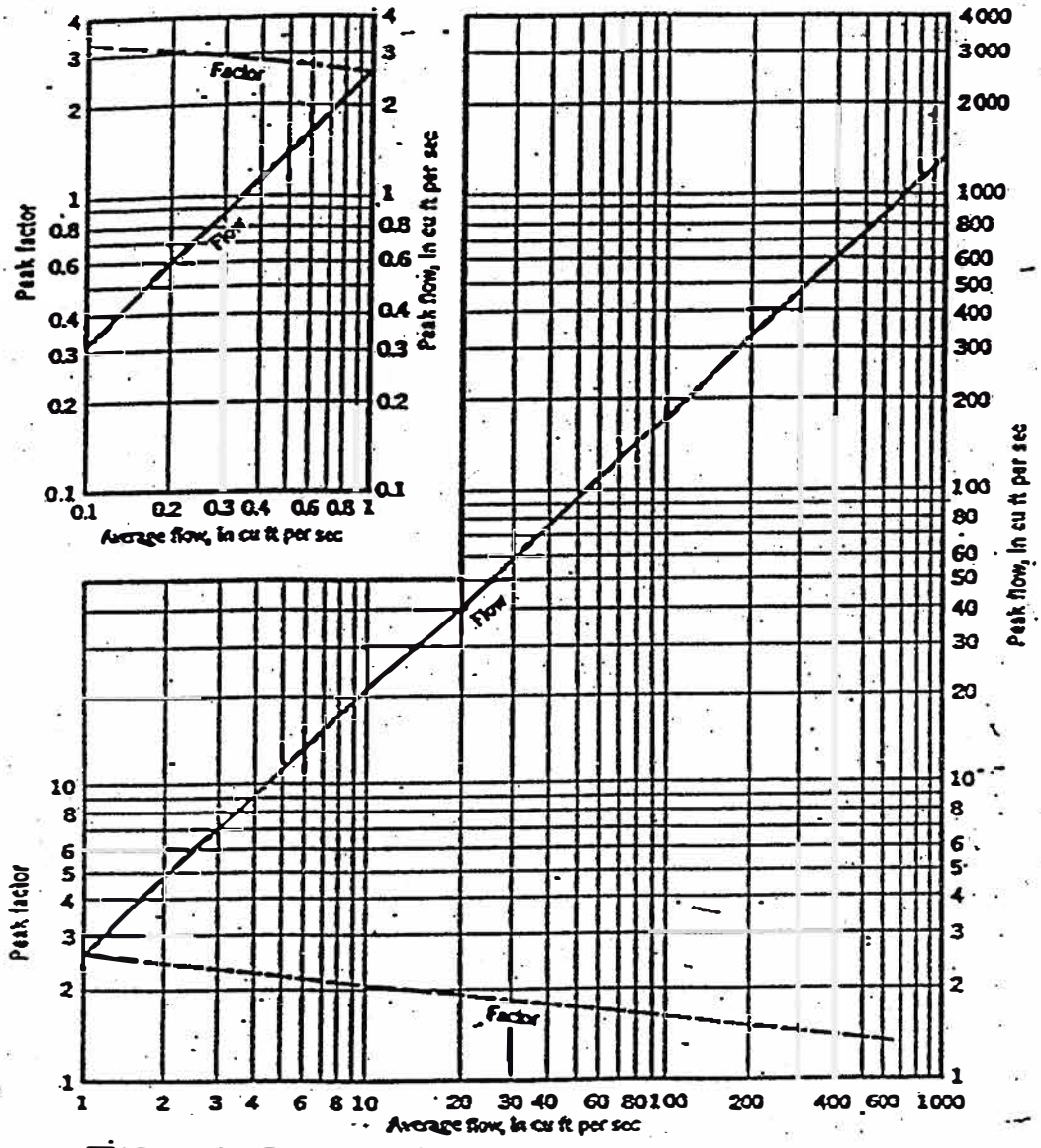


FIGURE 6.—Ratio of peak flow to average daily flow in Los Angeles. ($C_f \times 1.7$ = cu m/min.)

PF = peak factor (dimentionless)
Q_a = average flow rate in million gallons per day (mgd)
Q_p = peak flow rate in million gallons per day (mgd)

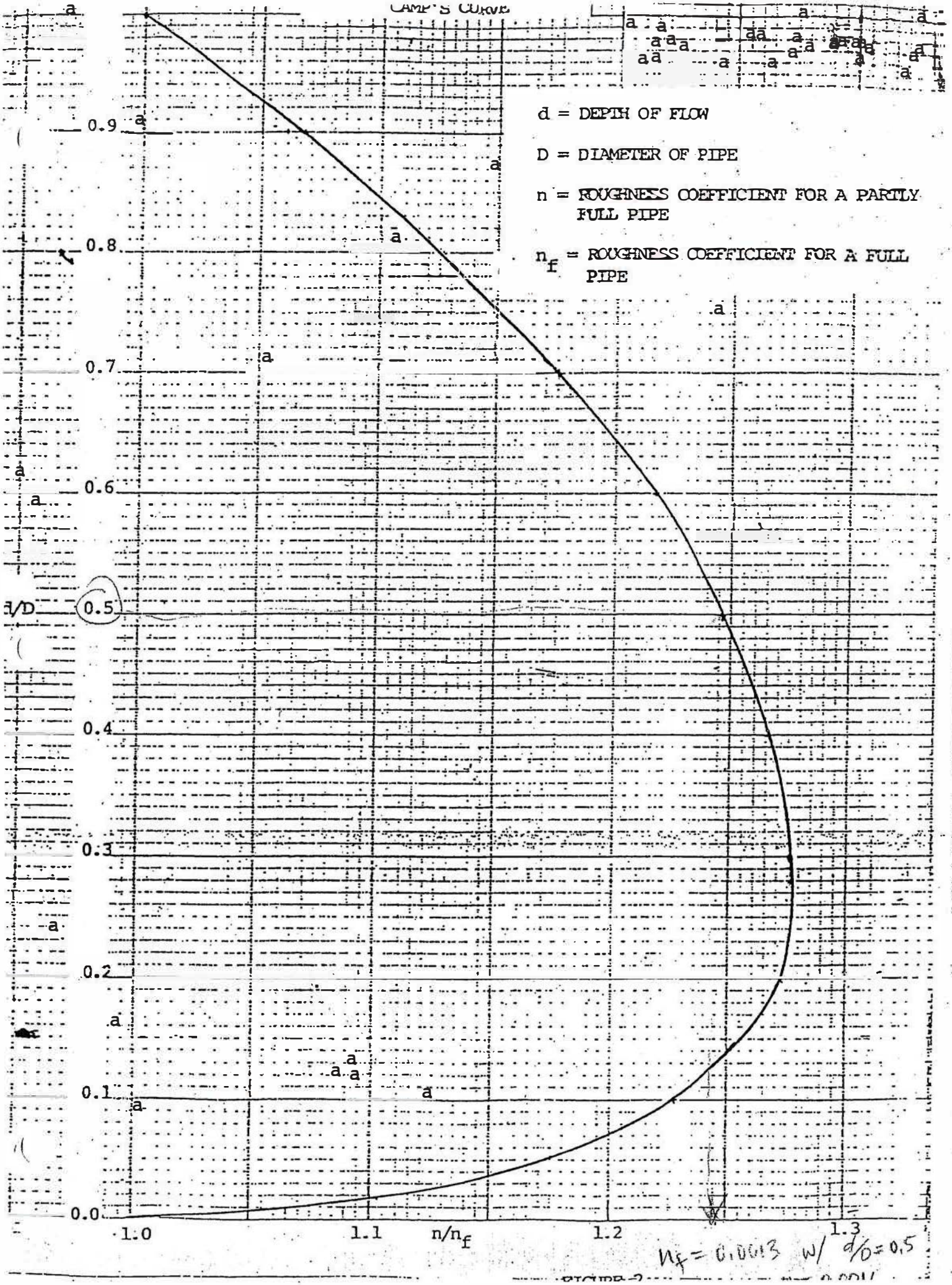
$$PF_i = 2.5\ (Q_a)^{-0.1}$$

$$Q_p = PF\ (Q_a)$$

$$= (Q_a)^{0.9}$$

2.5

FIGURE 1


CAMP'S CURVE
d = DEPTH OF FLOW
D = DIAMETER OF PIPE
n = ROUGHNESS COEFFICIENT FOR A PARTLY FULL PIPE
n_f = ROUGHNESS COEFFICIENT FOR A FULL PIPE
d/D
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
n/n_f
n_f = 0.0013 w/ d/D = 0.5

EXISTING STREET TRENCH NOTES:

1) CLEAN AND TACK COAT ON BOTH SIDES OF EXCAVATED TRENCH & BETWEEN AC COURSES WITH SPRAY APPLICATION OF SS-1H BINDER BEFORE PLACING A.C. SURFACE.

2) PLACE A TOTAL OF 10" OR EXISTING +3" A.C. BASE TO FINISH GRADE, WHICHEVER THICKNESS IS GREATER. A.C. BASE SHALL BE PLACED IN A MINIMUM OF 2 LIFTS. GRIND ENTIRE WEARING SURFACE CAP WIDTH INCLUDING A.C. BASE & EXISTING SURFACE TO DEPTH OF 2" [1.5"]* BELOW FINISH GRADE JUST PRIOR TO PLACING A.C. SURFACE.

3) 2" [1.5"]* SURFACE CAP SHALL BE PLACED THE SAME DAY AS THE PAVEMENT GRINDING, OR COVERED WITH NON-SKID STEEL PLATES COUNTERSUNK FLUSH WITH THE ADJACENT GRADES UNTIL THE A.C. SURFACE CAN BE PLACED.

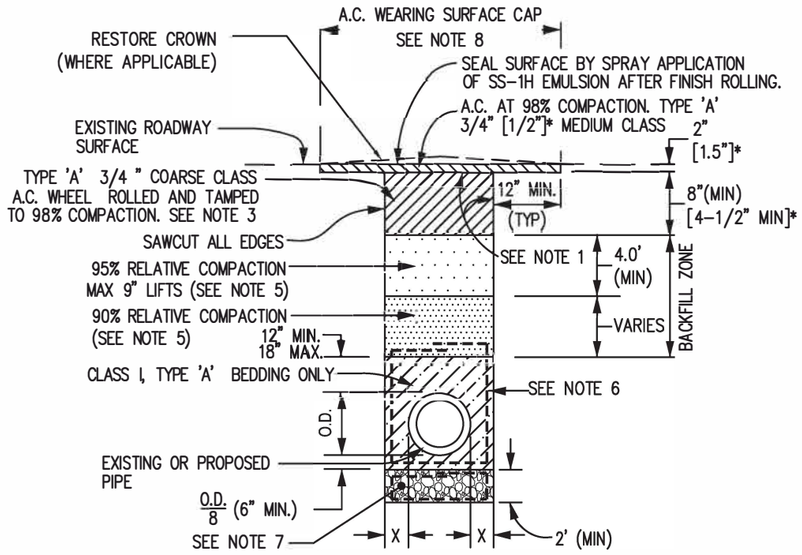
4) SHOVEL - SLICING OF BEDDING MATERIAL IN THE HAUNCH AREAS IS REQUIRED WHEN BEDDING IS NO HIGHER THAN THE QUARTER POINT OF THE PIPE.

5) THE CONTRACTOR SHALL USE CLASS III AGGREGATE BASE, 3/4" MAXIMUM GRADATION AS BACKFILL MATERIAL AND SHALL CONFORM TO SECTION 26 OF THE STANDARD SPECIFICATIONS.

6) GEOTEXTILE TO BE PLACED BETWEEN CLASS III A.B. AND BEDDING IF THE NATIVE SOIL SURROUNDING THE TRENCH IS FOUND TO BE HEAVY CLAY. FOR ALL OTHER NATIVE SOIL CONDITIONS THE GEOTEXTILE SHALL BE WRAPPED AROUND THE ENTIRE TRENCH AS SHOWN.

7) GEOTEXTILE AND CLASS I, BEDDING STABILIZATION MATERIAL SHALL BE USED FOR UNSUITABLE SOIL CONDITIONS ONLY OR AS DIRECTED BY CITY ENGINEER/INSPECTOR.

8) WIDTH OF FINAL A.C. WEARING CAP SHALL BE 6 FT MINIMUM OR THE TRENCH WIDTH PLUS 2 FT. MIN., WHICHEVER IS GREATER.



* [MINOR/RESIDENTIAL STREET]

EXISTING STREET TRENCH RESTORATION

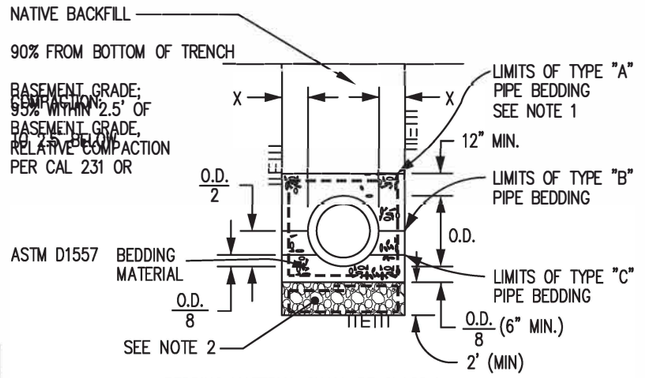
PIPE SIZE	LIMITS OF X	
	MINIMUM	MAXIMUM
24" OR LESS	4"	$4" + \frac{O.D.}{4}$
27" AND GREATER	6"	$6" + \frac{O.D.}{4}$

NEW STREET TRENCH NOTES:

1) GEOTEXTILE TO BE PLACED BETWEEN CLASS III A.B. AND BEDDING IF THE NATIVE SOIL SURROUNDING THE TRENCH IS FOUND TO BE HEAVY CLAY. FOR ALL OTHER NATIVE SOIL CONDITIONS THE GEOTEXTILE SHALL BE WRAPPED AROUND THE ENTIRE TRENCH AS SHOWN.

2) GEOTEXTILE AND CLASS I, BEDDING STABILIZATION MATERIAL SHALL BE USED FOR UNSUITABLE SOIL CONDITIONS ONLY OR AS DIRECTED BY CITY ENGINEER/INSPECTOR.

BEDDING TYPE	CATEGORY OF PIPE
A	VITRIFIED CLAY PIPE, CONCRETE PIPE 25" DIA. AND GREATER
B	CONCRETE PIPE 24" DIA. AND LESS
C	DUCTILE IRON PIPE

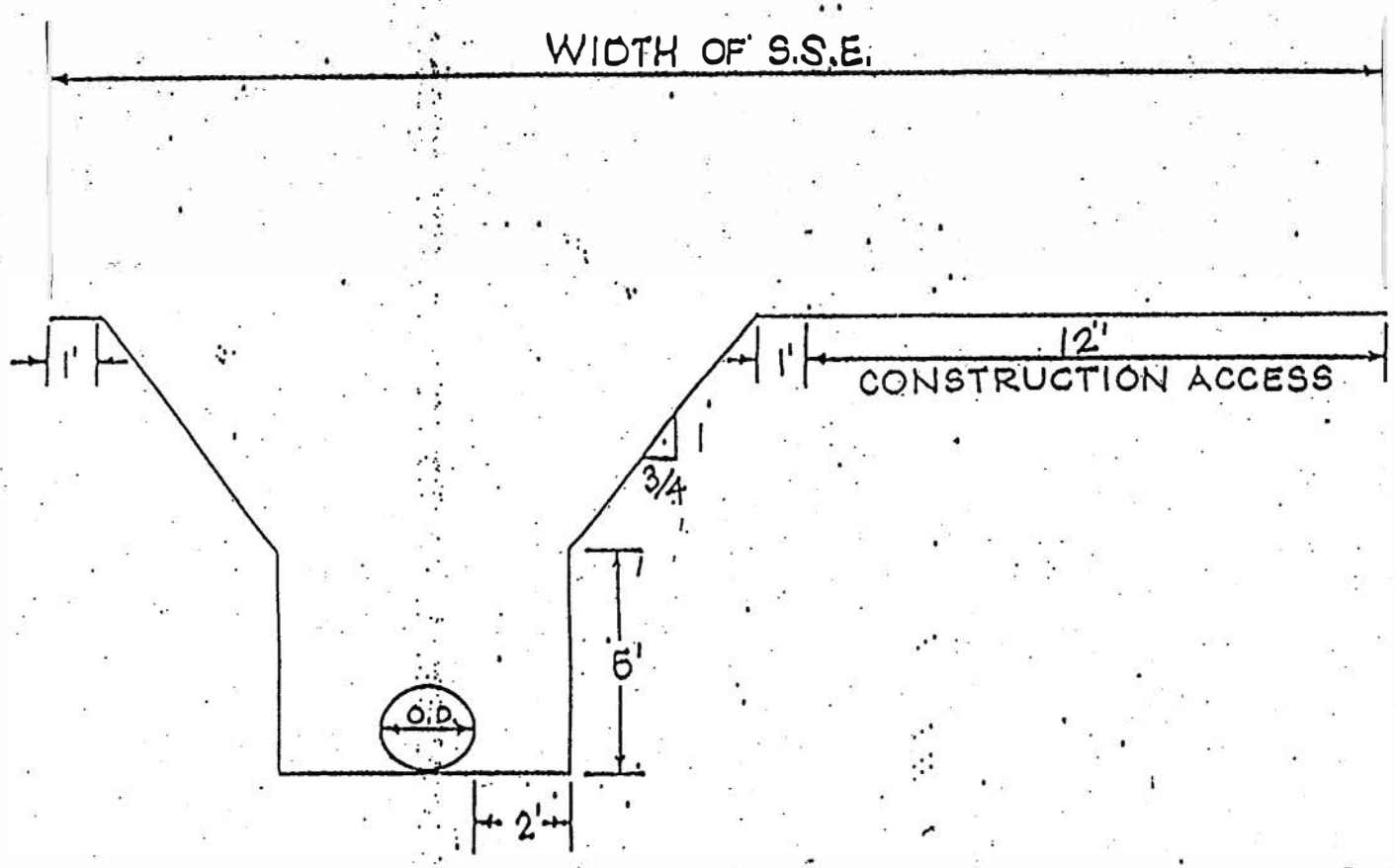


BEDDING MATERIAL SHALL BE CLASS I (CRUSHED STONE) IN ACCORDANCE WITH THE 1992 CITY STANDARD SPECIFICATION 1301-2.

NEW STREET PIPE BEDDING DETAIL

FOR ALL STORM AND SANITARY SEWER PIPE

FIGURE 3



SANITARY SEWER EASEMENT

FIGURE 4

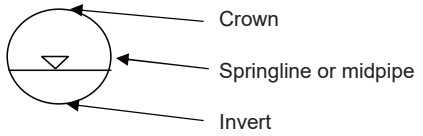
Existing Sanitary Sewer Mains **Vitrified Clay Pipe (VCP)**

New Laterals Main	6"	8"	10"	12"	15"	18"	21"	24"	27"	30"	32"	36"	39"	42"	48"
4"	F	F	F T	T	T	T	T	T	T	T	M	M	M	M	M
6"	F	F	F	T	T	T	T	T	T	T	M	M	M	M	M
8"		M	M	M	M	M	M	M	M	M	M	M	M	M	M
10"			M	M	M	M	M	M	M	M	M	M	M	M	M
12"				M	M	M	M	M	M	M	M	M	M	M	M
15"					M	M	M	M	M	M	M	M	M	M	M
18"						M	M	M	M	M	M	M	M	M	M
21"							M	M	M	M	M	M	M	M	M

Fitting F no band seals on mains larger than 10"

Insert Tee T

Manhole M



NOTES

1) No direct sewer lateral connections to mains larger then a 30". New MHs over mains larger than 30" requires the installation of a manhole. Coordination with Sanitary Sewer Division of PW should only be done for unique cases.
2) Connection to mains via a T-tap connection will be done in the presence of a Public Works Inspector.

3) Openings for Tee connections shall be diamond drilled as specified in Standard Details D-3. No exceptions.

4) Tee connections to the mainline shall be made from the 10:00 to 2:00 o'clock postion. 12:00 o'clock laterals should not be used because it is difficult to determine the origin of the lateral.
5) Type of Tee connection shall be submitted Public Works Inspector for review prior to installation.

6) If there is more then one sewer main in the street the order of connection should be the smallest diameter main to the largest diameter main with capacity being verified by City staff.

FIGURE 5

DIP CITY STANDARD NOTE

- **Ductile Iron Pipe (DIP):** DIP used for sanitary sewer shall conform to Section 101,"Pipe and Fittings", and Section 1207, "Pipe and Structures", of the Standard Specifications and these Special Provisions. All DIP used to convey sanitary sewage shall have an interior lined with ceramic epoxy. Ductile Iron Pipe for Sanitary Sewer shall be gasketed bell and spigot joint pipe, ANSI/AWWA C151/A21.51, gasket-ANSI/AWWA C111/A21.11, class 150. US Pipe and Foundry Co., Polyurethane-lined Tyton Joint DIP and Fittings or approved equivalent.

- **Ceramic Epoxy Lining** - All Ductile Iron Pipe and Fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends. Lining Material: The material shall be U.S. Pipe, PROTECTO 401 Ceramic Epoxy or approved equal. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. A test report verifying the following properties and a certification of the test results shall be submitted prior to pipe delivered to job-site.

A. A permeability rating of 0.00 when tested according to the procedure described in Method A of ASTM E 96-93, Procedure A with a test duration of 30 days.

B. The following tests shall be run on coupons from factory lined Ductile Iron pipe:

    1. ASTM B 117-85 Salt Spray (scribed panel)-Results to equal 0.0 undercutting after two years.

    2. ASTM G 95-87 Cathodic Disbondment (1.5 volts @ 77^{o}F)-Results to equal no more than 0.5mm undercutting after 30 days.

    3. Immersion Testing rated using ASTM D 714-87.
        a. 20% Sulfuric Acid-No effect after two years.
        b. 140^{o}F-25% Sodium Hydroxide-No effect after two years.
        c. 160^{o}F Distilled Water-No effect after two years.
        d. 120^{o}F Tap Water (scribed panel)-0.0 undercutting after two years with no effect.

    4. Abrasion Resistance-Less than 4 mils loss after one million cycles on a ±22.5^{o} sliding aggregate slurry abrasion tester using a sharp natural siliceous gravel with a particle size between 2 mm and 10 mm.

        Application: The entire area to receive the protective compound shall be free of grease, oil or other substances. All areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media to remove all rust, loose oxides, etc.

        The interior of the pipe shall receive 40 mils nominal dry film thickness of coating within 8 hours of surface preparation. No lining shall be applied when the substrate or ambient temperature is below 40 degrees Fahrenheit.

        The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500 volt test. Any defects found shall be repaired prior to shipment.

        Bedding Detail:
        Wrap DIP in 8 mm thick polyethylene in conformance with AWWA C105 also known as Polywrap for corrosion resistance. For bedding, use quarry fines structural backfill Section 1301-2.2.2 of the City Standard Specifications.

There can also be technological changes implemented such as flow restrictors, low water usage fixtures and even on-site primary treatment. With research in water reclamation, it is possible that upstream treatment and reuse will reduce flow further down the system.

STANDARDS AND COEFFICIENTS

I. EVALUATION STANDARDS

A. Minimum Velocity 2 feet per second
B. Mannings Coefficient n = .013

II. DESIGN STANDARDS

A. Minimum velocity ~~3~~ 2.5 feet per second to be used unless it will result in significant increase in system costs. i.e. depth and pump stations.

B. Mannings Coefficient n = .013

III. SEWAGE GENERATION COEFFICIENTS

	per ACRE(?)
A. Low density residential 2 to 5 DU/A	.0012 MGD
B. Medium density residential 6 to 12 DU/A	.0018
C. High density residential 13 to 40 DU/A	.005
D. Neighborhood Commercial	.001
E. Commercial	.0023
F. Industrial Park	.005
G. Industrial	.01
H. High Discharge (as existing or individual design)	.5
I. Public (schools-libraries-civic bldgs.)	.004
J. Recreation	.0006

IV. INFILTRATION

.001

V. PEAK FACTORS

1.5 minimum in major interceptors to 2.0 in collection system.

TABLE I

HYDRAULICS DIVISION		MGD/AC
RUAL, LOW DENSITY RESIDENTIAL	(2.0 DU/AC)	0.006
MEDIUM LOW, DENSITY RESIDENTIAL	(5.0 - 8.0 DU/AC)	0.0012
MEDIUM HIGH DENSITY RESIDENTIAL	(8 - 12 DU/AC)	0.0018
HIGH DENSITY RESIDENTIAL	(12 - 25 DU/AC)	0.0040
VERY HIGH DENSITY RESIDENTIAL	(25 - 40 DU/AC)	0.0050
NEIGHBORHOOD/COMMUNITY COMMERCIAL		0.0010
REGIONAL, GENERAL COMMERCIAL		0.0023
OFFICE		0.0040
COMBINED INDUSTRIAL/INDUSTRIAL		0.0060
INDUSTRIAL PARK		0.0025
CAMPUS INDUSTRIAL		0.0020
LIGHT INDUSTRIAL		0.0040
HEAVY INDUSTRIAL		0.0050
PUBLIC/QUASI-PUBLIC		0.0050
REGIONAL PARK & OPEN SPACE, PRIVATE RECREATION		0.0001
PRIVATE OPEN SPACE (SEE ABOVE)		0.0001
NON-URBAN HILISIDE		0.0001
AGRICULTURAL		0.0001
DOWNTOWN CORE AREA		
CULTURAL/INSTITUTIONAL		0.0020
CORE AREA COMMERCIAL		0.0018
PARK/COMMERCIAL (SEE ABOVE)		0.0015
HIGH SCHOOLS		0.0020
ELEMENTARY SCHOOLS		0.0012
JR. HIGH		0.0016
NEIGHBORHOOD PARK		0.0016

TABLE 7-3
Drainage Fixture Unit Values (DFU)

Individual Fixtures	Min. Size Trap and Trap Arm[7]	Private: Individual Dwelling	Private: 3 or more Dwellings	Public: General Use	Public: Heavy-Use Assembly
Bar Sink	1-1/2"	1.0	1.0		
Bar Sink	1-1/2"[2]			2.0	
Bathtub or Combination Bath/Shower	1-1/2"	3.0	3.0		
Bidet, 1-1/4" trap	1-1/4"	1.0	1.0		
Clinical Sink, 3" trap	3"			6.0	
Clothes Washer, domestic, 2" standpipe[5]	2"	3.0	3.0	3.0	
Dental Unit, cuspidor	1-1/4"			1.0	
Dishwasher, domestic, with independent drain	1-1/2"	2.0	2.0	2.0	
Drinking Fountain or Watercooler	1-1/4"			0.5	
Food-waste-grinder, commercial	2"			3.0	
Floor Drain, emergency				0.0	
Kitchen Sink, domestic, with one 1-1/2" trap	1-1/2"[2]	2.0	2.0	2.0	
Kitchen Sink, domestic, with food-waste-grinder	1-1/2"[2]	2.0	2.0	2.0	
Kitchen Sink, domestic, with dishwasher	1-1/2"[2]	3.0	3.0	3.0	
Kitchen Sink, domestic, w/grinder and dishwasher	1-1/2"[2]	3.0	3.0	3.0	
Laundry Sink, one or two compartments	1-1/2"	2.0	2.0	2.0	
Laundry Sink, with discharge from clothes washer	1-1/2"	2.0	2.0	2.0	
Lavatory, single	1-1/4"	1.0	1.0	1.0	1.0
Lavatory in sets of two or three	1-1/2"	2.0	2.0	2.0	2.0
Mop Basin, 3" trap	3"			3.0	
Receptor, Indirect waste, 1-1/2" trap[1,3]	1-1/2"			(1)	
Receptor, Indirect waste, 2" trap[1,4]	2"			(1)	
Receptor, indirect waste, 3" trap[1]	3"			(1)	
Service Sink, 2" trap	2"			3.0	
Service Sink, 3" trap	3"			3.0	
Shower Stall, 2" trap	2"	2.0	2.0	2.0	
Showers, group, per head (continuous use)	2"			5.0	
Sink, commercial, 1-1/2" trap, with food waste	1-1/2"[2]			3.0	
Sink, service, flushing rim	3"			6.0	
Sink, general, 1-1/2" trap	1-1/2"	2.0	2.0	2.0	
Sink, general, 2" trap	2"	3.0	3.0	3.0	
Sink, general, 3" trap	3"			5.0	
Urinal, 1.0 GPF				4.0	5.0
Urinal, greater than 1.0 GPF				6.0	6.0
Urinal, 1-1/2" trap	1-1/2"[2]			4.0	5.0
Washfountain, 1-1/2" trap	1-1/2"			2.0	
Washfountain, 2" trap	2"			3.0	
Wash Sink, each set of faucets				2.0	
Water Closet, 1.6 GPF Gravity Tank[6]	3"	3.0	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank[6]	3"	3.5	3.5	5.0	8.0
Water Closet, 1.6 GPF Flushometer Valve[6]	3"	3.0	3.0	4.0	8.0
Water Closet, 3.5 GPF Gravity Tank[6]	3"	4.0	4.0	6.0	8.0
Water Closet, 3.5 GPF Flushometer Valve[6]	3"	4.0	4.0	6.0	8.0
Whirlpool Bath or Combination Bath/Shower	2"	3.0	3.0		

[1]Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 7-4.
[2]Provide a 2"(51 mm) minimum branch drain beyond the trap arm.
[3]For refrigerators, coffee urns, water stations, and similar low demands.
[4]For commercial sinks, dishwashers, and similar moderate or heavy demands.
[5]Buildings having a clothes washing area with clothes washers in a battery of three (3) or more clothes washers shall be rated at six (6) fixture units each for purposes of sizing common horizontal and vertical drainage piping.
[6]Water closets shall be computed as six (6) fixture units when determining septic tank sizes based on Appendix K of this Code.
[7]Trap sizes shall not be increased to the point where the fixture discharge may be inadequate to maintain their self-scouring properties.