INTRODUCTION
This chapter describes the City of Stanwood’s (City) existing and future water service areas and
water service agreements, and provides a thorough description of the water system and its individual
components. The results of the evaluation and analyses of the existing water system are presented
later in Chapter 7.

WATER SERVICE AREA

History
The City was settled between 1870 and 1890 and was incorporated in 1903. The Stanwood Water
System began as a private water company in 1911. The original source of water was Lake Ketchum,
which lies approximately two miles north of the City. By the mid 1930’s, a new source of supply had
been constructed at the Hatt Slough Springs, approximately two miles south of the City. Major water
main extensions were constructed in the 1940’s and early 1950’s. Between 1948 and 1958, three
wells were drilled to supplement the water supply. In the mid 1960’s, improvements were made to
water mains and reservoirs were constructed at two locations. In September of 1986, the Stanwood
City Council placed before voters a proposition for purchase of the water system from the
Stanwood Water Company. The system was acquired by the City later that year.

Topography
The topography of the area served by the City varies greatly in elevation. The lowest areas served are
located along the Stillaguamish River in western Stanwood and south of the City limits. The flood
plains have an elevation between approximately 0 and 4 feet. The highest areas served are located in
the vicinity of the City’s Knittle and Cedarhome Reservoirs and have an elevation of approximately
250 feet.

Geology
The City’s water system is located in the Puget Sound Lowland in an area with a complex geological
history. The site conditions at the City’s supply sources are caused by at least two glaciations
separated by nonglacial and interglacial periods. Vashon glacial till, a dense mixture of sand, gravel,
silt, and clay, exists to a depth of 50 to 70 feet below ground surface in much of the upland areas
east of downtown Stanwood. Below the glacial till is a layer of Vashon advance outwash
approximately 60 to 80 feet thick composed of sandy and silty gravel. The Fure Well is completed in
this aquifer. Pre-Fraser glacial sediments beneath the advance outwash are 50 to 90 feet thick and
consist of sand with lenses of hard silt and gravel. The next underlying layer is the pre-Fraser non-
glacial deposits composed of fine sand with lenses of gravel, silt, and clay. The non-glacial deposits
are at least 250 feet deep. The Bryant Wells, Cedarhome Well, and Hatt Slough Springs appear to be
completed in this aquifer.
In summary, two aquifers exist within the City’s water service area. An unconfined aquifer within the Vashon advance outwash unit provided water to the Fure Well. A deeper, confined to unconfined aquifer within the pre-Fraser non-glacial deposits supplies water to the Bryant Wells, Cedarhome Well, and Hatt Slough Springs. The two aquifers are separated vertically by approximately 260 feet. Additional deeper aquifers several hundred feet below sea level and shallow aquifers of less than 100 feet in depth below the Stillaguamish floodplain, may also exist.

Water Service Area

The City is located in north Snohomish County, Washington, north of the mouth of the Stillaguamish River. The City’s corporate boundary encompasses an area of approximately 2.8 square miles, as shown in Figure 2-1. The City’s existing water distribution system extends beyond the City limits, as shown in Figure 2-1. The existing water system extends south to the Silvana Crest Subdivision on the south side of Hatt Slough and north to Drainage District 17 along Old Pacific Highway. The distribution system extends east to 48th Avenue NW (Valde Road) and west to the Stillaguamish River and Skagit Bay. The City’s existing retail water service area encompasses an area of approximately 10 square miles and is shown in Figure 2-3. The City is responsible for providing public water service, utility management, and water system development within this area.

The City will provide new water service within the City limits and where there are existing water mains (i.e. the retail water service area). Requests for new water service outside the City limits where there are no existing water mains fronting the property will only be granted after the area is annexed to the City or upon completion of an annexation agreement.

The City’s future water service area boundary was defined in the 1991 North Snohomish County Coordinated Water System Plan and is also shown in Figure 2-3. The future water service area boundary extends north to approximately 1 mile northwest of Lake Ketchum, east beyond 48th Avenue NW (Valde Road), south past Hatt Slough Springs, and west to Skagit Bay. The City’s future water service area boundary encompasses an area of approximately 22.4 square miles and extends 1 to 2 miles outside of the existing retail water service area.

The City’s existing water rights can be used throughout the defined water service area, per the 2003 Municipal Water Law and as approved by the Washington State Department of Health (DOH) in the City’s 2010 Comprehensive Water System Plan (WSP). According to the Municipal Water Law, the place of use for the City’s water rights is defined as the area served. Thus, the City can use its water rights outside of its corporate limits if the use is within the defined service area and all legal requirements defined in the Revised Code of Washington (RCW) 90.03.386(2) have been met. With the 2010 WSP, the City expanded its water right place of use to be the water service area in accordance with the Municipal Water Law. The City’s service area is consistent with the legal requirements since the service area does not conflict with other adopted plans or regulations.

WATER SERVICE AGREEMENTS

Water Service Area Agreement

All water purveyors located within a Critical Water Supply Service Area (CWSSA) are required to have a water service area agreement that identifies the external boundary of their water service area.
North Snohomish County was declared a CWSSA on October 19, 1988. The City prepared and signed a water service area agreement during the development of the North Snohomish County Coordinated Water System Plan, which was finalized in 1991. A copy of the agreement that the City signed in 1991 is contained in Appendix A.

SATELLITE SYSTEM MANAGEMENT

A Satellite System Management Agency (SSMA) is defined as a person or entity that is certified by the DOH to own or operate more than one public water system without the necessity for a physical connection between such systems. SSMA's were created to stop the proliferation of small water systems, many of which could not meet federal and state water quality and water system planning regulations. Based on the success of SSMA’s, DOH made recommendations to the legislature to include rules for designating entities as qualified SSMA's. In July 1995, Senate Bill 5448 became law that governs approvals of new water systems and sets forth requirements for SSMA's. The goal of the law is to ensure that the people of this state will receive safe and reliable water supplies in the future from professionally managed or properly operated water systems. SSMA's can provide three different levels of service:

1. Ownership of the satellite system;
2. Operations and management of the satellite system; or
3. Contract services only.

The service can be provided to new systems, existing systems that are no longer viable or existing systems placed into receivership status by the DOH.

The City does not own or operate any satellite systems and is not currently a SSMA. The City will consider providing satellite system management services to small neighboring water systems and evaluate becoming an SSMA on a case-by-case basis. Upon agreement between two systems to have the City provide SSMA services, the City will pursue the necessary steps to become an approved SSMA. These steps include:

- Submitting a notice of intent to DOH;
- Participating in a pre-submittal meeting with DOH;
- Submitting a SSMA plan to DOH that meets the plan requirements; and
- Obtaining approval of the plan from DOH.

If the City decides not to become the SSMA for small systems requesting assistance, then the Snohomish County Public Utility District (PUD) will likely provide these services. Snohomish County PUD currently operates several satellite systems and is an approved SSMA.

EXISTING WATER FACILITIES

This section provides a detailed description of the City’s existing water system and the current operation of the facilities. Detailed data on all of the water system facilities is contained in Appendix B. General water system facility data is summarized in the DOH Facilities Inventory.
(WFI) form. A copy of this form is contained in Appendix C. The analysis of the existing water facilities is presented in Chapter 7.

Pressure Zones

The City serves customers within an elevation range of approximately sea level, near the shores of Skagit Bay and the Stillaguamish River, to approximately 250 feet near the Knittle and Cedarhome Reservoirs. The wide range of elevations require that the water pressure be increased or reduced to maintain pressures that are safe and sufficient to meet the system’s flow requirements. This is achieved in the City’s system by dividing the water system into seven distinct pressure zones, as shown in Figure 2-1.

The pressures in the 125, 297, and 365 Zones are regulated by reservoir levels, as illustrated in the hydraulic profile, Figure 2-2. Pressures in the 125 Zone, which has a maximum hydraulic elevation of 125 feet, are established by the surface water level in the Bailey Reservoirs. The 125 Zone is primarily located west of Highway 530 in the flood plains. Pressures in the 297 Zone, which has a maximum hydraulic elevation of 297 feet, are established by the surface water level in the Knittle Reservoirs. The 297 Zone is predominately east of Highway 530. Pressures in the 365 Zone, which has a maximum hydraulic elevation of 365 feet, are established by the surface water level in the Cedarhome Reservoir. The 365 Zone, located in the northeast section of the City’s retail water service area, serves customers within an elevation range of approximately 175 to 250 feet.

The four smallest pressure zones are supplied by pressure reducing stations with water from the higher pressure zones. The pressure reducing stations decrease the pressure of water that is supplied to services located below the ridge that overlooks Pioneer Highway. The 252 Zone, which is located in the vicinity of Larson Road above Pioneer Highway, has one pressure reducing station that serves customers within an elevation range of approximately 90 to 140 feet. The 255 Zone serves customers in the Pioneer Hills neighborhood and residents southwest of 280th Street and 83rd Drive NW with two pressure reducing stations. The elevation range within the 255 Zone is approximately 25 to 170 feet. The 265 Zone has one pressure reducing station that serves the Hennings Estates development, which has elevations ranging from 55 to 160 feet. Lastly, in 2013 the small 242 Zone was converted to the 245 Zone and the zone was expanded to include low pressure areas that were in the 125 Zone. The 245 Zone encompasses an area between 81st Drive NW and the Burlington Northern Railroad (BNRR) south of 272nd Street NW and north of State Route (SR) 532. The 245 Zone is served by one pressure reducing station that delivers water to elevations ranging from approximately 10 to 115 feet.

Supply Facilities

Introduction

All water supply to the City’s water system is provided by a few groundwater wells in the East Stanwood Aquifer and one groundwater spring source. The City’s oldest source of supply, the Hatt Slough Springs, is located south of the City limits on the south side of Hatt Slough and is currently offline due to a November 2011 landslide restricting access to the site. Bryant Well No. 1 is the City’s largest single source of supply located near SR 532 and 268th Street NW. Bryant Well No. 2, which is located adjacent to Bryant Well No. 1, is offline due to a decline in capacity and is
considered an emergency source of supply. An emergency source is a source of supply that DOH has approved for use, but is not utilized for routine or seasonal demands. A replacement, Bryant Well No. 3, was drilled in 2013 and is planned for connection to the water system in 2015. The Cedarhome Well was installed in 2008 to replace the Sill Well, which has been offline since 1985 and is disconnected from the water system. The Fure Well, which is located on the eastern edge of the City limits, is out of service and is considered an emergency source. A summary of the well sources is shown in Table 2-1, and a detailed description of each source of supply is provided in the following sections.

**Table 2-1**

Supply Facilities Summary

<table>
<thead>
<tr>
<th>Well</th>
<th>Pressure Zone</th>
<th>Year Drilled</th>
<th>Use</th>
<th>Existing Pumping Capacity (gpm)</th>
<th>Well Depth (feet)</th>
<th>Well Diameter (inches)</th>
<th>Pump Type</th>
<th>Pump Motor Size (hp)</th>
<th>Water Treatment</th>
<th>Control Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hatt Slough Springs</td>
<td>125 Zone 1934</td>
<td>Temporarily Offline</td>
<td>260 n/a n/a Centrifugal</td>
<td>10</td>
<td>Cl2 Continuous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bryant Well No. 1</td>
<td>297 Zone 1948</td>
<td>Active</td>
<td>1,350 250 12 Turbine 75</td>
<td>n/a n/a</td>
<td>Cl2/MnH2S/As Knittle Tanks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fure Well</td>
<td>297 Zone 1951</td>
<td>Emergency</td>
<td>100 157 12 n/a n/a n/a</td>
<td>Knittle Tanks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bryant Well No. 2</td>
<td>297 Zone 1966</td>
<td>Emergency</td>
<td>0 200 12 n/a n/a n/a</td>
<td>Knittle Tanks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cedarhome Well</td>
<td>297 Zone 2008</td>
<td>Active</td>
<td>600 490 12 &amp; 16 Turbine 100</td>
<td>n/a n/a</td>
<td>Cl2 Knittle Tanks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bryant Well No. 3¹</td>
<td>297 Zone 2013</td>
<td>In Design</td>
<td>0 275 16 n/a n/a</td>
<td>Cl2/MnH2S/As Knittle Tanks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 = Bryant Well No. 3 has been drilled and is expected to have a capacity of 1,000 gpm when completed.
2 = Cl2: chlorination; Mn: manganese filtration; H2S: hydrogen sulfide removal; As: arsenic removal.

**Water Treatment**

The City transitioned to system-wide chlorination in 2008. The Cedarhome Well and Bryant Well No. 1 are chlorinated. Hatt Slough Springs was chlorinated as a precautionary measure when it was in use, even though harmful bacteria have never been detected. The spring source has been tested and determined not to be under the direct influence of surface water. Historically, the water quality at all of the sources has been excellent, aside from slightly higher than allowable manganese levels at Bryant Well No. 1 and Fure Well, and slightly higher than allowable arsenic levels at Bryant Well No. 1 prior to the completion of the Bryant Well Field Treatment Facility.

The Bryant Well Field Treatment Facility currently treats Bryant Well No. 1 for arsenic, manganese, and hydrogen sulfide using an oxidation and filtration process. This facility will also treat the future Bryant Well No. 3, the replacement for Bryant Well No. 2. Two chemicals are initially added to the raw water: sodium hypochlorite and ferric chloride. A low strength 0.8 percent sodium hypochlorite solution is created on-site using water, salt, and a chemical reactor. The ferric chloride is added to assist with arsenic removal and is purchased in 55-gallon drums. All chemicals are
injected into the raw water through metering pumps. In addition to feeding chemicals, an aeration system adds dissolved oxygen from the ambient air to the raw water to reduce hydrogen sulfide concentrations. After chemical addition, the raw water is filtered through a pressure vessel containing anthracite and greensand media to remove manganese, iron and arsenic compounds. A contact loop is provided after filtration to ensure that chlorine fully reacts with ammonia and reaches breakpoint before the treated water reaches the first customer downstream of the plant.

The Cedarhome Well is equipped with a sodium hypochlorite on-site generation system and a contact loop similar to the Bryant Well Field Treatment Facility. No other chemicals are added to this source.

When Hatt Slough Springs is in service, chlorination is achieved by continuous injection of sodium hypochlorite (liquid chlorine) into the system during operation of the pumps at the facility. The 12.5 percent concentrated sodium hypochlorite solution is created with 1 gallon of sodium hypochlorite per 8 gallons of water. The chlorination equipment at the Hatt Slough Springs site consists of a 50-gallon dilution tank and metering pump for the disinfection process.

The Fure Well is considered an emergency source and it is not currently chlorinated.

**Hatt Slough Springs**

The Hatt Slough Springs site is located south of the City limits and Hatt Slough, near the base of a steep slope. The springs are situated on City-owned property in an undeveloped area that is accessed by a dirt road from Marine Drive. Four spring collection areas are located within the fenced and secured property. Each collection area has an infiltration piping gallery that delivers water to a 300-gallon settling tank. Water is conveyed by gravity through pipes from each of the settling tanks to the pump building, which houses the mechanical, chlorination, and electrical equipment.

The access road to Hatt Slough Springs, which is partially located between a steep slope and the Stillaguamish River, is periodically blocked by debris from landslides. Significant landslides occurred in November 2011 and February 2012, with further debris from the hillside being deposited on the road several times per month. Currently, the source is offline due to landslides that do not permit vehicular access to the source. The source is not currently needed to meet demands and the City does not have imminent plans to repair the road to utilize the source.

The Hatt Slough Springs source was constructed in 1934 and was granted a maximum instantaneous water right of 1,125 gallons per minute (gpm) in 1939. The source has a maximum supply capacity of approximately 260 gpm. The 1992 Comprehensive Water System Plan questioned the ability of Hatt Slough Springs to continue as a source of supply because of the Environmental Protection Agency’s (EPA) Surface Water Treatment Rule. After collecting data between May 1994 and February 1997, DOH concluded that Hatt Slough Springs is a groundwater source that is not under the direct
Water System Description

influence of surface water. Water from the springs is pumped through an 8-inch asbestos concrete (AC) transmission main to the Bailey Reservoirs and the 125 Zone with 3 centrifugal 10 horsepower motors pumps. The City is considering either improving the Hatt Slough Springs facility or transferring the water right to another source of supply, as described in Chapter 6 and Chapter 9. Additional data on Hatt Slough Springs and the City’s wells is contained in Appendix B.

Bryant Wells

The Bryant Well site is located within the City limits near SR 532 and 268th Street NW. The well site is located close to the road in a relatively undeveloped area, on fenced and secured property owned by the City. Bryant Well No. 1 and No. 2 are housed in separate buildings that contains the mechanical, electrical, and telemetry equipment.

Bryant Well No. 1 was originally drilled in 1948 and its water right was obtained in 1951. The 12-inch-diameter, 250-foot-deep well has a current supply rate of approximately 1,350 gpm. The well has a maximum instantaneous water right of 2,000 gpm, which it shares with Bryant Well No. 2. Bryant Well No. 1 was rehabilitated in 2003 since the well was reaching the end of its design life. Rehabilitation consisted of installing a larger horsepower pump and a new water main to enable the source to provide water supply directly to the 297 Zone. In 2004, DOH determined that Bryant Well No. 1 is in hydraulic connection with the nearby surface water source, Church Creek, and required chlorination of the source water, which is now provided by the Bryant Well Field Treatment Facility.

Bryant Well No. 2 was placed in service in 1966 and shares the Bryant Well No. 1 water right. The 12-inch-diameter, 200-foot-deep well has been declining in capacity. The well’s capacity was approximately 1,000 gpm until 1998, when it decreased to approximately 600 gpm. Since then, the well’s capacity has declined severely and has not responded to rehabilitation efforts. The well is not currently in use and is considered an emergency source of supply. An emergency source of supply is a source that has been approved by DOH for emergency use and is not utilized for routine or seasonal water demands.

In 2013, the City drilled Bryant Well No. 3, which is the replacement well for Bryant Well No. 2. The replacement well, which will have a maximum capacity of 1,000 gpm, will allow the City to fully utilize the 2,000 gpm water right. Bryant Well No. 3, located adjacent to the Bryant Well Field Treatment Facility building, will be equipped with a submersible well pump and variable frequency drive (VFD) in 2015. Water supplied by Bryant Well No. 3 will be combined with water from Bryant Well No. 1 prior to treatment and supply to the 297 Zone. Additional data on the Bryant Wells and the City’s other sources of supply is contained in Appendix B.
CHAPTER 2

Fure Well

The Fure Well site is located off of Woodland Road near Church Creek, on the eastern edge of the City limits. The well site is located close to the road in an area that is currently undeveloped. The well is located inside the building that houses the mechanical and electrical equipment.

The Fure Well is offline and considered an emergency source of supply. The well has a maximum instantaneous water right of 150 gpm, which was obtained in 1951. The capacity of the 12-inch-diameter, 157-foot-deep well when it was in use was approximately 100 gpm. The well water, when it was utilized, pumped to the 297 Zone with a submersible pump and 15 horsepower motor. The water was withdrawn from a screened interval between 145 and 150 feet below ground surface. Since the well only penetrates the aquifer by 5 feet, the Fure Well produced a very low yield. In addition to low yield, the well also had water quality issues, including iron, manganese, and hydrogen sulfide. Rehabilitation of this well has been dismissed since improvements would likely include drilling the well deeper and installing a treatment facility on a small site for a well that is limited to a 150 gpm water right. The City is now considering transferring the water right to another source of supply as discussed in Chapter 6 and Chapter 9. Additional data on the Fure Well and the City’s other sources of supply is contained in Appendix B.

Cedarhome Well

Fure Well Building
Water System Description

The Cedarhome Well was installed and tested in 1995. The 16-inch diameter, 490-foot-deep well is located southeast of the intersection of 68th Avenue NW and Jensen Road in an area surrounded by mostly farmland and school playgrounds. The Cedarhome Well is equipped with a pitless unit and submersible well pump. The instantaneous water right amount of 600 gpm was transferred from the City’s Sill Well, an abandoned source of supply, to the Cedarhome Well. The Cedarhome Well is currently pumping at its maximum capacity of 600 gpm. Additional data on the Bryant Wells and the City’s other sources of supply is contained in Appendix B.

Pump Station Facilities

The City’s water system has a total of two booster pump stations. The Cedarhome and Knittle Booster Pump Stations are utilized to fill the 365 Zone Cedarhome Reservoir. A summary of the booster pump station facilities is shown in Table 2-2, and a detailed description of each facility is provided below. Additional data on the City’s pump stations is contained in Appendix B.

<table>
<thead>
<tr>
<th>Booster Pump Station</th>
<th>Suction Pressure Zone</th>
<th>Discharge Pressure Zone</th>
<th>Year Constructed</th>
<th>Existing Pumping Capacity (gpm)</th>
<th>Number of Pumps</th>
<th>Pump Type</th>
<th>Pump Motor Size (hp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knittle BPS</td>
<td>297 Zone</td>
<td>365 Zone</td>
<td>1908</td>
<td>1,380</td>
<td>4</td>
<td>Centrifugal</td>
<td>(1) 3, (2) 5, (1) 50</td>
</tr>
<tr>
<td>Cedarhome BPS</td>
<td>297 Zone</td>
<td>365 Zone</td>
<td>2006</td>
<td>1,000</td>
<td>3</td>
<td>Centrifugal</td>
<td>(3) 20</td>
</tr>
</tbody>
</table>

Cedarhome Booster Pump Station

The Cedarhome Booster Pump Station was originally constructed in 1973 and replaced in 2006 with a larger capacity facility. The new above-grade Cedarhome Booster Pump Station is located on the northwest corner of 68th Avenue NW and 282nd Place NW. Three identical, horizontal split case centrifugal pumps powered by 20 horsepower motors provide the primary supply from the 297 Zone to the 365 Zone Cedarhome Reservoir. The pump station does not have a power receptacle to enable connection.
CHAPTER 2

of a portable engine generator set for backup power supply.

Knittle Booster Pump Station

The Knittle Booster Pump Station, which was constructed in 1998 for the Bay View Lane development, is located north of 276th Street NW on the Knittle Reservoir site. The above-grade pump station and adjacent Knittle and Cedarhome Reservoirs are located on property that is owned by the City. The pump station has four end-suction centrifugal pumps that are used to pump water from the Knittle Reservoirs to the 365 Zone Cedarhome Reservoir, primarily as a backup to the Cedarhome Booster Pump Station. The primary pump is rated at 15 gpm and powered by a 3 horsepower motor. The two lag pumps are rated at 85 gpm and powered by 5 horsepower motors. The fourth pump, which can provide fire flow to the 365 Zone, is rated at 1,175 gpm and powered by a 50 horsepower motor. The pump station has a power receptacle to enable connection of a portable engine generator set for backup power supply.

Storage Facilities

The City’s water system has two storage facilities that supply the 125 Zone, two that supply the 297 Zone, and one that supplies the 365 Zone. A summary of the storage facilities is shown in Table 2-3, and a detailed description of each facility is provided below. Additional data on the City’s storage facilities is contained in Appendix B.

Table 2-3
Storage Facilities Summary
0.2 MG Knittle Reservoir No. 1

Knittle Reservoir No. 1 is located north of 276th Street NW and Stauffer Road on a dirt road and provides 200,000 gallons of water storage for the 297 Zone. The 26-foot-diameter, 50-foot-tall concrete tank was constructed in 1990 and provides approximately 3,970 gallons of storage per foot height. A single 12-inch-diameter water main serves as the reservoir’s common inlet/outlet pipe. The reservoir is anchored for seismic events.

1.0 MG Knittle Reservoir No. 2

Knittle Reservoir No. 2 is located on the same site as Knittle Reservoir No. 1 and also provides water storage for the 297 Zone. The 61-foot-diameter, 47-foot-tall steel tank was constructed in 1997 and provides approximately 21,860 gallons of storage per foot height. A single 12-inch-diameter water main serves as the reservoir’s common inlet/outlet pipe.

0.2 MG Bailey Reservoirs

The 200,000-gallon Bailey Reservoirs are located on 81st Drive NW and supply the City’s 125 Zone. The 45-foot-diameter, 17.5-foot-tall concrete tanks were constructed in 1989 and replaced the original wood reservoirs that were constructed over 50 years ago. Each tank provides approximately 11,900 gallons of storage per foot height. A single 10-inch-diameter water main serves as the reservoirs’ common inlet/outlet pipe. The reservoirs are anchored for seismic events.
Adjacent to the Bailey Reservoirs is the Bailey Booster Pump Station building, which was historically used to pump water from the 125 Zone to the 297 Zone. As the water system grew and new facilities were constructed in the upper pressure zones, the booster pump station became unnecessary. In 2012, the pumps were removed and the building was remodeled. An altitude valve was installed in the building to fill the Bailey Reservoirs from the 297 Zone.

**0.55 MG Cedarhome Reservoir**

The 550,000-gallon Cedarhome Reservoir is located on the Knittle Reservoir site, north of 276th Street NW and Stauffer Road. The reservoir was constructed in 2009. The composite elevated tank, which consists of a concrete base and an elevated steel tank, has a low water level of 329.5 feet and an overflow elevation of 365 feet. Above an elevation of 339 feet, the reservoir has a uniform diameter of 53.3 feet and provides approximately 16,710 gallons of storage per foot height to the 365 Zone. The storage area below 339 feet is conical and provides a varying volume of water storage capacity per foot height. A single 16-inch-diameter water main serves as the reservoir’s common inlet/outlet pipe. The reservoir is anchored for seismic events.

**Distribution and Transmission System**

The City’s retail water service area contains more than 64 miles of water main ranging in size from less than 1 inch to 42 inches. As shown in **Table 2-4**, most of the water main (approximately one-third) within the existing retail water service area is 8-inch diameter, and nearly 80 percent of all water main is 8-inch diameter or smaller.
The water main in the system is asbestos concrete, cast iron, ductile iron, galvanized iron, polyethylene, PVC, and steel as shown in Table 2-5. All new water main installations are required to use ductile iron water main in accordance with the City’s development and construction standards.

The life expectancy of water main is generally 50 years. Approximately 14 percent of water main within the system is known to be older than 50 years and approximately one-quarter of the water main is considered to be in fair condition. Fair condition pipe is primarily asbestos cement, steel, or galvanized iron. Of particular concern are the older steel pipes located in various parts of the retail water service area, and the old service saddles and service lines in the older part of the City west of Pioneer Highway. The PVC and ductile iron pipes are generally in good or excellent condition.

**Table 2-4**
Water Main Diameter Inventory

<table>
<thead>
<tr>
<th>Diameter (Inches)</th>
<th>Length (Feet)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larger than 16</td>
<td>1,281</td>
<td>0.4%</td>
</tr>
<tr>
<td>16</td>
<td>9,064</td>
<td>2.6%</td>
</tr>
<tr>
<td>10</td>
<td>11,654</td>
<td>3.4%</td>
</tr>
<tr>
<td>6</td>
<td>42,962</td>
<td>12.5%</td>
</tr>
<tr>
<td>12</td>
<td>53,910</td>
<td>15.7%</td>
</tr>
<tr>
<td>4 or smaller</td>
<td>104,609</td>
<td>30.5%</td>
</tr>
<tr>
<td>8</td>
<td>119,133</td>
<td>34.8%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>342,613</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Table 2-5**
Water Main Material Inventory

<table>
<thead>
<tr>
<th>Diameter (Inches)</th>
<th>Length (Feet)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast Iron</td>
<td>277</td>
<td>0.1%</td>
</tr>
<tr>
<td>Steel</td>
<td>6,054</td>
<td>1.8%</td>
</tr>
<tr>
<td>Polyethylene</td>
<td>10,595</td>
<td>3.1%</td>
</tr>
<tr>
<td>Galvanized Iron</td>
<td>20,754</td>
<td>6.1%</td>
</tr>
<tr>
<td>Asbestos Cement</td>
<td>64,763</td>
<td>18.9%</td>
</tr>
<tr>
<td>PVC</td>
<td>108,368</td>
<td>31.6%</td>
</tr>
<tr>
<td>Ductile Iron</td>
<td>131,802</td>
<td>38.5%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>342,613</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
CHAPTER 2

Pressure Reducing Stations

Pressure reducing stations are connections between adjacent pressure zones that allow water to flow from the higher pressure zone to the lower pressure zone by reducing the pressure of the water as it flows through the station, thereby maintaining a safe range of pressures in the lower zone. A pressure reducing station is essentially a below-grade vault (typically concrete) that normally contains two pressure reducing valves, sometimes a pressure relief valve, piping and other appurtenances. The pressure reducing valve hydraulically varies the flow rate through the valve (up to the flow capacity of the valve) to maintain a constant pressure on the downstream side of the valve for water flowing into the lower pressure zone.

Pressure reducing stations can serve multiple purposes. They can function as an active supply facility by maintaining a continuous supply of water into a lower zone that has no other source of supply, such as a well or reservoir. Pressure reducing stations can also function as standby supply facilities that are normally inactive (no water flowing through them). The operation of this type of station is typically triggered by a drop in water pressure near the downstream side of the station. A typical application of this function is a pressure reducing station that is only needed to supply additional water to a lower zone during a fire flow situation. The pressure setting of the control valve within the station allows it to remain closed during normal system operation and open only during high demand conditions, like fire flows, to provide the additional supply needed.

The City’s water system has a total of 11 pressure reducing stations, as shown in profile view in Figure 2-2. The SR 532 and Pioneer Highway station is connected between the 297 Zone and the 125 Zone and provides water to the lower zone during fire flow situations. One of the City’s newest pressure reducing station, located near Cedarhome Drive and BNRR, will be activated in 2015 when adjacent pressure zone improvements are completed. When operating, the pressure reducing station will also serve to supply the 125 Zone during fire flow situations. Four pressure reducing stations supply water from the 365 Zone to the 297 Zone during fire flow situations. The other five pressure reducing stations actively supply water from the 297 Zone to the four smaller pressure zones. If water was supplied directly from the 297 Zone to these lower zones, high pressure problems would exist. A listing of all pressure reducing stations and related data is contained in Appendix B.

Water System Interties

Water system interties are physical connections between two adjacent water systems. Interties are normally separated by a closed isolation valve or control valve. Emergency supply interties provide water from one system to another during emergency situations only. An emergency situation may occur when a water system loses its main source of supply or a major transmission main and is unable to provide a sufficient quantity of water to its customers. Normal supply interties provide water from one system to another during non-emergency situations and are typically supplying water at all times.

The City’s water system currently has no interties. However, the North Snohomish County Coordinated Water System Plan discusses possible interties connecting the City with the Arlington and Tatoosh water systems. Other interties that the City may consider include the City of Everett, Snohomish County PUD, and Skagit County PUD. Potential interties are discussed in more detail in Chapter 6.
**Water System Description**

**Telemetry and Supervisory Control System**

Successful operation of any municipal water system requires gathering and using accurate water system information. A telemetry and supervisory control system gathers information and can efficiently control a system by automatically optimizing facility operations. A telemetry and supervisory control system also provides instant alarm notification to operations personnel in the event of equipment failure, operation problem, fire, or other emergency situations.

The City's telemetry and supervisory control system consists of a radio-based supervisory control and acquisition (SCADA) system that was upgraded in 2003 by RH2 Engineering, Inc. Each of the City's water facilities are monitored through programmable logic controllers connected to a human machine interface (HMI) computer. Alarms generated by the SCADA system are transmitted to the staff by phone using dedicated alarm systems. Daily data from the SCADA system is continuously collected on the HMI computer system. Operators can view real time or historical HMI data.

**Water System Operation and Control**

When the Hatt Slough Springs source of supply is online, the springs continuously supply the 125 Zone and the Bailey Reservoirs. Hatt Slough Springs is not equipped with telemetry to control the source of supply based on the levels in the Bailey Reservoirs. When Hatt Slough Springs is offline due to access limitations, the 125 Zone is supplied with water from the 297 Zone via an altitude valve at the Bailey Reservoirs. The SR 532 and Pioneer Highway pressure reducing valve does not normally supply water, but is set to flow water to the 125 Zone upon a suppressed level in the Bailey Reservoirs or during a localized drop in pressure, such as during a fire flow.

The City’s main source of supply, the Bryant Wells, supplies water to the Knittle Reservoirs and the 297 Zone. The Cedarhome Well also supplies the 297 Zone. The operation of the Bryant and Cedarhome Wells is controlled by the water levels in the Knittle Reservoirs. The Fure Well is offline and is not capable of supplying the system. The 245, 252, 255, and 265 Zones also receive water from the 297 Zone through five active pressure reducing stations.

The 365 Zone is supplied with water from the 297 Zone through the Cedarhome and Knittle Booster Pump Stations. The operation of these booster pump stations is controlled by the water levels in the Cedarhome Reservoir.

**ADJACENT WATER SYSTEMS**

The area outside and immediately adjacent to the City’s future water service area is unincorporated Snohomish County. Most of the water systems located close to the City are relatively small. Some of the larger systems in Snohomish County include the City of Arlington, located approximately 14 miles east of Stanwood and the City of Marysville, located approximately 20 miles southeast of Stanwood. A few small community water systems are located on northeast Camano Island, which is approximately 1 mile west of Stanwood. Several small water systems located adjacent or close to the City’s future water service area boundary are shown in **Figure 2-3**. A brief description of each water system follows.
Wilderness Ridge Community Club and Northwest Water System

The Wilderness Ridge Community Club water system is located north of the City’s future water service area boundary. The Wilderness Ridge system has approximately 284 service connections. Water is supplied to the system by two groundwater wells that are currently untreated. The Northwest Water System is a smaller public water system that is located within the Wilderness Ridge water system boundary. The Northwest Water System has 35 service connections and water is supplied by two groundwater wells. There are no current plans for interties between either of these two systems and the City’s water system.

Warm Beach Water Association

The Warm Beach Water Association water system is located approximately 1.5 miles south of the City’s future water service area. The system has approximately 580 service connections. Three groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.

Warm Beach Conference Grounds

The Warm Beach Conference Grounds water system is located north of the Warm Beach Water Association system, approximately 1 mile south of the City’s future water service area. The Warm Beach Conference Grounds water system provides service to approximately 551 service connections with four groundwater wells. There are no current plans for interties between the two systems.

Sunday Lake Community Club and Silver Springs Estates

The Sunday Lake Community Club and the Silver Springs Estates are water systems located approximately 0.9 miles east and 1.7 miles east, respectively, of the City’s future water service area. The Sunday Lake Community Club has approximately 156 water service connections and Silver Springs Estates has approximately 25 water service connections. One well provides water to the Sunday Lake Community Club, which is owned and operated by the Snohomish County PUD. One well provides water to the Silver Springs Estates. There are no current plans for interties between either of these two systems and the City’s water system.

Whiteside Homeowners Association

The Whiteside Homeowners Association water system is located approximately 3.1 miles south of the City’s future water service area. The system has approximately 27 service connections. Two groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.

Lakewood West Water Association

The Lakewood West Water Association water system is located approximately 2.9 miles south of the City’s future water service area. The system has approximately 26 service connections. Two groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.
**Lake Ki Sunrise Addition Water Company**

The Lake Ki Sunrise Addition Water Company water system is located approximately 3.7 miles southeast of the City’s future water service area. The system has approximately 3 service connections. Two groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.

**Lakeside Shores Improvement Association**

The Lakeside Shores Improvement Association water system is located approximately 2.9 miles south of the City’s future water service area. The system has approximately 62 service connections. Two groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.

**Kayak Point Golf Course**

The Kayak Point Golf Course water system is located approximately 3.5 miles south of the City’s future water service area. The system has approximately 62 service connections. Two groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.

**Snohomish PUD Lake Goodwin**

The Snohomish PUD Lake Goodwin system is located approximately 0.9 miles south of the City’s future water service area. No connection or source information is available at this time.

**Seven Lakes Water Association**

The Seven Lakes Water Association water system is located approximately 1.5 miles south of the City’s future water service area. The system has approximately 266 service connections. Three groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.

**Snohomish PUD Kayak Water System**

The Snohomish PUD Kayak water system is located approximately 3.5 miles south of the City’s future water service area. The system has approximately 367 service connections. Two groundwater wells provide water to the system. There are no current plans for interties between this system and the City’s water system.

**Silvana Water Association**

The Silvana water system is located approximately 1.4 miles southeast of the City’s future water service area. The system has approximately 130 service connections. One groundwater well to provide water to the system. There are no current plans for interties between this system and the City’s water system.
CHAPTER 2

Skagit PUD Judy Reservoir System

The Skagit PUD Judy Reservoir system’s nearest pipes are located approximately 2.2 miles northeast of the City’s future water service area. The system, not specifically shown on Figure 2-3, has approximately 29,938 service connections. One reservoir, one ground water well, and a groundwater Ranney well/infiltration gallery provide water to the system. There are no current plans for interties between this system and the City’s water system.

Tatoosh Water Company

The Tatoosh Water Company water system is located approximately 0.9 miles east of the City’s future water service area. The Tatoosh Water Company water system provides service to approximately 131 connections with two groundwater wells. There are no current plans for interties between the two systems.
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