

SECTION IV-6 – PROJECT CLOSEOUT

6.1 Execution

Start up and operational field tests shall be conducted by the pump manufacturer's factory trained start-up representative. The start-up and operational test shall be conducted in the presence of the design engineer, Water Department personnel, and the contractor. Final site specific adjustments shall be made to ensure a properly functioning system.

6.2 Operation and Maintenance Manuals

A. Submittals

Four copies of the operation and maintenance manual shall be submitted to the Fort Worth Water Department prior to final acceptance.

B. Materials

1. Laminated 8 1/2" x 11" loose leaf paper
2. Printed on one side only
3. Include all diagrams and illustrations, attach foldouts as required.

C. Contents

1. Table of contents and index
2. Description of each system and component
3. Complete starting and stopping procedure
4. Emergency stopping procedure
5. Operating instructions
6. Routine and special maintenance procedures
7. Lubrication requirements, including items to be lubricated, type of lubricant, frequency, and diagram of items to be lubricated.
8. Manufacturer's printed operating and maintenance instructions, parts lists, illustrations, and exploded view diagrams.
9. Complete copy of approved shop drawings, include cross sections with part numbers.
10. List of spare parts, recommended spare parts, manufacturer's price, and recommended quantity.
11. Name, address, and phone number of supplier's headquarters.
12. Safety instructions and requirements
13. Electrical schematic diagram
14. Control wiring diagram
15. Copies of warranty, bond, and service contract, as applicable.
16. Certified performance curves, engineering data, and test results.
17. Guide to trouble shooting

18. Copy of all data obtained during operational field tests and start up documentation

6.3 Pump Manufacturer's Warranty

The pump manufacturer shall warrant, in writing, the pump system to be free from defects in materials for a period of one (1) year starting from the date of final acceptance.

6.4 As-Builts

Design engineer shall be required to provide as-built drawings, one copy electronically and one copy on mylar, to the Fort Worth Water Department, prior to final acceptance. As-builts shall be signed and sealed by design engineer.

6.5 Project Closeout

Prior to final acceptance, the Developer shall transfer ownership of the lift station property to the City of Fort Worth. Transferring ownership of property for a wastewater lift station shall be done by a warranty deed with back-up title information subject to the City's approval of the size, location, and condition of the title at the Developer's expense.

DESIGN CRITERIA

1. BASIC DESIGN REQUIREMENTS

The Fort Worth Water Department considers the following basic practices as standard requirements. Under isolated conditions, warranted only by special situations, the Water Department Engineering staff may recommend and/or approve variations to some of these standards.

- A. Wastewater Main Location: The normal location of the wastewater main shall be in the south or west one-quarter of the street, as appropriate.
- B. Wastewater Main Line Size: The minimum size for a wastewater main shall be 8-inch.
- C. Wastewater Service Main:
 - (1) For lots with frontages of 75 feet or less:
Wastewater Service main shall be located 10 feet south or west of the centerline of the lot frontage, as appropriate, except where the grade of the wastewater main serving the lot is 3.00 percent or more. Where the wastewater main grade is 3.00 percent or greater, the wastewater service main shall be located 5 feet upstream from the lower lot front corner.
 - (2) For Lots with Frontages exceeding 75 feet:
Wastewater Service main shall be located five (5) feet south or west of the center of the lot frontage, as appropriate, except where the grade of the wastewater main serving the lot is 3.00 percent or more. Where the wastewater main grade is 3.00 percent or greater, the wastewater service main shall be located five (5) feet upstream from the lower lot corner.
 - (3) “Services” Crossing Divided Thoroughfares or Wide Paved Streets: A proposed wastewater service main that requires crossing over half of a divided thoroughfare (either existing or proposed) or across more than 40 linear feet (perpendicular to street center line) of street pavement (either existing or proposed), the proposed service shall connect to public wastewater main which extends across the divided thoroughfares and meets all the requirements of this section.
 - (4) Length of Wastewater Service: Wastewater Service mains shall be extended from the main to the property line when the service is installed.

- (5) Wastewater Service Main Material: When a wastewater service main crosses a water line (long side services), the pipe shall meet SDR-26 requirements.
- (6) Large Wastewater Services: All wastewater service mains that are 6-inches or larger shall connect to a manhole on the wastewater main or lateral unless approved by the Water Department.

D. Manholes: Manholes shall be placed at all points of change in alignment, grade or size of wastewater main, intersection of two or more wastewater mains, at the end of the line, and any locations to provide accessibility for maintenance ease.

- (1) Distance Between Manholes: On wastewater mains, the maximum distance between wastewater manholes shall be as follows:

<u>Size of Wastewater Main</u>	<u>Maximum Distance Between Manholes</u>
smaller than 18" (I.D.),	500 feet
18" (I.D.) to 30" (I.D.)	800 feet
33" (I.D.) to 48" (I.D.)	1,000 feet
54" (I.D.) and larger	2000 feet

- (2) Wastewater Manholes In the Flood Plain: For wastewater main manholes located in the 100 year flood plain, manhole covers and rings shall have gaskets and shall be bolted or have approved means of preventing inflow. Where gasket manholes are required for more than three manholes in a sequence, a venting method, such as raising the rim at least one foot above 100-year flood plain, will be provided on every third manhole. If this is not practical, an approved alternate venting method, which will minimize inflow, will be used.
- (3) Manhole at End of Line: All wastewater mains and laterals shall end (highest point) with a manhole.
- (4) Offset Manholes: When connecting a new lateral to an existing wastewater main, which is 24-inch and larger, then use an offset wastewater manhole (see Figure 120 of the General Contract Documents).
- (5) Concrete Collars: All wastewater main manholes, that the rim is at approximate ground level, shall have a concrete collar to secure manhole frame. Manholes located in concrete paved areas or street will not require concrete collars.

- (6) Shallow Manholes: All manholes that have a depth of four (4) feet or less are Shallow Manholes.
 - (7) Flowlines of Wastewater Mains: In manholes with pipes of different sizes (diameters), the tops of pipes shall be placed at the same elevation (crown to crown). Outside drop manholes installation is required if the connecting wastewater main having an elevation difference greater than 3 feet or less. Elevation difference 3 feet or less shall have a hydraulic slide to reduce turbulence.
 - (8) Manhole Covers: Manhole covers of nominal 24-inch or larger diameter are required for all wastewater manholes where personnel entry is anticipated.
 - (9) Manhole Inserts: To reduce inflow and infiltration into the wastewater collection system, all manholes shall be equipped with watertight manhole insert. Pipe size smaller than 18-inch shall have plastic insert installed. Pipe size 18-inch and above shall have stainless steel lockable insert installed.
 - (10) Clay Dams: These dams are to be installed close to the downstream manholes or downstream of major storm main conflict.
 - (11) Manhole Testing: Manhole testing shall be tested using vacuum testing, meeting the ASTM requirements.
- E. Horizontal Deflection in Wastewater Mains: Horizontal deflection in wastewater main shall be accomplished by joint deflection only. The minimum radius will be 500 feet.
- F. Wastewater Main Material: Pipe material, type and class for wastewater main shall be those listed in the General Contract Documents and General Specifications of the Fort Worth Water Department.
- G. Inverted Siphons: Inverted siphons shall have two or more barrels, a minimum pipe diameter of six inches and shall be provided with necessary appurtenances for convenient flushing and maintenance. The manholes shall have adequate clearances for rodding. Sufficient head shall be provided and pipe sizes selected to assure velocities of at least three feet per second at initial and design flows. The inlet and outlet details shall be arranged so that the normal flow is diverted to one barrel. Provisions shall be made such that any barrel may be taken out of service for cleaning.

Provisions shall be made to allow cleaning across each bend with equipment available to the entity in charge of operation and maintenance of the facility. Inverted siphons shall be designed to preclude nuisance odors.

- H. Aerial Crossing: Pipe with restrained joints or monolithic pipe shall be required between manholes on each end of bridged sections. Bridged sections shall be designed to withstand the hydraulic forces applied by the occurrence of a 100-year flood, including buoyancy. Pipe material shall also be capable of withstanding impact from debris. Bank stabilization shall be provided to prevent erosion of bank sections. Pier supports shall be spaced and designed to ensure that adequate grade, slope and structural integrity are maintained.
- I. Minimum Spacing From Water Line: The purpose of maintaining minimal spacing between water and wastewater mains is to protect the public water distribution system from contamination from wastewater. Contamination may occur when vacuum develops within water main due to breakage or malfunction of relief valve. The minimum horizontal space between a new wastewater main and a water main shall be nine (9) feet measured from the outside diameter of the water and wastewater mains. The wastewater main that is parallel to a water main shall be installed in a separate trench. When the nine-foot separation distance can not be achieved, the following guidelines will apply:
- (1) Where a proposed wastewater main parallels an existing water line, the wastewater main shall meet SDR-26 requirements. The vertical separation shall be a minimum of two (2) feet between outside diameters and horizontal separation shall be a minimum of four (4) feet between outside diameters. The wastewater line shall be located below the water line.
 - (2) Where the wastewater main crosses the water line and the wastewater main is constructed of SDR-26, an absolute minimum distance of 6-inches between outside diameters shall be maintained. The wastewater main shall be below the water line and wastewater pipe joint shall be centered on the water line.
 - (3) Where a wastewater main crosses under a water line, the wastewater main shall meet SDR-26 requirements. Further, a minimum two-foot separation distance shall be maintained. The initial backfill shall be cement stabilized (two bags per cubic yard) sand for all sections of wastewater main within 9 feet of the water line. The initial backfill shall be from 1/4 diameter below the bottom of the pipe (minimum 6-inches) to one pipe diameter (minimum 12-inches) above the top of the pipe.

- (4) Where a wastewater main crosses over a water line, all portions of the wastewater main within 9 feet of the water line shall be SDR-26, using appropriate adapters. An alternate method would be to place the wastewater main in a pressure grade (150 psi pressure class) casing pipe for at least 18 feet (9 feet each side of water line). The wastewater main shall be supported with spacers at least every five feet or grouted with concrete. Non grouted casing pipe must be sealed at both ends with cement grout or acceptable sealant.
- J. Minimum Cover: Where the topography requires that a wastewater main line is to be installed with less than 2-1/2 feet of cover, the pipe shall be either encased in concrete or constructed of ductile iron pipe through the restricted area.
- K. Wastewater Line Testing: Under the Fort Worth Water Department General Contract Documents and Specifications, wastewater main is required to be tested by air or water to a specified condition and the pipe is required to be examined by television camera. To be able to accomplish these test phases, the system shall incorporate the following features:
- (1) Where steep grades in wastewater pipe between normally spaced manholes impose excessive test pressure in the lower pipe segments and Contractor tests with water, the pipe shall incorporate tees for test purposes as appropriate between manholes. Such tees shall have the branches the same size as the run diameter; the branch shall be oriented up; the run shall be wrapped to just below the branch bell with concrete encasement; and the branch shall incorporate a plug. After test, the tees shall be plugged and then blocked with concrete.
- (3) Project requirements shall contain provisions for the independent contractor to use television camera equipment to be installed or removed at the end of all wastewater mains. In all cases a manhole is required at the end of the wastewater main for that and other maintenance purposes.
- L. Curves on Wastewater Lines: Every effort should be made to eliminate curves on wastewater lines whenever possible. If curves must be utilized on wastewater lines, then the minimum radius shall be 500 feet. In addition, manholes are required every 250 to 300 feet, preferably at point of curve and point of tangent.

2. WASTEWATER LATERALS

The design of wastewater laterals follows the same basic design procedures as those outlined for mains, except, of course, that the information required is reduced in complexity to conform to the reduced function of a lateral. The Preliminary Map prepared for the main may easily be utilized to show lateral system also.

3. FINAL WASTEWATER DESIGN PROCEDURE.

A. SIZING

- (1) Using a population density of 18 persons per acre, calculate the cumulative population load at each point of load increment to determine the load on each section below that point using:
 - (a) Average load per person per day equal to 100 gallons
 - (b) Average load per person in (GPM)=100/1440= 0.0694 GPM
 - (c) Average load of a given population (in GPM)
(0.0694 GPM) x (population) = (load in GPM)
 - (d) Ratio of Design Load to Average Load is expressed by:

$$M = 1 + \frac{14}{4 + \sqrt{P}}$$

Where: M = Ratio of Design Load to Average Load
P = Population in thousand

- (e) The Water Department has found through study that an infiltration load must be considered for use on projects serving large areas developed prior to 1963. An allowance of 1.5 times the peak load, determined using the Harmon's Formula, will be used in order to provide for excess infiltration in such areas.
- (f) Design Load = M (times 1.5 in special areas defined under "e" above) times the average load generated by the ultimate population to be served by the main being designed.

As an alternative method of calculating design flow, the following procedure may be used:

- (2) Using the cumulative population at each load point based on residential and employment density, calculate the cumulative

population load at each point of load increment to determine the load on each section below that point using:

- (a) Average load per person per day equal to 80 gallons
Average load per employee is 40 gallons per day
- (b) Average load per person (in GPM) = $80/1440=0.0556$
GPM
Average load per employee (in GPM)= $40/1440=0.0278$
GPM
- (c) Average load of a given population (in GPM) = $(0.0556$
GPM x population) + $(0.0278$ GPM x employment) = (load
in GPM)
- (d) Ratio of Design Load to Average Load is expressed by:

$$M = 1 + \frac{14}{4 + \sqrt{P}}$$

Where: M = Ratio of Design Load to Average Load
P = Population in thousand.

- (e) It has been found that the use of Harmon's formula alone does not represent peaking factors associated with inflow/infiltration from design storm events. In order to provide for these additional flows an allowance of 2.17 (minimum) times the peak load, determined using Harmon Formula, will be used to provide for inflow/infiltration.
- (f) Total Design Load =M(times 2.17) times the average load generated by the ultimate population to be served by the main being designed.

B. FINAL PLAN AND PROFILE

Prepare a final plan and profile incorporating all of the information accumulated in accordance with the basic design requirements. In addition, design engineer shall provide:

- (1) The latest development platting in the event that the platting has not been recorded.

- (2) All information needed for processing right-of-ways across private and public properties
- (3) Test hole data.
- (4) Contract Documents (Bid Proposal)
- (5) Engineer's cost estimate.

TABLE 4-1

Minimum and Maximum Grades for Wastewater Pipe

Size of Pipe in Inches I.D.	Minimum Slope in percent	Maximum Slope in percent
8	0.40	8.40*
10	0.29	6.23*
12	0.22	4.88*
15	0.16	3.62*
18	0.12	2.83*
21	0.09*	2.30*
24	0.08*	1.93*
27	0.06*	1.65*
30	0.055*	1.43*
33	0.05*	1.26*
36	0.045*	1.12*
39	0.04*	1.01*
>39	See Below	See Below

Note * - TNRCC minimum/maximum requirements per Chapter 317 30TAC

For lines larger than 39 inches in diameter (I.D.), the slope may be determined by the Manning's formula to maintain a minimum of 2.0 feet per second when flowing full and a maximum velocity less than ten feet per second when flowing full.

$$V = \left(\frac{1.49}{n} \right) (R_h^{0.67}) (S^{0.5})$$

Where:

V = velocity (feet/second)

n = Manning's roughness coefficient (n = 0.13)

R_h = hydraulic radius (feet)

S = slope (feet/feet)