

SECTION 3 - WASTEWATER SYSTEM DESIGN REQUIREMENTS

3.01. General

The Town of Prosper shall approve the location of all wastewater lines. The arrangement, character, extent, size and location of all wastewater lines shall be in general conformity with the Town's Buildout Wastewater System Capital Improvement Projects, and should be considered in their relation to existing and planned streets, topographical and environmental considerations, and the land uses proposed to be served by such facilities.

Wastewater lines shall be sized and extended through the limits of a property to serve adjacent properties. In phased construction of thoroughfares, the sewer lines shall be extended the entire length of the thoroughfare being constructed.

3.02. Plan Requirements

Plans for wastewater mains shall include both plan and profile views. A full checklist for civil construction plans can be found in the Development Manual on the Town of Prosper website.

3.03. Easements

Wastewater mains located outside of public right-of-way shall be centered in a minimum fifteen feet (15') wide exclusive use wastewater easement. Wastewater easements running parallel to a property line shall be located wholly on one lot. At highway, railroad, creek, and other crossings or locations where the depth of the wastewater main measured to bottom of pipe exceeds ten feet (10'), the width of the wastewater easement shall be increased a minimum of one and one-half (1.5) times the depth of the wastewater main. Easements for wastewater lift stations and other facilities not specifically provided for by this section shall be determined by the Executive Director of Development and Community Services, or his/her designee.

3.04. Location

Wastewater mains located in public right-of-way shall generally be located in the center of undivided streets and as determined by the Executive Director of Development and Community Services, or his/her designee on divided streets. Wastewater mains located adjacent to creeks and other waterways shall generally follow the alignment of the waterway and be located a minimum of ten feet (10') behind the top of bank. Wastewater mains located in easements shall be located in the center of the easement.

Wastewater mains shall not be located in alleys unless explicitly approved by the Executive Director of Development and Community Services, or his/her designee. Wastewater mains shall not cross residential lots unless explicitly approved by the Executive Director of Development and Community Services, or his/her designee.

Trees shall not be planted within wastewater easements. Wastewater mains shall not be located within five feet (5') of any existing tree. Upon approval of the Executive Director of Development and Community Services, or his/her designee, ornamental trees may be planted within the easement, but no closer than five feet (5') to a wastewater main.

3.05. Horizontal Alignment

Longitudinal bending of the pipe to match the radius of a roadway shall be used, provided the radius is not less than the pipe manufacturer's recommendation, typically three hundred times the diameter (300xD). Joint deflection of the pipe to match the radius of a roadway may be used, provided the angle of deflection is no more than 80% of the pipe manufacturer's recommendation. All other changes in direction shall occur at manholes. When not under a roadway, wastewater mains shall generally be straight from manhole to manhole.

Where a parallel wastewater line is required due to excessive depth, the parallel line shall be offset from the wastewater main by five feet (5') to the side of the street with the majority of wastewater services.

3.06. Vertical Alignment

Wastewater mains shall be designed with a straight profile from manhole to manhole. No vertical curves or vertical bends shall be allowed between manholes. Wastewater mains shall have a minimum cover of four feet (4') within right-of-way or public easements. Additional cover may be required to allow a lateral to extend at 2% grade from the wastewater main to a minimum five-foot (5') depth at a point ten-feet (10') beyond property line while maintaining clearance from water line or franchise utility lines. Excessively deep main lines shall be avoided if not required due to physical constraints.

Wastewater mains shall be designed for a minimum velocity of two feet per second (2 fps) and a maximum velocity of ten feet per second (10 fps) at peak flow. Under gravity flow conditions, this corresponds to Table 3.1 with minimum and maximum grades using Manning's Equation for PVC pipe with a roughness coefficient of 0.013:

Table 3.1 – Pipe Diameter Grade Limits

Pipe Diameter (inches)	Minimum Grade (percent)	Maximum Grade (percent)
8"	0.33%	8.40%
10"	0.25%	6.23%
12"	0.20%	4.88%
15"	0.15%	3.62%
18"	0.11%	2.83%
21"	0.09%	2.30%
24"	0.08%	1.93%

Where the depth of a wastewater main exceeds twelve feet (12'), a parallel wastewater line shall be constructed where laterals will be connected.

3.07. Clearance to Other Utilities

A. Water

The separation between wastewater mains, manholes, and other appurtenances and water mains is governed by Title 30 of the Texas Administrative Code, Part 1, Chapter 217, Subchapter C, Rule 217.53(d) and Chapter 290, Subchapter D, Rule 290.44(e). In general, wastewater mains, manholes, and other appurtenances and water mains shall be installed in separate trenches and shall have a separation distance of nine feet (9') in all directions measured from the outside surface of each facility.

Crossings of wastewater mains and water mains may be accomplished by using wastewater pipe with a minimum pressure rating of 150 psi OR by encasing the water or wastewater main for a distance of nine feet (9') either side of the crossing with a casing pipe having a minimum pressure rating of 150 psi. Under either scenario, a minimum eighteen-foot (18') joint of water pipe shall be centered on the wastewater main with a minimum separation distance of twelve inches (12").

B. Storm Drain

Wastewater mains shall maintain a minimum clearance of eighteen inches (18") from storm drain systems measured from the outside surface of each facility. Where minimum clearance cannot be met, the wastewater main shall be encased in six inches (6") of concrete.

C. Other Utilities

Wastewater mains shall maintain a minimum clearance of twelve inches (12") from other public and private utilities measured from the outside surface of each facility. Where a wastewater main encroaches into a private utility easement, the clearance shall be as specified by the private utility operator.

3.08. Creek Crossings

Wastewater mains shall be designed to cross under creeks and other waterways. The creek crossing shall consist of a watertight steel encasement pipe and a wastewater main supported by approved spacers. Manholes shall be provided ten feet (10') outside the top of bank on both sides of a creek crossing. Creek banks and channels disturbed by construction shall be stabilized to prevent erosion of the backfill materials. Creek channels shall be analyzed to determine if stabilization is necessary to prevent erosion that may expose or damage the wastewater infrastructure.

Aerial crossings may be used only when alternatives for crossing under a creek have been found to be not technically feasible. The aerial crossing shall consist of a rust-resistant steel encasement pipe with welded joints and a wastewater main supported by approved spacers. Manholes shall be provided at the top of bank on both sides of an aerial crossing.

A structural engineer shall design the aerial crossing to support the dead loads of the structure and the live loads of the wastewater main under full flow conditions with no deflection. Buoyancy of the aerial crossing and the impact of debris must be considered if partially or fully submerged by a 100-year rainfall event. Supporting piers shall not obstruct the normal channel of the waterway. A scour analysis shall be conducted and provided to the Town for review. Armoring of the channel may be required to prevent erosion.

3.09. Size Required

Wastewater mains shall be sized for the peak flow of the contributing basin under gravity flow conditions with no surcharges. Manning's Equation shall be used to determine the full-flow capacity of each segment of the wastewater system using a roughness coefficient of 0.013 for PVC pipe. No wastewater, other than laterals or force mains, shall be less than eight-inch (8") diameter. The peak flow shall be calculated based on Table 3.2 or other industry-standard assumptions approved by the Executive Director of Development and Community Services, or his/her designee:

Table 3.2 – Peak Flow Calculation

Land Use	Assumptions	Peak Flow Dry	Peak Flow Wet**
Single Family	3.5 lots per acre (assumed) 3.5 persons per lot 100 gallons per person per day 4.0 peak factor	4,900 GPAD*	5,550 GPAD
Multi Family	15 units per acre (assumed) 3.0 persons per unit 100 gallons per person per day 4.0 peak factor	18,000 GPAD	18,650 GPAD
Commercial Industrial	50 parking spaces per acre (assumed) 1.0 persons per parking space 20 gallons per person per day 4.0 peak factor	4,000 GPAD	4,650 GPAD
School	20 gallons per student per day 4.0 peak factor	80 gal/student/day	80 gal/student/day + 650 GPAD
Nursing Home	100 gallons per bed per day 4.0 peak factor	400 gallons per bed per day	400 gal/bed/day + 650 GPAD
Hospital	200 gallons per bed per day 4.0 peak factor	800 gallons per bed per day	800 gal/bed/day + 650 GPAD

*Gallons per acre per day (GPAD)

**Infiltration shall be 650 gallons per acre per day (GPAD).

Where calculated wastewater flows exceed 2 MGD, the peak factor for the basin may be reduced to 3.0. Where approved zoning or existing development has resulted in densities less than or greater than the assumed densities indicated above, the density of the approved zoning or existing development may be substituted for the assumed density. Other peaking factors for larger basins may be approved by the Executive Director of Development and Community Services, or his/her designee.

3.10. Pipe Materials

Wastewater main materials shall generally be as follows:

A. PVC Pipe (Non-Pressure Rated)

Fifteen-inch (15") and smaller wastewater mains shall be ASTM D3034 SDR 35 (less than 15' deep) or SDR 26 (greater than 15' deep). Eighteen-inch (18") and larger wastewater mains shall be ASTM F679.

B. PVC Pipe (Pressure Rated)

Twelve-inch (12") and smaller wastewater mains shall be ASTM D2241 SDR 26 with a minimum pressure rating of 160 psi. Fifteen-inch (15") and larger wastewater mains shall be AWWA C905 DR25 with a minimum pressure rating of 165 psi. The Design Engineer shall make a recommendation for any pipe over 165 psi.

C. Other Pipe Materials

No other pipe materials may be used without the explicit approval of the Executive Director of Development and Community Services, or his/her designee. A technical memorandum detailing design criteria and construction methods may be required to support alternative pipe materials.

3.11. Manholes and Cleanouts

Manholes shall be constructed at all junctions of wastewater lines sized six inches (6") and greater; at changes of grade, direction, and pipe size; at the beginning and end of segments installed by other than open cut; within thirty feet (30') of the beginning and end of aerial crossings; and at other locations such that the spacing between manholes does not exceed the following in Table 3.3:

Table 3.3 – Manhole Spacing

Pipe Diameter (inches)	Maximum Manhole Spacing (feet)
15" and less	500'
18" thru 30"	800'
33" and larger	1,000'

Manholes shall be sized as shown in Table 3.4.

Table 3.4 – Manhole Diameter

Pipe Diameter (inches)	Manhole Diameter (feet)
27" and less	5'
30" and larger	6'

Manholes on mains twelve inches (12") or smaller shall have a minimum drop of 1/10 foot across the invert. Due to physical constraints, the 1/10 ft drop may be eliminated with the approval of the Executive Director of Development and Community Services or his/her designee. Where different size pipes enter a manhole, the pipe crowns shall be at the same elevation or the smaller pipe shall be higher. Drop manholes shall be required where the inflow elevation is more than two feet (2") above the outflow elevation. New drop structures shall be constructed on the exterior of the manhole. Interior drop structures will be allowed on existing manholes.

Where multiple wastewater pipes enter a manhole, the minimum distance between pipes, measured along the outer surface of the manhole, shall be eighteen inches (18") for cast-in-place manholes and per the manufacturer's recommendation for precast manholes. If a lesser clearance is necessary, a special structural design may be required as determined by the Executive Director of Development and Community Services, or his/her designee.

Where manholes must be constructed in a floodplain, sealed manholes shall be provided to prevent the inflow of storm water. Where more than three (3) consecutive manholes are to be sealed, every 3rd manhole shall be vented two feet (2') above the ultimate 100-year water surface elevation or six feet (6') above the adjacent ground elevation, whichever is greater. The Engineer shall provide the 100-year water surface elevation on the plans, along with a reference to the source of information.

A cleanout may be installed at the end of a line provided it is no more than 250 feet upstream of the nearest manhole. For a line to be extended in the future, a cleanout or manhole may be installed at the end of the line or a single joint of pipe may be installed and capped, provided that the future connection point is located outside or roadway paving.

3.12. Lift Stations and Force Mains

The wastewater system shall be laid out so that all wastewater mains shall be gravity flow. The use of a wastewater lift station and force main may be approved by the Executive Director of Development and Community Services, or his/her designee and the Director of Public Works where terrain and/or municipal boundaries prohibit the extension of a wastewater main by gravity flow. All wastewater lift stations and force mains shall be designed in accordance with TCEQ requirements.

The Engineer shall prepare a technical memorandum detailing the technical characteristics and design features of the wastewater lift station, including service area map with flow analysis, sizing of the wet wells, pumps, and force main. The lift station shall be connected to the Town's Supervisory Control and Data Acquisition (SCADA) system for remote monitoring of the lift station's status. The Developer shall be responsible for all costs associated with design, implementation, and testing of the lift station and related systems, including integration with the Town's existing SCADA system.

Wastewater lift stations shall be surrounded by an eight-foot (8') decorative metal fence with masonry columns and a sixteen-foot (16') sliding gate. A twelve-foot (12') wide concrete drive with a twenty-foot (20') long turnaround consisting of reinforced concrete subgrade that meets the current fire lane standards shall be provided. This drive shall be used for maintenance access to the lift station and shall provide access to the control panel and wet wells. A landscape and irrigation plan shall be provided around the lift station as determined by the Executive Director of Development and Community Services, or his/her designee. All lift stations shall provide the ability for odor control (charcoal canisters or other).

Wastewater force mains shall be white-colored pressure rated PVC pipe. The minimum size for force mains shall be six inches (6") unless explicitly approved by the Executive Director of Development and Community Services, or his/her designee. Force mains shall include plug valves at 1,200' spacing along the force main to isolate segments for repair. Where force mains connect to the wastewater main, the manhole shall have a sulfate resistant coating.

3.13. Wastewater Laterals

Wastewater laterals shall be designed as follows:

A. Residential Subdivision

Every lot shall have a minimum of one (1) wastewater lateral. Wastewater laterals for single-family, duplex, and townhome subdivisions shall consist of a minimum four-inch (4") diameter pipe on a minimum two percent (2%) grade for each lot. Laterals for single-family lots shall be located at the center of the lot. Laterals for duplex and townhome lots shall be consistently located within the development. Laterals shall have a minimum separation distance of ten feet (10') from the water service.

Wastewater laterals for residential subdivisions shall be extended to a point ten feet (10') beyond the property line at a minimum depth of five feet (5') to bottom of lateral. The lateral shall then be extended upward at a 1:1 slope to a point four feet (4') above the ground elevation and capped.

B. Multi-Family and Non-Residential Development

Wastewater laterals for multi-family and non-residential developments shall be minimum six-inch (6") diameter pipe on a minimum two percent (2%) grade. A minimum of one lateral per building shall be provided. Laterals shall have a minimum separation distance of ten feet (10') from water services. A manhole shall be provided where the lateral connects to the wastewater main.

A larger wastewater lateral may be required where peak flows are anticipated to exceed 350 gallons per minute (gpm). Examples of this may include hospitals, nursing homes, athletic facilities, hotels, high-density apartments, and manufacturing facilities.

C. Restrictions

Wastewater laterals shall be connected via wye fittings only. Tees and boots will not be allowed.

3.14. Trenchless Construction

A. Launching and receiving pits for trenchless construction shall be a minimum of five feet (5') from the edge of pavement.

B. The location, size and depth of the launching and receiving pits for trenchless construction shall be evaluated during construction plan review.

C. Approved Methods

1. Horizontal Boring: All horizontal bores shall be dry bored unless approved by the Executive Director of Development and Community Services, or his/her designee. Rust resistant steel casing minimum of one fourth inch (1/4") thick, or thicker if deemed necessary by the Design Engineer, shall be used with Raci patented casing spacers, or approved equal.

2. Pipe Jacking: Pipe shall be designed to withstand all jacking forces with a factor of safety of two (2.0) during construction.

3. Tunneling: Tunneling may be used after approval from the Executive Director of Development and Community Services, or his/her designee.

D. All mains installed under existing roadways shall be installed by bore unless otherwise approved by the Executive Director of Development and Community Services, or his/her designee.