Section 4
Sanitary Sewers

4.0 SANITARY SEWERS

Sanitary sewers should be designed to maintain self-cleaning velocities and allow for ease of maintenance.

This section presents design guidance for construction of sewers in the public right-of-way and on private property. Design criteria for wastewater pumping stations are discussed in Section 5.0.

4.1 Definitions

A. ***Annual Average Design Flow*:** The average daily flow volumes anticipated to occur over a calendar year.

B. ***Building Drain:*** That part of the lowest piping of a drainage system which receives the sanitary discharge from piping inside the walls of a structure or building, and conveys it to a point two feet outside the outer face of a structure, wall or foundation into the side sewer or to an on-site sewage disposal system. Building drains shall not carry roof drainage, groundwater or surface runoff.

C. ***Cleanout:*** An upturned pipe which provides a means for flushing or inserting cleaning tools.

D. ***Effluent:*** Wastewater or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or any part thereof.

E. ***Industrial Process Wastewater or Process Wastewater:*** That category of wastewater containing water carried wastes other than those traditionally derived from human or household customer sources (as defined in FHCMC 1513.0421). Process wastewater is also sometimes referred to as "non-domestic sewage". There are two subcategories of process wastewater

F. ***Interior Channel Drop:*** A planned drop of the invert elevation within a manhole to convey wastewater from the incoming pipe(s) to the outgoing sewer.

G. ***Lateral or Lateral Sewer:*** A sewer to which side or private sewers may be connected from adjacent properties.

H. ***Natural Outlet:*** Any outlet into a watercourse, pond, ditch, lake or other body of surface water or groundwater. It does not include connections to the Town of Friday Harbor Wastewater Treatment Plant, authorized on-site sewage, stormwater disposal systems, or other authorized sewage disposal mechanisms or systems.

I. ***On-Site Sewage Disposal System:*** Any system or combination of piping, treatment or other facilities that collect, store, treat, and/or dispose of sewage and effluent on the property where it originates, or an adjacent or nearby property under the ownership of the user of the system or in which the user has a recorded interest for the purpose of maintaining the system on such other property. In general, these include septic tanks, drainfields, pressure mounds, etc. The Town does not permit or maintain on-site sewage disposal systems within the Town.

J. ***Peak Flow:*** The maximum momentary load placed on a wastewater pumping station, sewer main, force main, etc.

K. ***Peak Factor:*** A value which, when multiplied by the average design flow, yields an estimate of the highest flow rate to be expected over a short period of time.

L. ***Practicable:*** Capable of being accomplished within prudent natural, social or economic constraints using readily available resources and reasonable reliable technology and practices.

M. ***Private Pump Station:*** An appurtenance of a side sewer, private sewer or on-site sewage disposal system which, alone or in conjunction with the side sewer or private sewer, conveys domestic strength sewage or effluent by lifting or pumping to another sewer.

N. ***Private Sewer***: A sewer which is not owned or maintained by a public authority, and which serves two or more users on one or more parcels, and is constructed by private contract.

O. ***Private Storm Sewer:*** A storm sewer not owned or maintained by a public authority.

P. ***Public Sewer:*** A sewer which is controlled and maintained by a public authority.

Q. ***Sanitary Sewage***: Wastewater consisting of water-carried wastes from human and household customer sources as well as water-carried wastes from some business, institutional or commercial customers which do not generate industrial process wastewater.

R. ***Sewage:*** Water-carried waste products or discharge from human beings or other wastes from residences, private or public buildings, including, but not limited to, industrial waste.

S. ***Sewer:*** A pipe, conduit, structure, or appurtenance for conveying sewage.

T. ***Sewer System:*** The entire system of component parts intended for the collection, treatment, processing and disposal of sewage from its point of origin to its ultimate point of disposal, as owned and operated by the Town.

U. ***Side Sewer (private):*** A sewer, from a single user, not directly controlled or maintained by a public authority, which begins outside the outer face of a structure wall or foundation, conveying wastewater from the building drain to a public sewer or private sewer, including any tees, taps, wyes, etc. at the connection to the public sewer.

V. ***Side Sewer Stub:*** That portion of a side sewer which is constructed along with the sewer prior to direct connection to the premises to be served.

W. ***Domestic Strength Sewage:*** Wastewater which complies with specifications designated by the Public Works Director, Town Sewer Rates and Regulations or the Friday Harbor Municipal Code as not requiring special treatment, monitoring or additional handling prior to acceptance by the Wastewater Treatment Plant, considering chemical, physical and organic content, including but not limited to B.O.D., suspended solids, and Phosphorus. Domestic strength sewage is further defined in Chapter 13 of the Friday Harbor Municipal Code.

X. ***High Strength Sewage:*** Wastewater accepted for discharge into the Wastewater Treatment Plant, but which does not meet the criteria for acceptance as domestic strength sewage, whether because of special characteristics, special treatment requirements, special monitoring or additional handling as a condition of acceptance. High strength sewage is further defined in Chapter 13 of the Friday Harbor Municipal Code.

Y. ***Storm Water:*** That category of wastewater consisting of runoff occurring during or following any form of natural precipitation and resulting from such precipitation, including snow melt.

Z. ***Storm Sewer or Storm Drain***: A sewer which conveys storm water.

AA. ***Trunk Sewer:*** A sewer that receives many tributary branches and serves a large territory.

BB. ***Underdrain:*** A drain that carries away groundwater. Also, the drain laid below a sewer through wet ground to facilitate construction.

CC. ***Wastewater:*** "Wastewater" includes anything released into the Wastewater Treatment Plant and generally includes water-carried wastes from domestic, business or commercial, or manufacturing or industrial sources. Additionally, wastewater is divided into two general classes for purposes of rates and treatment requirements (as defined herein):

1. domestic strength sewage
2. high strength sewage

4.2 Public Sewers

Design of public sanitary sewers shall be in accordance with the Town of Friday Harbor Standard Drawings, Ecology's *Criteria for Sewage Works Design*, and the following design parameters.

A. Pipe Sizes

1. Minimum pipe size for public sewers shall be 8 inches. Pipe size shall be determined based on the following design criteria:
   a. Design population density shall be based on current or future zoning, potential zoning changes and/or site specific requirements.
   b. The design criteria in the latest edition of Ecology's Criteria for Sewage Works Design, Section C Sewer shall be used in sizing the sewer system.
   c. The Town may require the Applicant to complete a downstream analysis, to include all tributaries, to verify downstream capacity.

B. Materials and Products

1. Gravity Sewer pipe shall be PVC in accordance with ASTM D3034, SDR 35.

Gravity pipe with less than 2.5 feet of cover shall conform to AWWA Standard C900, DR14.

2. Fittings – All Pipe fittings shall be PVC with gasketed joints compatible with PVC pipe. The Town will accept PVC solvent joints.

3. Pipe Bedding Material – bedding for PVC Pipe shall consist of native or import material meeting the following gradation:

Sand Sieve Size	Percent Passing
3/4"	100
3/8”	70 – 100

No. 4	55 – 100
No. 10	35 – 95
No. 20	20 – 80
No. 40	10 – 55
No. 100	0 – 10
No. 200	0 – 3

Pipe Bedding for ductile iron pipe may be Bank Run Gravel for Trench Backfill as defined in WSDOT Standard Specification 9-03.

Bedding material shall be free of topsoil or organic matter.

C. Pipe Slopes

1. All public sewers shall be designed and constructed to give mean velocities, when flowing at a depth of 0.7 times the diameter, of not less than 2.0 feet per second (fps) for the anticipated total flow at build out of the area served by the pipe. The following minimum & desired slopes shall apply:

SANITARY SEWER SIZE (INCHES)	MIN. SLOPE (V = 2.0 FPS)(FEET PER 100')	MIN. DESIRED SLOPE (FEET PER 100')
8	0.40	0.52
10	0.28	0.36
12	0.22	0.29
15	0.15	0.20
18	0.12	0.16
21	0.10	0.13
24	0.08	0.10

2. Desired slopes are 1.3 times the minimums shown above, and should be used unless impractical, particularly at the start of lines. Desirable flow conditions shall always take precedence over upsizing a pipe to maintain a shallower grade.

3. Pipe slopes greater than 0.20 ft/ft shall include a stability analysis addressing the need for anchorage subject to approval of the Public Works Director.

D. Pipe Depth

1. The minimum side sewer pipe cover is 60 inches and the side sewer slope is 0.02 ft/ft, minimum.

2. Design depth shall provide for side sewer connections which pass under adjacent water mains. Pipe cover shall provide for frost protection and structural considerations.

E. Roughness Coefficient

1. A roughness coefficient n = 0.013 shall be used for all pipe.

F. Horizontal Alignment

1. Sanitary sewers shall generally be located 5 feet south or west of the centerline of the road or alley. Detectable metallic marking tape shall be installed at 1 foot directly over the pipe to mark the pipe location as per the Town of Friday Harbor standards.

2. The maximum distance between manholes shall be 300 feet on all straight sewer lines unless otherwise approved by the Director.

3. Curvilinear sewers are not allowed without approval of the Director.

G. Vertical Alignment

1. All sewers shall be laid with uniform slope between manholes. Pipe crowns shall be matched when upsizing, subject to the minimum drops specified below. Downsizing of pipes shall be allowed only on approval of the Director. When downsizing is approved, a decrease in diameter of only one pipe size smaller shall be allowed at a manhole, and the invert elevation of the smaller (downsized) pipe shall provide the required minimum drop through the manhole.

2. A minimum interior channel drop of 0.1 feet shall be required through all manholes. Maximum interior channel drops shall be 1.5'. "Drop Manholes" shall only be allowed with the approval of the Public Works Director.

H. Manholes

1. The following design parameters shall apply to manholes in public sewers:
   a. Steps shall be positioned over the shelf having the largest footing area.
   b. Manholes shall be placed at each change of alignment, grade or pipe size, and at the intersection of two or more sewer pipes 8 inches or larger.
   c. Manhole spacing requirements are detailed above in Section 4.2-F.
   d. Manhole channel drops shall be constructed as required in Section 4.2G2.
   e. No service shall directly enter a manhole. An exception would be made for end manholes that have no chance of being used to continue a main line. The Director's approval shall be required.

I. Connection to Existing Manholes

1. Where new sanitary sewer mains are to be connected to an existing manhole, and the existing manhole does not have a usable pipe stub for extension, the existing manhole shall be core drilled not higher than 0.2 feet over the invert elevation. A Kor-n-Seal boot is to be placed on the sewer line and the connection is to be sealed with non-shrink grout inside and outside of manhole. A representative of Friday Harbor's Wastewater Treatment Department must be on-site during a connection to an existing sewer. Notify the Wastewater Treatment Department two (2) business days in advance of the connection.

J. Temporary Manholes

1. Temporary manholes shall be placed on all extensions of sewer pipes. These manholes are not required to have poured channels and are removed when the line is extended.

K. Combined Sewers

1. Combined sanitary and storm sewers are prohibited. No surface, groundwater or roof drain may be connected to a public sanitary sewer.

L. Separation of Sewers and Other Utilities

1. Unless specified otherwise, a 10-foot horizontal separation and 18-inch separation must be maintained between all sanitary sewer mains and water mains in accordance with the most recent edition of the Washington State Department of Ecology's Criteria for Sewage Works Design. See the Town's Standard Drawing W-1: Pipeline Separation.

M. Easements

1. Sewer easements shall be a minimum of 20-feet wide unless otherwise approved by the Director. Additional width may be required for deep sewers. Easements are required for all public sewer lines outside the public right-of-way. Easements must be recorded with San Juan County Auditor's Office on a final plat or a separate recorded document prior to approval of a final plat.

4.3 Side Sewers

This section provides recommended design guidelines pertaining specifically to sanitary side sewers. Connection of storm drains, roof drains, underdrains or any other type of surface or ground water collection facility to a side sewer is expressly prohibited.

A. Pipe Size and Alignment

1. Side sewer stubs from the sewer main to the right-of-way/property line shall be a minimum of 6-inches. From the right of way/property line to the building shall be a minimum of 4-inch diameter for single family residences and 6-inch diameter for all other uses. Side sewers shall be installed from the public main to the right of way or a point 10 feet behind any existing or future sidewalk or curb, whichever is greater. Side sewer connections to the public main shall be done in accordance with the Standard Drawings.

2. The building drain shall extend at least 2 feet beyond the wall of the building served. Side sewers shall drain away from the building with a minimum slope of 0.02 ft/ft (1/4 inch per foot). Vertical and horizontal curves are not recommended.

3. PVC side sewer tees shall meet ASTM D3034, SDR 26.

4. Location: Preferably double service at lot lines. Use alternate lot line from water service location. If water and sewer service are at the same lot line, keep a 10-foot separation.

B. Pipe Depth

1. All side sewers should have at least 3.5 feet of cover unless approved by the Director. Frost protection via pipe cover or insulation shall be considered in all designs.

C. Connection to Manholes and Catch Basins

1. No catch basin or surface drain may be connected to a side sewer or sewer main.

Storm drainage and sanitary sewage shall not be combined in a single sewer on private property.

D. Connection to Public Sewer Main

1. Connection to Existing Sewer Line: Where connection of new sewer main to the existing system is made between manholes, install a new standard manhole on the existing main. Service must be maintained for users above the connection. The channeling of the new manhole may be accomplished by cutting off the top half of the pipe through the manhole and constructing the channel around it in accordance with the Standard Plans. This method is subject to Town approval after examination of the existing pipe.

2. Sewer connection permits will be issued by the Land Use Department. Side sewer connections shall be in accordance with the Standard Drawings. Side sewers shall not connect directly to a manhole (see 4.2 H 1 e for exception). All connections shall be coordinated with the Public Works Department. The applicant's contractor shall perform all taps to existing sewer mains. The connection shall be observed by the Public Works Department. Notify the Public Works Department 2 business days in advance of the connection.

E. Cleanouts

1. Surface cleanouts are required at the right of way line and building connections. Cleanouts shall be provided every 100 feet and at every angle point 45 degrees or greater. Cleanouts shall only be allowed on side sewers 6 inches or less in diameter. Manholes shall be installed on all side sewers 8 inches and larger. All cleanout shall be installed per the Standard Drawings.

F. Cleaning Sewer Lines

Clean all sewer lines in a manner acceptable to the Town. Methods may include flushing, rodding, or forcing an inflatable ball through the pipe. Remove all debris so that none is flushed into the existing sewer system.

G. Sewer Leakage Testing

Leakage testing shall be by air testing, infiltration testing or exfiltration testing. The Developer is responsible for determining the groundwater level to the Town's satisfaction. The selected test shall be conducted as follows:

1. Air Testing: Test pressure shall be 3.5 psi over the groundwater head at the mid-point of the test section. The time for the pressure to drop 0.5 psi to 3.0 psi shall be greater than the following:

Pipe Size	Seconds per Linear Foot of Pipe
6-inch	0.25
8-inch	0.46
10-inch	0.72

2. Infiltration: This method is acceptable only when groundwater level is above the top of all pipe in the test section. Provide acceptable method of measuring infiltration flow. Test for one hour minimum. Maximum infiltration shall not exceed the following rates:

Allowable Leakage per 100 Feet of Pipe in Gallons/Hour

Pipe Size	Groundwater Head Over Pipe at Upper End				
	2-ft	4-ft	6-ft	8-ft	11-ft
6-inch	1.0	1.4	1.7	2.0	2.2
8-inch	1.3	1.8	2.2	2.6	2.9
10-inch	1.6	2.3	2.7	3.2	3.6

3. Exfiltration: Fill pipe to 6 feet over the crown of the pipe at the high end of the test section or to 6 feet over the groundwater level. Do not exceed 16 feet of head at the low end of the test section. Test for one hour minimum. Maximum exfiltration shall not exceed the following rates:

Pipe Size	Exfiltration Rate per 100 Feet of Pipe in Gallons/Hour
6-inch	1.7
8-inch	2.2
10-inch	2.7

4.4 Private Sewers

A. All private sewer systems connecting to the public system must meet all Town Standards and testing requirements.

4.5 Marking Tape

A. All Public and Private sanitary sewer mains and services shall be installed with detectable continuous marking tape installed one foot above the pipe. The marker shall be detectable metallic tape labeled “SEWER” and shall be furnished by the contractor.

4.6 Testing and Inspections

A. Inspection of the work by the Town and its authorized agents shall be strictly for the benefit of the Town and nothing contained herein shall be construed to relieve the Developer of his obligations.

1. The Town shall at all times have access to the work for the purpose of inspecting and testing. The Developer shall provide proper facilities for such access and for such inspection and testing. Testing of all public and private sanitary sewer manholes and piping shall be conducted after backfilling operations have been completed. All tests shall be coordinated with the Public Works Department and shall be witnessed by a Town representative. In all cases, the Contractor shall furnish all labor, materials, and equipment to make the required tests and shall bear the full cost of the required test. The Town will determine the amount of inspection time necessary to ensure compliance with the plans and specifications. In the event that test results do not conform to the accepted standards, the Contractor, at the Contractor’s expense, shall correct all deficiencies and retest until they conform to the testing requirements. Notify the Public Works Department 2 business days in advance of the testing.

2. If any work should be covered up without approval or consent of the Town, it must be uncovered for inspection at the Developer's expense.

3. The Developer shall make reasonable tests of the work at the Developer's expense upon the Town's request and shall maintain a record of such tests.

4. For a performance test to be observed by the Town, the Developer shall make whatever preliminary tests are necessary to assure that the material and/or equipment are in accordance with the specifications.

B. Low Pressure Air Test

1. All new sanitary sewer mains and service lines shall be pressure tested using the low pressure test methods outlined in the most recent edition of the WSDOT Standard Specifications for Road, Bridge and Municipal Construction.

C. Deflection Test (Mandrel)

1. Deflection testing for PVC pipe shall may be required. Testing shall be completed in accordance with the most recent edition of the WSDOT Standard Specifications for Road, Bridge and Municipal Construction, Section 7-17.3(2)G.

D. Television Inspection

1. All new sewer lines 6 inches and larger shall be inspected by the use of a television camera before final acceptance. The Contractor shall bear all costs associated with the initial inspection and any additional television inspections required after any deficiencies have been repaired. Any bellies exceeding 1/4 inch is considered a deficiency.

F. In cases where groundwater is present in sufficient quantities, infiltration tests may be required by the Director.

4.7 General Notes (Sanitary Sewer)

A. The General Notes, provided on Standard Dwg. S-0, shall be included on any plans that provide for the installation of the sewer system.