Section 7
Water

7.0 WATER SERVICE

A. The Town owns and maintains a municipal water system that services the Town and portions of unincorporated San Juan County. The Town's water service area for new connections is limited to within the Town. Connection to the Town's water system is required when mains are within 200 feet of a facility. All water improvements must be inspected before covering. Privately constructed improvements (e.g., in a new subdivision) do not become property of the Town until officially accepted by Town Council. All water system improvements and meter vault locations must be approved in advance by Town. Application for service is made at the Town Hall.

B. The applicant shall submit calculations, stamped by a Washington State licensed professional engineer, supporting the proposed water main extension meets the Town's fire flow requirements, and static and residual pressures.

C. Water service outside the Town is not available except for specific building lots whose right to connect was previously established by Ordinance.

7.1 Definitions

A. ***Air/Vacuum Relief Valve*:** An air valve placed at the high points in a pipeline to release air automatically and prevent the pipeline from becoming air-bound with a resultant increase of pressure and also permits inlet of air into an empty pipe to relieve a vacuum.

B. ***Backflow:*** A flow condition, induced by a differential in pressure that causes the flow of water or other substances in the opposite direction than intended allowing contaminants to enter the public water system.

C. ***Blocking Plate:*** A tool fabricated from metal plate to temporarily block flow through a flanged connection.

D. ***Check Valve:*** A valve provided with a hinged disk that opens in the direction of normal flow and closes with reversal of flow.

E. ***Distribution Main:*** A public water pipe comprising part of the distribution system used to deliver potable water, for customer needs which, in many cases, includes irrigation and fire protection, to the customer's individual service line(s); and to deliver water to fire hydrants for fire protection.

F. ***Distribution System:*** That portion of a public water system which conveys water from the transmission facilities to consumers.

G. ***Fire Flow:*** A water demand for a specific development to be used in the design of the water system for the project. Section 7.2 C lists the minimum fire flow requirements. The system must be designed to deliver this flow, on top of the maximum day demand, without dropping the pressure below 20 PSI, and without exceeding a velocity of 15 feet per second, in any portion of the system, whether new or existing.

H. ***Gate Valve:*** A valve in which the closing element consists of a disk which slides over the opening or cross-sectional area through which water passes, and fits tightly against it.

I. ***IFC:*** International Fire Code

J. ***Pressure Reducing Valve (PRV):*** An automatic control valve designed to reduce a higher inlet pressure to a lower constant outlet pressure regardless of fluctuating flow rates and/or varying inlet pressure.

K. ***Private Service Line:*** Is the pipe that extends from the water meter to the customer and delivers potable water for domestic needs as well as, in some cases, irrigation and fire protection.

L. ***Transmission Main:*** A large diameter public water pipe comprising part of the distribution system used to deliver large quantities of potable water over long distances from the source to a reservoir, booster pumping facility, and/or to a networked system of distribution mains. Typically, services and fire hydrants are not connected to transmission mains.

M. ***Water Service Tap & Service Line:*** The water service tap is the connection to the distribution main of a service line. The service line is the pipe which extends from the service tap to the water meter.

7.2 Water Demands

A. Average Day and Maximum Day Demands

1. The Maximum Day Demands shall be estimated in accordance with the most current edition of the Town of Friday Harbor's Water System Plan.
2. Use the gross developable acreage when calculating the demands. This demand is used for designing most systems within a well-established water grid.

B. Peak Hour Demands

1. The Peak Hour Demands shall be estimated as stated above. Use the gross developable acreage when calculating the demands. This demand is used for sizing remote systems, single feed systems, or newly developing areas.

C. Fire Flow Demands

1. The minimum fire flows list below are required. In all cases water facilities shall be provided to supply fire flows commensurate with the fire code.

   Single family residential – 500 gpm for a duration of 30 minutes

   Multifamily residential/Commercial 750 gpm for duration of 60 minutes

   Industrial: 1,000 gpm for a duration of 60 minutes

2. In sizing piping and other public water system components, the required fire flows are added to Maximum Day Demands for determining total consumptive use.

D. Hydraulic Modeling

1. On some projects, the Town will require that a hydraulic model be performed to prove that the design meets minimum standards. The determination of whether a project must be modeled is at the sole discretion of the Town. If the Town or its consultants complete modeling the Developer shall reimburse the Town for its costs.
2. Steady-state hydraulic models are allowed, provided the following conditions are met:
   a. The system reservoirs shall be modeled at the lowest elevation in their operating range.
   b. Fire-flow scenarios shall be evaluated under max-day demand conditions.
   c. The existing water system must be included in the model back to the reservoir, or to a main determined by the Town to be large enough that the project's demands would be hydraulically insignificant.
   d. Demands shall be calculated only in accordance with the method contained in the Town of Friday Harbor's Water System Plan Update. This calculation shall be included in the model submission.
   e. The datum used for elevations within the model shall be clearly referenced.
   f. The model submission shall include a map with pipe and node numbers legibly marked, and reservoirs identified as actual or representative of a tie-in to the existing water system. The map shall also include references to existing streets and features to help orient the map properly.

7.3 Water Pressure

A. Water pressures during maximum day demand conditions, with reservoirs at average water level, should be designed between 45 and 80 psi at every point in the system unless approved by the Town.

B. Residual water pressures during fire flow demand conditions shall be designed to be no less than 20 psi at every point in the system.

C. Pressures over 80 psi: If static pressures exceed 80 psi then each service line shall be required to have an approved individual pressure reducing valve set to reduce pressure on the consumer side of the valve to between 40 and 50 psi. The cost to install the pressure reducing valve shall be at the customer's expense.

D. Where the water system is expanded in such a way as to be delivering water in excess of 80 psi of static pressure, a PRV station shall be installed on the distribution line at the location necessary to reduce delivered pressures to below 80 psi.

E. Areas Served by Pressure Reducing Valves: Some areas may be supplied through pressure reducing valves in the main supply system. In areas where this is allowed, no matter what the local service pressure is, an individual pressure reducing valve is also required for each service connection.

7.4 Size of Pipe

A. Standard Sizes

B. Only the Town's standard sizes of pipes shall be allowed, unless otherwise approved. Standard sizes are 8", 10", and 12".

C. Exceptions to the above sizes are as follows:

1. In cases of a bridge crossing (existing bridge) or other conditions where a standard size would be infeasible or would limit the capacity below that needed, special consideration may be given to using non-standard sizes.
2. 6-inch piping shall only be allowed on hydrant lines which are less than 50 feet in length. All other lines shall be 8" or larger.

D. Service line sizes shall be coordinated with the Town.

E. Sizing Based on Velocity

1. The following criteria shall be used to determine the sizes of the pipes to be used:
   a. At maximum day demand, 5 fps maximum design velocity.
   b. At fire flow demand, 15 fps maximum at required fire flow.

7.5 Type of Pipe

A. All pipes shall be clearly marked with the manufacturer's name, type, class and thickness as applicable. In accordance with Safe Drinking Water Act (SDWA) 1417 (a)(1) A all pipe, pipe or plumbing fixture, and solder or any flux in drinking water system shall be lead free.

1. Mains
   a. PVC Pipe (Preferred): 6-inch through 12-inch pipe shall meet the requirements of ANSI/AWWA C-900. Pipe greater than 12-inch shall meet the requirements of ANSI/AWWA C-905. PVC pipe shall have the same outside dimensions as ductile iron pipe and shall be a minimum of SDR 18. Pipe shall be listed by Underwriters' Laboratories, Inc.
   b. Ductile Iron Pipe (By Town Approval): 6-inch through 12-inch pipe shall meet the requirements of AWWA C-151, Class 52, with a 1/16" cement mortar lining meeting the requirements of AWWA C104. Ductile iron pipe be joined by using bolted flanged joints shall be Special Thickness Class 53. Non-restrained joints shall be either rubber gasket type, push on type, or mechanical type meeting the requirement of AWWA C111.
   c. High- Density Polyethylene (HDPE) Pipe (by Town Approval): 6-inch through 12-inch pipe shall meet the requirements of AWWA C906 and ASTM D3350 having a cell classification of 345464C or better (PE3408). The pipe must be DR 11 rated for a minimum pipe pressure of 200 psi. HDPE pipe shall be butt fused welded. Pipe dimensions and workmanship shall conform to ASTM F714. Pipe shall be Ductile Iron Pipe Size (DIPS). Saddles shall be electro fusion welded.

d. Restrained Joints: The restraining of ductile iron pipe, fittings and valves shall be accomplished by the use of either a bolted or boltless system. Any device utilizing round point set screws shall not be permitted. All couplings installed underground to connect ductile iron or PVC pipe shall be manufactured of ductile iron.

2. Service Lines, including Private Service Lines
   a. Service lines shall be Type K Copper pipe, Rehau PEX pipe or high density polyethylene tubing (copper tube size) meeting the requirements of AWWA C901, SDR 11, with a minimum pressure rating of 200 psi. Refer to Standard Drawings for additional requirements.

7.6 Fittings

A. All fittings for ductile iron pipe or PVC pipe shall be ductile iron compact fittings conforming to AWWA C-153 or Class 250 Gray Iron conforming to AWWA C-110. Joints shall meet the requirement of AWWA C-111. Where possible, provide griprings or megalug joint restraints at all mechanical joints instead of thrust blocking. Thrust blocks shall be provided at ends of dead end lines, at vertical bends and opposite the lateral branch tees. Fittings shall be cement mortar lined, meeting the requirements of AWWA C104. Gaskets for flat faced or raised faced flanges shall be 1/8-inch thick neoprene having a durometer of 60 plus or minus 5 or 1/16 cloth inserted. Bolts, nuts and washers used for securing fittings shall be of similar material. Steel bolts shall meet the requirements of ASTM A307 or ASTM F568 for carbon steel or ASTM F593 or ASTM F738 for stainless steel. Nuts shall meet the requirements of ASTM A563 for carbon steel or ASTM F594 or ASTM F836 for stainless steel. Iron bolts and nuts shall meet the requirements of ASTM A536, grade -45-12.

B. All fittings for HDPE pipe shall be standard HDPE fittings, meet the HDPE pipe specifications in Section X.5 A. above, and be manufactured by injection molding or extrusion and machining. All fittings shall have the same working pressure as the pipe.

Pipe sections shall be joined by butt fusion or electrofusion complying with ASTM D2657 and the joints shall be equal or greater in strength than the pipe. Socket fusion joints shall not be used. Class 150, ANSI B16.5 flanges shall be use for connections for flanged connections of another material. Flange backing rings used shall be cast iron, hot dipped galvanized with galvanized nuts, bolts and washers or 316 stainless steel with 316 stainless steel nuts, bolts and washers. All bolts, buried and unburied, shall be coated with Armite Anti-Seize Compound No. 609, or equal, prior to installation.

C. Bends are required where a change of direction of the water main occurs which cannot be accommodated by pipe joint deflection as provided in Section 7.15... Tees and crosses are required where lateral mains are needed as part of the project and where future needs dictate. Tees are required where fire hydrant leads are needed as part of the project and where future fire hydrant or main extension needs dictate. Reducers are needed where a change of pipe size is required. All fittings shall be mechanical joint type unless otherwise specified.

D. Thrust blocks shall be required on all bends, sized according to the soil bearing capacity.

7.7 Distance from Other Utilities

Water mains are typically installed 5 feet north or east of the street centerline. Water line locations and distances from other utilities shall meet the criteria outlined by the Washington State Department of Ecology and the Washington State Department of Health. No new utility pole shall be located within 8 feet of an existing hydrant or water line.

7.8 Depth of Pipes

Water mains shall be installed with minimum cover of 30 inches and service lines with a minimum cover of 24 inches.

More than 4 feet of cover will be permitted on a case by case basis to allow for adjustment to other previously existing utilities. Consideration shall be given to the vertical alignment of future or proposed roadways whenever known.

7.9 Laying Pipe on a Radius

A. Pipe may be laid on a radius provided the radius is a minimum of 1.33 times the minimum radius allowed by the manufacturer (75% of the manufacturer's allowable joint deflection). If pipe cannot be laid on a radius then it shall be laid on tangent sections with appropriate bends placed at approximately equal intervals around the curve.

7.10 Valves

A. Gate Valves, 6-inch to 12-inch: Gate valves shall be used on all 6-inch to 12-inch lines and shall be M&H Style 929 or Clow Medallion. The design, materials, and workmanship of all gate valves shall conform to AWWA C-515. Gate valves shall be resilient wedge non-rising stems (NRS) with two internal O-ring stem seals.

B. Valve operator shall be of the traveling nut or worm gear type, sealed, gasketed, and permanently lubricated for underground service. Valve operators shall be constructed to the standard of the valve manufacturer to withstand all anticipated operating torques and designed to resist submergence in ground water.

C. All valves installed for future extensions shall be plugged by blind flange or mechanical plug.

D. Valve Locations

1. Valve spacing shall exceed more than 800 feet in residential areas, nor more than 500 feet in commercial areas.
2. At intersections:
   One valve on each leg.
   Valve on dead end line where dead end line intersects the main water line.
   Provide ability to serve water line from alternate directions in a looped system, while isolating a section of main for maintenance, repair or continuation.

E. Air/Vacuum Relief Valves: Air/vacuum relief valves are needed at high points to allow release of air during filling the pipe with water as well as to allow accumulated air to be expelled under normal operation. Further, air valves are needed to prevent a vacuum from occurring and to allow air into the main when draining the pipe.

F. Blow-Off Valves/Assembly: If a fire hydrant is not located at the end of a dead end main, a blowoff assembly shall be required. The pressure rating for blowoff assemblies shall be 200 psi.

G. Valve Box: Valve boxes shall be installed on all buried valves. The box shall be of cast iron, two piece slip type standard design with a base corresponding to the size of the valve. The box shall be coal tar painted by the manufacturer using its standard. The cover shall have the word "WATER" cast in it.

H. All valves installed for future extensions shall be plugged by blind flange or mechanical plug.

7.11 Thrust Blocking

A. Where used, the location of all thrust blocks shall be shown on the plans. Thrust block concrete shall be have a minimum 2,500 psi strength and placed against undisturbed earth. A plastic barrier shall be placed between all thrust blocks and fittings. See the Standard Plans for thrust block location and sizing requirements/calculations.

7.12 Marking Tape and Tracer Wire

A. All pipe and services shall be installed with continuous marking tape installed 12 inches above the water main. The marking tape shall be plastic non-biodegradable, metal core or backing marked "water" which can be detected by a standard metal detector. Tape shall be Terra Tape "D" or approved equal. In addition to marking tape, install a tracer wire. Tracer wire shall be 14 gauge copper, continuous solid core, with 30 mil HDPE insulation and rated for direct burial. . The tracer wire shall be taped to the top of the pipe at 10-foot intervals, brought up the outside of the lower portion of a valve box and then inside the upper section.

7.13 Connections

A. Water Main Extensions

1. It is the policy of the Town to require any developer or owner making a main extension to bring the main to the further edge or line of the property to be served and used.

2. Mains serving more than 20 lots or three fire hydrants must be looped.

B. Water Main Connections

1. The existing water system shall remain in operation during connections. Connections shall be by tapping tee or inline valve.
2. When connecting a new water main to an existing water main restrained joints on all fittings shall be required.
3. Prior to connecting a new water main to an existing water main all pressure testing and bacteria testing shall pass before the connection is made.

4. A representative for the Town must be present during the connection. Contact the Town 48 hours prior to making the connection.
5. The Town representative may require additional thrust blocking or any pipe deflection.

C. Service Connections 2 Inch and Smaller

1. Single Parcels. No connection to the water system shall be made until all applicable fees are paid (FHMC 13.05.020). Once the applicable fees are paid the Town shall tab the main, and furnish and install the service line, meter setter, curb stops, a meter, meter box and such valves as may be required.
2. Plat Subdivisions and Roadway Reconstruction Projects. The developer shall be responsible to tap the new mains and be responsible to furnish and install the service line, meter setter, curb stop, meter box and such valves that may be required before the main is pressure tested and connected to the Town's system. Meters will not be installed until the applicable fees are paid. The Town will provide and install the meters.

D. Service Connections 3 Inch and Larger

1. No connection to the water system shall be made until all applicable fees are paid (FHMC 13.05.020). All service taps to live water mains shall be made by the Contractor and witnessed by the Town. All other work associated with the water service line, vault and meter installation shall be performed by the Contractor and will be monitored by the Town. Once the applicable fees are paid the Town shall furnish a meter.

E. Water Meters

1. All water use and service shall be through a meter. Making connection with the domestic water system, each residential, commercial or industrial building shall be considered an individual consumer and shall be supplied through a separate meter and service connection. Sub-metering for individual units within a building is permitted, when the individual meters are supplied from a separate service connection to the Town's main. The Town will not be responsible for reading of sub-meters.
2. Meters shall be placed in right of way or easements dedicated to the Town.
3. Meters shall be installed behind the sidewalk or in the planter area.
4. Meters shall not be installed in driveways, sidewalks or curb ramps unless approved by the Town. Where so approved, service lines shall be sleeved beneath the sidewalk into the meter box through a 2-inch (minimum sleeve).

F. Backflow Prevention Device

1. If required by the Town any service shall be contingent upon the installation of a backflow prevention device of a type approved by the Washington State Department of Health for the protection of the Town's water supply from cross connection. All backflow devices shall be installed, tested and monitored per the Town's Cross Connection Control Program (WAC 246-290-490).

7.14 Fire Hydrants

A. Location

1. Fire hydrant locations will be reviewed by the Town. Hydrants should be located as close to a street intersection as possible with intermediate hydrants along the street to meet area requirements. Hydrant spacing shall be as follows:

   Single-family residential zones – 400 feet maximum. In cul-de-sacs provide hydrant coverage equivalent to a block grid system. Typically, a hydrant is set 150 feet from the center of the end lot in the cul-de-sac and a second hydrant is set 400 feet from this hydrant.

   Commercial and multifamily residential zones -300 feet maximum. Hydrant maybe spaced closer if necessary to provide building coverage or to increase the number of hydrants.

2. All supply valves serving hydrants shall comply with Section 7.7.
3. Hydrants shall be located at the end of radius at intersections, 2 feet (minimum) inside of the right-of-way line.
4. Hydrants shall not be located within 5 feet of wheelchair ramps or within 3 feet of driveways.
5. Hydrants shall be installed in locations that provide clear and unobstructed access for operations and maintenance. A 3 foot clear space shall be maintained around the circumference of fire hydrants. If a hydrant must be located in areas subject to heavy traffic protection against damage from collision is needed.
6. Hydrants on a 6” line must be installed within 50’ of the main.

B. Requirements

Hydrants installed in the Town’s water system shall meet the following requirements:

1. M&H Style 929 or Clow Medallion and conform to AWWA C502. See Fire Hydrant Standard Drawing for additional requirements.
2. The bottom foot valve must have a minimal opening of 5 ¼”.
3. Hydrant shall be manufactured with operating nut and thrust nut made of bronze or stainless steel, with bearings located both above and below the thrust collar and the operating nut protected by a cast-iron weather shield. Hydrant shall have safety flanges and steel stem coupling. Nozzle section must rotate 360 degrees. Hydrant shall be manufactured with a main valve seat ring of bronze threaded into a bronze drain ring. A 360 degree drain channel shall have a minimum of two drain outlets. Hydrant bonnets, barrels, and foot pieces shall be cast iron with internal working parts of bronze or stainless steel. Hydrants shall have a minimum of two 2 ½” openings and on 4 ½” port. A Storz adapter shall be installed on all fire hydrants.
4. Thrust blocks shall be installed behind the hydrant.

7.15 Easements

A. Easements are required for all public water lines outside the public right-of-way. Water easements shall be a minimum of 15-feet wide. Additional width may be required by the Town. Easements must be recorded with San Juan County Auditor's Office on a separate recorded document prior to approval of a final plat.

7.16 Testing

A. The water main pipes and service lines shall be disinfected and tested before being placed in service. New work may be connected to the existing water system at a new or existing valve by providing a flanged connection with a blocking plate installed. All tests shall be performed by the Contractor with the blocking plate in place and shall be coordinated and witnessed by the Town. Notify the Town 2 business days prior to testing. Water for testing and disinfecting shall be obtained by the Developer by arrangement with the Town. All pumps, gauges, plugs, 2-inch blowoffs, saddles, corporation stops, miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished, installed and operated by the Contractor. The Contractor shall provide an oil-filled pressure gauge with a range of 0 to 300 psi.

B. Feed for the pump shall be from a barrel or other container, wherein the actual amount of "makeup" water can be measured periodically during the test period. All temporary connection to the existing water lines for filling or flushing new pipe lines shall be equipped with double check valve assemblies to prevent backflow into the existing waterline The section to be disinfected shall be thoroughly flushed at maximum flow prior to chlorination.

C. The pipeline shall be backfilled sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place and time allowed for the concrete to cure before testing. Where permanent blocking is not required, the developer shall furnish and install all temporary blocking and remove it after testing. The mains will be filled by the Town slowly and air expelled from the pipeline prior to starting the test. Water will be allowed to stand under pressure a sufficient length of time to allow the escape of air and allow the lining of the pipe to absorb water.

D. The pipeline shall be subjected to a hydrostatic pressure test of twice its working pressure. The test shall be accomplished by pumping the main up to the test pressure, stopping the pump for 15 minutes while things stabilize, then pumping the main up to the test pressure again and closing a valve between the pump and the pump and the line being tested. The test shall be conducted for a period of two hours.

During the test, the section being tested shall be observed to detect any visible leakage.

A clean container shall be used for holding water for pumping up the pressure on the main being tested. This makeup water shall be sterilized by the addition of chorine to a concentration of 50mg/l. The quantity of water required to restore the pressure shall be accurately determined by the pumping through a positive displacement meter approved by the Town.

E. The quantity of water lost during the test period shall not exceed the number of gallons as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{266{,}400}$$

Where:

L=allowable leakage, gallons/hour
S=gross length of pipe tested, feet
D=nominal diameter of the pipe, inches
P=test pressure during the leakage test, psi

Make-up water shall be pumped from a container that will allow the amount of water pumped to be easily computed or verified.

There should be no appreciable loss of pressure during the 15-minute test intervals.

All leaks shall be repaired or defective material replaced and the test repeated as directed by the Town.

F. The Contractor shall be responsible for repair of any damage resulting from or caused by leak testing.

G. All tests shall be made with the fire hydrant auxiliary gate valves open and pressure against the hydrant valve. Each valve shall be tested by closing each in turn and relieving the pressure beyond. This test of the valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The Contractor shall verify that the pressure differential across the valve does not exceed the rated working pressure of the valve.

H. Defective materials and workmanship, discovered as a result of the tests, shall be replaced. Whenever it is necessary to replace defective materials or correct the workmanship, the tests shall be rerun at the Developer's own expense, until a satisfactory test is obtained.

7.17 Disinfection

A. Before being placed into service, new water mains and repaired portions of, or extensions to, existing mains shall be chlorinated and a satisfactory bacteriological report obtained. In the event two unsatisfactory bacteriological reports are obtained on a section of pipe, the Contractor shall revise his method of disinfection and the form of applied chlorine.

B. Flushing

Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have become lodged in the pipe. If a hydrant is not installed at the end of the main, then a tap shall be provided large enough to develop a flow velocity of at least 2.5 fps in the water main.

Taps required by the Contractor for temporary or permanent release of air, chlorination or flushing purposes shall be provided by the Contractor as part of the construction of water mains.

Where dry calcium hypochlorite is used for disinfection of the pipe, flushing shall be done after disinfection.

The Contractor shall be responsible for disposal of treated water flushed from mains and shall neutralize the wastewater for protection of aquatic life in the receiving water before disposal into any natural drainage channel, i.e., receiving water, waters of the State, including wetlands. The Contractor shall be responsible for disposing of disinfecting solution to the satisfaction of the Town. At a minimum, chlorinated water shall be dechlorinated to a concentration of 0.1 parts per million (ppm) or less, and pH adjustment to within 6.5 – 8.5 standard units before discharging to surface waters of the State or to a storm sewer system that drains to surface waters of the State.

C. Requirement of Chlorine

Before being placed into service, new mains and repaired portions of, or extensions to, existing mains shall be chlorinated so that a chlorine residual of not less than 25 mg/l remains in the water after standing 24 hours in the pipe. The initial chlorine content of the water shall be not less than 50 mg/l.

D. Form of Applied Chlorine

Chlorine shall be applied by one of the methods which follow, to give a dosage of not less than 50 mg/l of available chlorine.

1. ***Dry Calcium Hypochlorite –*** As each length of pipe is laid, sufficient high-test calcium hypochlorite (65 to 70 percent chlorine) shall be placed inside the pipe to yield a dosage of not less than 50 mg/l available chlorine, calculated on the volume of the water that the pipe and appurtenances will contain.

   The number of grams of 70 percent test calcium hypochlorite required for a 20-foot length of pipe equals $0.238 \times d^2$, in which “d” is the diameter in inches.

2. ***Liquid Chlorine*** – A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device, or the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas, or the gas itself, must provide means for preventing the backflow of water into the chlorine.
3. ***Chlorine-Bearing Compounds in Water*** – A mixture of water and high-test calcium hypochlorite (65 to 70 percent Cl) may be substituted for the chlorine gas-water mixture. The dry powder shall first be mixed as a paste and then thinned to a 1 percent chlorine solution by adding water to give a total quantity of 7.5 gallons

of water per pound of dry powder. This solution shall be injected in one end of the section of main to be disinfected while filling the main with water.

4. ***Sodium Hypochlorite*** – Sodium hypochlorite, commercial grade (12.5 percent Cl) or in the form of liquid household bleach (5 to 6 percent Cl), may be substituted for the chlorine gas-water mixture. This liquid chlorine compound may be used full strength or diluted with water and injected into the main in correct proportion to the fill water so that dosage applied to the water will be at least 50 mg/l.

E. Point of Application

The point of application of the chlorinating agent shall be at the beginning of the pipeline extension or any valved section of it, and through a corporation stop inserted in the horizontal axis of the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of applications may be used when approved by the Town.

F. Rate of Application

Water from the existing distribution system, or other source of supply, shall be controlled to flow very slowly into the newly-laid pipeline during application of the chlorine. The rate of chlorine gas-water mixture or dry gas feed shall be in such proportion to the rate of water entering the newly-laid pipe that the dosage applied to the water will be at least 50 mg/l.

G. Preventing Reverse Flow

No connections shall be made between the existing distribution system and new construction other than by a flange connection with blocking plate in place and a hydrant connection with a State Department of Health approved backflow preventer installed in the connecting line.

H. Retention Period

Treated water shall be retained in the pipe at least 24 hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least 50 mg/l.

I. Chlorinating Valves, Hydrants, and Appurtenances

In the process of chlorinating newly laid pipe, valves, hydrants, and other appurtenances shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.

J. Chlorinating Connections to Existing Water Mains and Water Service Connections

The chlorinating procedure to be followed shall be as specified in AWWA Standard C651. All closure fittings shall be swabbed with a very strong chlorine solution at least as strong as liquid household bleach (5 to 6 percent Cl).

K. Final Flushing and Testing

Following chlorination, treated water shall be flushed from the newly-laid pipe until the replacement water throughout its length shows, upon test, the absence of chlorine. In the event chlorine is normally used in the source of supply, then the tests shall show a residual not in excess of that carried in the water supply system.

A sample tap shall be located ahead of the flushing hose for convenience and for sanitary sampling.

Before placing the lines into service, a satisfactory report shall be received from the local or State Health Department on samples collected from representative points in the new system. Samples will be collected and bacteriological tests obtained by the Water Department. Upon receiving a satisfactory test result, the line may be placed in service by removing the blocking plate, tightening the flanged connection and opening the valve at the connection point.

At a minimum, chlorinated water shall be dechlorinated to a concentration of 0.1 parts per million (ppm) or less, and pH adjustment to within 6.5 to 8.5 standard units, if necessary, before discharging to surface waters of the State or to a storm sewer system that drains to surface waters of the State.

A Town representative must be on-site to observe the flow testing and sampling. Contact the Town two business days in advance.

7.18 Final Water Main Acceptance

Prior to the Town accepting the water main the developer shall demonstrate to a Town representative that the fire flow and static and residual pressures required in Section 7.2 and 7.3 are achieved. The Town shall be provided a minimum of two business days notice to observe these tests.

7.19 General Notes (Water)

The General Notes, provided on Standard Dwg. W-0, shall be included on any plans that provide for the installation of the water systems.

7.20 Pressure Systems

A. A pressure system consists of its own pumps, reservoirs and distribution mains. In some limited instances, a system consists of pressure reducing valves to maintain water pressure.

B. As development continues and the water system is expanded, areas will be encountered which are at elevations that will require the establishment of additional pressure zones in order provide water service within appropriate water pressures. Generally this will require the construction of additional booster pumping stations and reservoirs. In some cases the use of pressure reducing valves will be the means of establishing the pressure zone. However, when considering the use of pressure reducing valves, an examination of the potential and feasibility of extending service from an established pressure zone which will provide the area within appropriate water pressures and which is supported by reservoir(s) storage will be required. If such an established pressure zone can be extended and utilized, preference in this regard will be generally the required approach.

The creation of a new pressure zone will be allowed only on approval by the Public Works Director.

7.21 Booster Pump Stations

A. General

1. Design of water booster pump stations shall be performed by a professional engineer licensed in the State of Washington. The design of water booster pump stations is an engineering matter and is not subject to detailed recommendations or requirements other than as required by these Standards. The applicant's engineer shall submit all supporting documentation, in report form, including all relevant design information needed for the Town to review for adequacy of the proposed design. The design report shall be submitted with each water booster pump station and shall demonstrate its conformance with the standards as outlined herein. Booster stations are also subject to project approval by Washington State Department of Health (DOH). The applicant's engineer is responsible for the design report and construction document submittal to DOH and for obtaining DOH approval prior to construction.
2. General construction of public and private water booster pump stations and appurtenances is required to conform to International Building Code, Uniform Plumbing Code and National Electrical Code. Further, during design and procurement of components that go into the system, many national standards are specified for minimum conformance.
3. They are as follows:
   a. ANSI - American National Standards Institute
   b. ASTM - American Society for Testing and Materials
   c. AWWA - American Water Works Association
   d. CFR - Code of Federal Regulations
   e. FSS - Federal Specifications and Standards, General Services Administration
   f. HIPS - Hydraulic Institute Pump Standards
   g. IEEE - Institute of Electrical and Electronics Engineers
   h. NEC National Electrical Code
   i. NEMA - National Electrical Manufacturers' Association
   j. NEPA - National Environmental Policy Act
   k. NFPA - National Fire Protection association
   l. OSHA - Occupational Safety and Health Administration
   m. RCW - Revised Code of Washington (Laws of the State)
   n. SEPA - State Environmental Policy Act
   o. SSPC - Steel structures Painting Council
   p. UL - Underwriter Laboratory listing
   q. WAC - Washington Administrative Code
   r. WISHA - Washington Industrial Safety and Health Administration

B. Pump Station

1. Booster pump stations shall be incorporated whenever a development needs higher pressure than is available from the existing source. Booster pump stations constructed as part of new development are part of the water distribution system and shall be dedicated back to the Town in the same manner as water main extensions. Booster pump stations shall be of a construction type and outward

appearance consistent with the neighborhood. Unless required for technical reasons the facility shall be entirely above ground, with good insulation and sound barrier. The roofing shall be long lasting (50- year life), low maintenance type with good insulation for energy conservation. Private water booster pump stations are not allowed. There shall be suction and discharge headers with easy accessibility. On the discharge side, there shall be a sufficient straight run of transmission pipe in order to incorporate a flow meter. A flow meter is required on the discharge line preferably above ground inside the building and easily accessible.

2. The pump station designer shall consider the likelihood of vandalism and break-in. The Town may require intrusion alarms wired to communicate to the water system operators through the SCADA system, if the Town considers it necessary.
3. The pump station shall have provisions for communication and connection to the Town's SCADA system via wireless signals.
4. The pump station site shall be landscaped and irrigated with timed automatic sprinklers. Preference shall be given to shrub patches rather than grass to provide screening and decrease maintenance.
5. A ventilation system is required to protect pump motors from high temperatures.
6. A heating source is required to maintain temperatures above freezing during cold weather.
7. The station shall be designed so as to ease removal of existing pumps and motors for maintenance as well as to allow installation of future pumps and motors. Easy access to the station must be provided for maintenance as well as for daily status inspection.

C. Pumps and Motors

1. The pump stations shall have at least TWO pumps to provide redundancy. The number of pumps required will generally be dictated by the capacity size of the station keeping with prudent modern design for efficiency and flexibility of operation to meet varying demands considering summer to winter average daily demand varies over a factor of two. The station shall be so designed that required maximum day demand can be met with the largest pump out of service. Size the pumps so that pump run times are maximized, rather than larger size pumps running for repeated short periods.
2. The pumps selected shall conform to hydraulic standards and the manufacturer shall conform to applicable NEMA and ANSI standards. Pump performance curve shall have smooth drooping characteristic from the cut-off head to the lowest operating head. The pumps chosen shall operate with high efficiency (75% or more) in the operating range.
3. Pump motor shall always be directly coupled and sized to meet the power required by the pump through the designed range of total pumping heads and pumping volumes. Motors shall have copper windings and operate at efficiency of 92% or above in the operating range. Motors shall be three phase squirrel cage induction motors.
4. Pumps shall not be set directly on the floor. Rather, pumps shall be mounted on concrete housekeeping pads.
5. Pumps shall be provided with mechanical seals.
6. Pump selection shall meet the following criteria:
    a. The pump performance curve shall support proper pump performance through the designed range of total pumping heads and pumping volumes while operating within the most efficient portion of the pump curve. The proper operation includes performing without cavitation and within suction heads

designed for the pump. The performance curve shall always be positive from shutoff head throughout the range of the curve. No pump shall be selected which has the potential of reaching shutoff head through possible adverse system pressure ranges.

b. Pump motor shall be sized so as not to exceed maximum rated horsepower through the designed range of the pump.
c. Wire-to-water pump/motor efficiency through the designed range of the pump shall be an important consideration when selecting such equipment.
d. Greased lubricated bearings are preferred.

7. Each pump shall be equipped with isolation valves in the suction and discharge lines and a dampened check valve or solenoid activated pilot controlled diaphragm check value. The check valve shall not slam when a pump shuts down.
8. A flow meter shall be provided on the discharge side on the pumps.

D. Electrical

1. Electrical service from the utility shall be 3 – phase, 480 volt standard. If a transformer is provided, the primary shall be connected delta and the distribution side wye with neutral grounded. A separate 240 / 120 volt station service shall be provided by the electric utility or derived from a station service transformer.
2. All station electrical shall conform to the latest National Electrical Code. All electrical components and wirings shall be UL listed as applicable, and be industrial grade.
3. Protection systems are required on electrical equipment to protect against phase-to-phase and phase-to-ground faults as well as to protect against single phasing. The booster station shall have a well-designed grounding system to which all the equipment grounds need to be connected.
4. The short circuit ratings of electrical switchgear shall be the calculated available or the industry standard, whichever is higher.
5. Above grade water booster pump stations shall have receptacles conveniently placed to ease maintenance equipment to be plugged in without extension cords. All the receptacles shall be GFI or distributed from a GFI circuit breaker installed in the station service panel. One of the duplex receptacles shall be an isolated ground type installed near the enclosure containing the SCADA Remote Terminal Unit (RTU)
6. Booster pump stations shall have good interior lighting and dusk to dawn motion sensor, tamper proof exterior lighting.
7. All the controllers and the associated protection equipment shall be centrally located in a free standing motor control center (MCC) with copper incoming bus sized adequately in order to allow future expansion. NEMA 12 enclosures are preferred. The control shall be soft-start/soft-stop with pump control and running bypass circuitry.
8. Each motor drive shall have a motor circuit protector. Further, each motor shall have an integrated protection module to detect and isolate the motor for overload, phase loss, phase reversal and ground faults, as a minimum. There shall be push button switches to turn the pump on and off locally and a selector switch (Local – Off – Remote) to switch from local to remote control. Also, there shall be LED indicator lights – red to indicate running, green as stand-by.
9. The MCC shall have indicator instrumentation for station voltage, current, power factor, and kW / kWh. Additionally, each of those meters shall incorporate an output signal 4 – 20 mA and / or pulse in order to communicate to the local RTU.

E. Auxiliary Generating Equipment

1. All booster pump stations shall have an auxiliary generator and automatic transfer switch.
2. The following general requirements shall apply to all internal combustion engines used to drive auxiliary electrical generating equipment.
3. The engine must be protected from operating conditions that would result in damage. Protective equipment shall be capable of shutting down the engine and activating an alarm on site. Protective equipment shall monitor for conditions of low oil pressure and overheating. Emergency equipment shall be protected from damage at the restoration of regular electrical power
4. Engine block heaters are required on all water cooled units.
5. Fuel storage is required to supply a minimum of 12 hours of operation at maximum design load. No buried tanks will be allowed.
6. The engine shall be located above grade with adequate ventilation of fuel vapors and exhaust gases.
7. All emergency power generating equipment shall be automatically exercised. Frequency and duration shall be user programmable.
8. The engine generator unit and automatic transfer switch size shall be adequate to provide power for pump motor starting current and for lighting, ventilation, and other auxiliary equipment necessary for safety and proper operation of the booster station. Provisions shall be made for automatic and manual start-up and load transfer. The generator must be protected from operating conditions that would result in damage to equipment. Provisions should be considered to allow the engine to start and stabilize at operating speed before assuming the load.