


CLEARANCES	Initial	Date	Date Received in Council Office	Agenda Date	Assigned to:
Originator:		9/4/2018		9/11/2018	Public Works/Coun
Division Head:					
Dept. Head:		9.4.18			
Prosecutor:					
Purchasing/Budget:					
Executive:					

TITLE OF DOCUMENT:

Resolution approving Lake Whatcom Water & Sewer District Comprehensive Plan

ATTACHMENTS:

SEPA review required?	() Yes	() NO	Should Clerk schedule a hearing ?	() Yes	() NO
SEPA review completed?	() Yes	() NO	Requested Date:		

SUMMARY STATEMENT OR LEGAL NOTICE LANGUAGE: (If this item is an ordinance or requires a public hearing, you must provide the language for use in the required public notice. Be specific and cite RCW or WCC as appropriate. Be clear in explaining the intent of the action.)

Resolution approving Lake Whatcom Water & Sewer District Comprehensive Plan

COMMITTEE ACTION:**COUNCIL ACTION:**

Related County Contract #:

Related File Numbers:

Ordinance or Resolution
Number:

Please Note: Once adopted and signed, ordinances and resolutions are available for viewing and printing on the County's website at: www.co.whatcom.wa.us/council.

PROPOSED BY: _____
INTRODUCTION DATE: September 11, 2018

RESOLUTION NO. _____

APPROVING LAKE WHATCOM WATER AND SEWER DISTRICT
WATER SYSTEM COMPREHENSIVE PLAN

WHEREAS, the Lake Whatcom Water and Sewer District has been in the process of developing a Water System Comprehensive Plan; and

WHEREAS, State law (RCW 57.16.010(7)) requires the County Council to approve, conditionally approve, or reject comprehensive water system plans; and

WHEREAS, a determination of non-significance was issued pursuant to the State Environmental Policy Act on November 28, 2017; and

WHEREAS, the Whatcom County Public Works Department approved the Water System Comprehensive Plan on February 12, 2018; and

WHEREAS, the Whatcom County Planning and Development Services Department issued a Local Government Consistency Determination relating to the Water System Comprehensive Plan on March 5, 2018; and

WHEREAS, the Whatcom County Health Department approved the Water System Comprehensive Plan on March 12, 2018; and

WHEREAS, the Lake Whatcom Water and Sewer District submitted a final Water System Comprehensive Plan (June 2018), revised to address agency comments, for review and approval by the County Council; and

WHEREAS, under the provisions of state law, the Whatcom County Comprehensive Plan, and County-wide Planning Policies, water service in rural areas must be at rural levels and should not be used as a basis for rezoning property; and

WHEREAS, the County Council reviewed Lake Whatcom Water and Sewer District Water System Comprehensive Plan for compliance with the approval criteria set forth in RCW 57.16.010(7)) and RCW 57.02.040 and finds that the plan satisfies these criteria, subject to certain conditions.

NOW, THEREFORE, BE IT RESOLVED that the County Council hereby approves the Lake Whatcom Water and Sewer District Water System Comprehensive Plan dated June 2018, subject to the following conditions:

1. Water service shall be provided consistent with densities allowed in the Whatcom County Zoning Code (Title 20).
2. Provision of water to land outside the Urban Growth Area shall not serve as the basis for rezoning properties.

APPROVED this _____ day of _____ 2018.

ATTEST

WHATCOM COUNTY COUNCIL
WHATCOM COUNTY, WASHINGTON

Dana Brown-Davis, Clerk of the Council

Rud Browne, Council Chair

APPROVED AS TO FORM:

Civil Deputy Prosecutor

LAKE WHATCOM WATER AND SEWER DISTRICT



WATER SYSTEM COMPREHENSIVE PLAN

JUNE 2018

Board of Commissioners:

Laura Weide,
Todd Citron, Bruce Ford
John Carter, Leslie McRoberts

Bill Hunter, PE - Interim General Manager

Prepared By:

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for the provision of water services for Lake Whatcom Water and Sewer District, including a capital construction and improvement plan, is hereby adopted by Lake Whatcom Water and Sewer District and forwarded for approval to the Whatcom County Council,. In accordance with WAC 246-290-100, the District also forwards the plan to the Washington State Department of Health for approval and to adjacent utilities to assess consistency in planning efforts.

ADOPTED by the Board of Commissioners of Lake Whatcom Water and Sewer District, Whatcom County, Washington, at a regular meeting thereof held this 27th day of June, 2018.

Laura Weide, Board President

Todd Citron, Commissioner

Bruce Ford, Commissioner

Leslie McRoberts, Commissioner

John Carter, Commissioner

Approved as to form, District Legal Counsel

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Introduction

The purpose of this Water System Plan is to assist Lake Whatcom Water and Sewer District (LWWSD, formerly Whatcom County Water District 10) in making the best use of available resources to provide high quality water service and to protect the health of the District's customers.

The Water System Plan will guide the District in its decision-making regarding capital improvements and operations. It will also help the Washington State Department of Health ("DOH") verify that the District's water systems comply with the federal Safe Drinking Water Act and relevant state regulations.

The Water System Plan has been prepared in accordance with the requirements, sequence, and formatting outlined in the Washington Administrative Code WAC 246-290-100. This Plan is an update of the District's 2010 Water System Plan. It is the intent of the Board of Commissioners that, once adopted, this Water System Plan and its appendices will meet current DOH planning standards, and supplant the 2010 Water System Plan. If the current Water System Plan is inadvertently silent on any issue of policy, the Board of Commissioners will separately consider such matters if and when presented by existing or potential water system customers.

defined by the Lake Whatcom Water and Sewer District Administrative Code, Section 3.4.

There are areas within the overall District boundary that are not included in any of the Future Service Areas. These areas are zoned rural forestry (RF), commercial forestry (CF), or are owned by the City of Bellingham, Whatcom County, or Whatcom Land Trust and designated as space that will not be developed. Figure 2-1 shows the Whatcom County zoning designations. Given the current climate in the Lake Whatcom Watershed, it is unlikely that these areas will be developed. The District has made no determination not to serve these properties.

The District is proposing minor boundary adjustments in Geneva near its border with the City of Bellingham, and along Academy Road in the North Shore area adjacent to Whatcom County Water District 7. Both of these adjustments are to adjust service areas to eliminate boundary overlaps and acknowledge that the properties are more likely to be served by the adjacent water purveyors.

1.1 Ownership and Management

The water system name as listed in DOH official records is Lake Whatcom Water and Sewer District. The District's Public Water System ID numbers are:

- 959101 – South Shore Service Area (Geneva to Sudden Valley)
- 081181 – Eagleridge Service Area
- 52957B – Agate Heights Service Area
- 047828 – Johnson Well Service Area (Group B)

The District is a special purpose water and sewer district governed by RCW Chapter 57. A copy of the District's Certification of Registration from the Department of Revenue is included in Chapter 10.1 – Supportive Documents.

The District is governed by an elected, five member Board of Commissioners. The Commissioners determine policy, set rates and charges, and approve the budget. The District employs a full-time General Manager and an operating and administrative staff currently numbering seventeen persons. The General Manager is in charge of daily operations and approves expenditures within the budget. The in-house District Engineer also functions as the Assistant General Manager. The District routinely engages a consultant engineering firm and consultant attorney to advise and aid the Board in its decision-making. The consultant-engineering firm provides analysis, design, plan review, and construction management services to the District on an on-call basis. See Figure 1-2 for the full organizational chart.

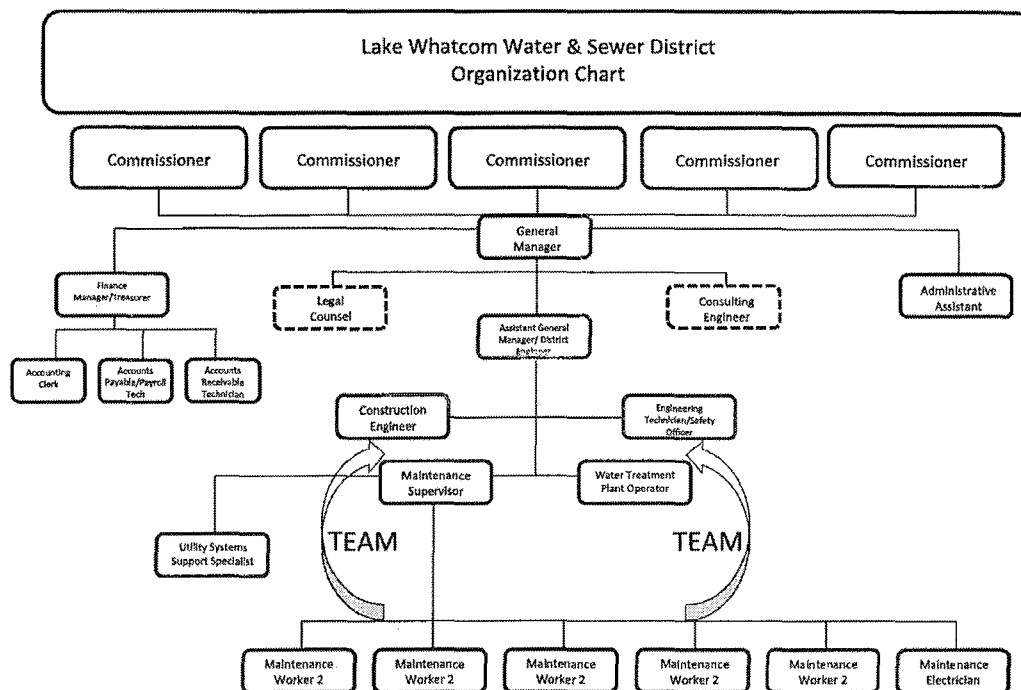


Figure 1-2: Lake Whatcom Water and Sewer District Organizational Chart

City of Bellingham bulk water. Since 1977, the distribution system has been gradually expanded and upgraded by means of numerous utility local improvement districts, developer extensions, and Drinking Water State Revolving Fund loan projects. In 2004, the District installed a water main that connected the Sudden Valley water system to the Geneva water system. This enables the District to supply Geneva with water produced by its water treatment plant in Sudden Valley. The District no longer purchases bulk water from the City of Bellingham, but the connection is still serviceable as an emergency intertie.

The Geneva Area has a mixed history of growth. The State's 1990 Growth Management Act and the 1992 imposition of a sewer capacity moratorium slowed the pace of population growth in the Geneva area. Throughout the 1990-2000's, Whatcom County and the City of Bellingham have been engaged in comprehensive land use planning and/or the legal appeals related thereto in an effort to determine and control maximum potential population densities for the Geneva area. Because most of the Geneva Area is within the Lake Whatcom watershed, efforts have been made to minimize potential impacts of urban development on the water quality of Lake Whatcom while recognizing the existing urban character and development pressures of the area.

The District's Geneva area currently contains several land use categories:

- Urban Growth Area ("UGA"), zoned Urban Residential ("UR")
- Existing urban character residences located outside of the UGA (Strawberry Point area)
- Rural residential areas outside of the UGA, some with water service, and some anticipated to require water service in the future
- Recreational Open Space (land restricted from development)

The Geneva area also includes the District's approximately 90 sewer-only customers along Lake Whatcom Boulevard, between Geneva and Sudden Valley, and Euclid Avenue. The Lake Whatcom Boulevard customers obtain their potable water from individual wells or direct private withdrawals from Lake Whatcom. The Euclid Avenue customers are served by the Glen Cove Water System which purchased water from the City of Bellingham.

C. North Shore Area - Eagleridge:

There are approximately 107 District water connections in the North Shore Areas while there are over 340 District sewer connections in the same area. The majority of the District's customers in this area are sewer-only customers that are served by individual wells or direct private withdrawals from Lake Whatcom.

The District began operating the Eagleridge Water System in 1989. It currently serves 68 residences from an intertie with the City of Bellingham's water system and a District-owned water booster station.

to supply the new, higher elevation reservoir. A Pressure Reducing Valve (PRV) vault was also installed to maintain acceptable pressure at the Agate Height subdivision.

Further expansion of the Agate Heights water system within the North Shore Area, beyond the Agate Heights subdivision, is discussed in detail in the North Shore Consolidation Study (Appendix C). As mentioned above, the Study assumes that the water source for the consolidated system would be the well at Agate Heights, and that the City connection at Eagleridge would remain as an emergency back-up supply. The consolidated water system could merge the Eagleridge other Group A and B water systems, and homes with individual wells and direct private surface water withdrawals with the Agate Heights water system.

1.2.2 Geography

Detailed information on the physical characteristics of the Areas is included in Appendix N. Summaries of the geography for each Area are included below.

A. South Shore (Sudden Valley and Geneva):

In the Sudden Valley area, the water system traverses very steep terrain, with system elevations ranging between 314 and 1,070 feet above sea level. This portion of the system has 47 PRVs to maintain appropriate water pressure throughout the system because of the steep terrain. Sudden Valley and Geneva are connected by 1.3 miles of 8-inch water main and one pressure reducing valve. The District's water intake is in the deeper, larger Basin 3 of Lake Whatcom.

The Geneva area also includes steep terrain, with elevations in the current service area ranging between 314 and 800 feet above sea level. Geneva currently has two pressure zones served by gravity and a third higher-elevation pressurized zone to serve the south end of the service area. The City of Bellingham bounds this service area on the west.

B. North Shore - Eagleridge:

The Eagleridge system currently has one pressure zone. The City of Bellingham bounds this area on the west.

C. North Shore - Agate Heights:

The Agate Heights (a.k.a. Richalou Estates) water system contains four pressure zones. The original Agate Heights reservoir is at 557 feet above sea level. A second tank was installed at 825 feet to serve the Lake Whatcom Residential and Treatment Center and the highest zone of Agate Heights.

1.2.3 Neighboring/Adjacent Purveyors:

The City of Bellingham is adjacent to the west of the District at Geneva and at Eagleridge. The Glen Cove Water Corporation is located within the Geneva Area and adjacent to Bellingham's City limits. Glen Cove has 21 connections and purchases water from the City of Bellingham. There have been discussions with the Glen Cove Water Association about consolidating with LWWSD and becoming part of the South Shore water system. Adjacent to LWWSD's northern boundary is Whatcom County

There is one intertie from the Sudden Valley water system to the Geneva water system. With this intertie the District supplies water to Geneva from its water treatment plant in Sudden Valley.

B. Geneva Area:

The Geneva water system includes:

- 15 miles of water distribution mains,
- 0.5 MG distribution reservoir
- Inactive 0.07 MG reservoir
- One mile long intertie with the Sudden Valley water system
- A transmission pump station (Beecher at Columbus Street)
- 7 pressure reducing valve stations, and
- Two distribution pressure booster stations (LID W-5 and South Geneva at Lake Louise Road).
- An emergency intertie with the City of Bellingham located on Lakeway Drive at Scenic Avenue (currently has a transmission booster pump stations but the District is investigating removing and replacing it with PRV since there is increased pressure on the City side.)

The current number of ERUs in Geneva is 1136. With approved reduced source criteria (and further decreases in demands, documented in the 2016 Water Use Efficiency Update [Appendix B]), the water supply source from Sudden Valley is adequate to supply the estimated full build-out of 1239 connections for Geneva.

A small distribution booster station was added in 1999 at Lookout Ave. / Coronado Ave. in the Geneva Area. The District received a request for water service from 5 single-family homeowners with failing individual wells. The booster station was required since the houses would not have adequate pressure due to their elevation relative to the existing reservoir and their distance from the water main. The homeowners formed LID W-5, plans were approved by DOH, and construction was completed in 1999.

A Developer Extension Agreement project added a booster pump station and approximately 2234 feet of 8-inch HDPE water main to serve existing and future development. The project was constructed in 2010. The booster pump station is located on Lake Louise Road and serves the area in the vicinity of Beecher Ave and 10th / 11th Streets (currently known as Lost Creek Ln.). The future plan is to construct a reservoir at the top of this highest pressure zone and convert the booster pump station to a transmission pump station to feed the future reservoir.

Whatcom County Coordinated Water System Plan

The District's Water System Plan is consistent with the Whatcom County Coordinated Water System Plan (September 2016). Specific areas of impact are discussed in the appropriate sections of this plan.

Lake Whatcom Watershed Protection Plan

The District's Water System Plan is compatible with the Lake Whatcom Management Program 2015-2019.

City of Bellingham Water System Plan

The District's Water System Plan is consistent with the City of Bellingham Water System Plan (2009 with update in 2013). The City of Bellingham is the wholesale water purveyor for the Eagleridge Water System. The City of Bellingham also provides water storage in its own tanks for the Eagleridge Water System. The City of Bellingham can also provide water to the Geneva area through an emergency intertie.

In accordance with the Whatcom County Coordinated Water System Plan Regional Supplement (CWSP), the District matches the minimum fire flow requirements of the City of Bellingham (the adjacent municipal corporation) for the District's Geneva and North Shore/Eagleridge areas.

Lake Whatcom Water and Sewer District's Sewer Comprehensive Plan

This Water System Plan is consistent with population forecasts of the District's Sewer Comprehensive Plan adopted in May 2014. DOE approval was received on June 6, 2014.

1.5 Existing Service Area Characteristics

Detailed information on the Area characteristics are included in Appendix N. The earlier Figure 1-1 showed the geographic relationship of all District territory subareas. The South Lake area has no District water facilities, and none are proposed within the planning horizon of this plan update.

1.6 Future Service Area

Service can be extended into Future Service Areas shown on Figure 1-1 if all other land use regulations are met. Over the past ten years, distribution system expansions have generally been limited to developer extension agreements or local improvement districts formed by resident petition.

The residences presently served by direct-draw from Lake Whatcom, private wells, or small water systems have been included in the planning forecasts. These residences are located on the north shore from the city limits to the end of North Shore Road, and on the south shore from Strawberry Point in Geneva to Sudden Valley, and along the northern section of Euclid Avenue. The residences on the north shore are discussed in Appendix C, and the residences along the northern section of Euclid Avenue (Glen Cove Water System) have expressed potential interest in consolidating. Grant applications have previously been submitted to investigate the Glen Cove consolidation feasibility, but the District was not one of the successful applicants.

Resolution 757 also outlines the procedure for establishing new temporary water systems within the District's borders. As a general rule, the District has declined to own and/or operate Group B water systems or Group A systems that were not constructed under developer extension agreements. One exception to this is the operation of the North Shore Johnson well, currently serving only two existing residences. The District may consider operating satellite/remote systems on a case-by-case basis for compelling public health reasons, and if doing so will not have a negative financial impact on other District ratepayers. The *Eagleridge Water System* and *Agate Heights Water System (aka Richalou Estates)* are isolated Group A systems created by developers to District standards and now owned and operated by the District.

Design and Performance Standards: The District has adopted minimum design and performance standards equivalent to or better than those in the Whatcom County Coordinated Water System Plan. The District's design and performance standards are defined in *Lake Whatcom Water and Sewer District Design and Construction Standards – September 2017 (Appendix H)*.

Surcharge for Outside Customers: The District currently has no out-of-District customers and no surcharge policy. If and when Outside Customers approach the District for service, the District will address the issue of surcharges.

Formation of Local Improvement Districts Outside Legal Boundaries: The District will evaluate LID's outside the legal boundaries on a case-by-case basis. If the District is approached about providing water service outside its boundary, it would determine the feasibility of the expansion and follow the guidelines outlined by the Whatcom County Coordinated Water System Plan.

Urban Growth Area (UGA): Within an Urban Growth Area, the District may extend water services with minimal permitting, although the District will not generally pursue system extensions unless a developer or group of landowners is willing to pay for the extension up front. If the extension will benefit additional future populations (either infilling on individual lots or future raw land developments), the developer is generally required to size the facilities for those anticipated populations, and is generally allowed to recover a proportionate sum via latecomer agreements with the District. The Geneva Area is the only District area that is part of an UGA (City of Bellingham). The District may consider up-front participation in a developer extension on a case-by case basis if a public health interest would be served by doing so.

Outside of the UGA, service extension requests will be considered on a case-by-case basis and governed by RCW 36.70A.110(4). The facilities will be designed to provide for rural population densities allowed by current zoning, and will be designed in accordance with good engineering practice. According to the Municipal Water Law, Attachment 8, "Rural governmental services' or 'rural services' include those public services and public facilities historically and typically delivered at an intensity usually found in rural areas, and may include domestic water systems, [and] fire and police protection services...Water service must be designated at the level of service designated appropriate by the local land use authority for that area."

borders, the District already has many of the powers associated with being an SMA, the Board affirmed their previous decision and will not seek SMA approval.

1.10 Conditions of Service (Duty to Serve)

The District's Administrative Code defines the conditions under which it will provide water service including having sufficient physical capacity and water rights, and consistency with local planning and District policies. The District has two documents that are used to procure new water services. The first is the Residential Water Permit Application for single residential requests. The second is the Developer Extension Agreement (DEA) which is used for system extensions by developers. These documents include Purveyor responsibilities, customer responsibilities, current connection fee schedule, consent agreements for inspection, maintenance, and repair activities, cross-connection control requirements, latecomer provisions and project-specific system design requirements in the case of developer extensions. Meter and material specifications are included in the District's design and construction standards. A copy of the Residential Water Permit Application and DEA template are included in Appendix G. The District's design and construction standards are included in Appendix H.

1.11 Complaints

The District's policy and process for dealing with complaints is described in detail in Section 6.8 – Customer Complaint Response Program.

Seasonal variation in water demand in Sudden Valley is very small. This can be seen in Appendix B, Exhibit 1 where summer demands are only about 10-20% higher than annual average demands. This is also demonstrated in the low MDD:ADD ratio of 1.34. The low seasonal variation in demand is consistent with the landscaping and forested nature of the community. Exhibit 1 shows that demand from all customer classes increased by a similar amount (roughly 10-20%) in the summer months.

Distribution System Loss (DSL) in Sudden Valley has decreased from 27.6% in 2005-2007 to 12.9% in 2012-2014. See Appendix B for further details and efforts toward minimizing DSL.

B. Geneva Area:

As of January 2017, the Geneva Area had 1,065 service connections and 1,132 ERUs. The estimated population is 3,056 (2.7 times the number of ERU's). The majority (90%) of the ERUs come from the "Residential" customer class, 4% of ERUs are of the "Multi Unit" customer class, and 5% are of the "Institutional" customer class.

Detailed analysis of water use was presented in the WUE Plan (Appendix B). In summary, the highest ADD for 2012-2014 was 152 gpd per ERU (2013). This assumes an estimated 100% full-time occupancy and is less than the 245 gpd per ERU approved in 1997 Source Criteria Reduction Report approved by Department of Health. To remain conservative but more realistic than the 245 gpd/ERU, a value of 175 gpd/ERU will be used for future projections. Because the conservation program is mature and this is a fairly low ADD relative to other water systems, this is the only ADD value used and there is no projection with additional conservation savings.

MDD for Geneva is based on daily readings of the Dutch Harbor intertie meter. The highest MDD for 2014-2015 was 322 gpd per ERU. This is significantly less than the MDD of 500 gpd per ERU approved in 1997. To move closer to actual demands but remain conservative, an MDD of 370 gpd/ERU is used for future projections.

Demand in the Geneva area demonstrates moderate seasonal variability. Exhibit 1 of the Water Use Efficiency Plan shows that summer demands are about 35% higher than annual average demands. The MDD:ADD ratio of about 2 is also in line with this observation. The summer demand increase of 35% is fairly consistent across all three customer classes.

Distribution System Loss (DSL) in Geneva has decreased from 11.0% in 2005-2007 to 9.1% in 2012-2014. See Appendix B for further details and efforts toward minimizing DSL.

C. North Shore Area - Eagleridge:

The District had 68 ERUs on the Eagleridge water system as of January 2017. The estimated population is 197 (2.9 times the number of ERUs). All of the ERUs are from the "Residential" customer class.

Detailed analysis of water use is presented in the WUE (Appendix B). In summary, water use for 2012-2014 shows a maximum ADD of 231 gpd per ERU. This is significantly lower than previous assessments, so to remain conservative but more realistic, an ADD value of 250 gpd/ERU is used for future projections (without

programs that are mature and water use is quite low, so demands with conservation savings represent current demands.

The minimum zoning outside of the Geneva UGA and the Sudden Valley LAMIRD is one lot per five acres (R5A). Whatcom County Code 20.32.252 Rural Residential Overlay allows higher density development with public water, but it only applies to areas designated Rural Neighborhoods in the Whatcom County Comprehensive Plan. ***There are no areas within the District that are designated Rural Neighborhood.*** Therefore, public water will not change the allowable density of any subdivision in the District.

A. Sudden Valley Area

The Sudden Valley Area is a residential area with a golf course and a small strip mall. There are no projected agricultural or industrial water needs. The Sudden Valley Community Association has its own water source for irrigation of the golf course. Future development in Sudden Valley is projected to consist of infill of vacant lots and may include restoring the SVCA Campground or development of private commercial lots near the Village Market.

Water Demand Forecasting: Water demand forecasting for Sudden Valley is summarized at the end of Section 2. The projected growth rate is based on the 2014 LWWSD Comprehensive Sewer Plan, which indicates a projected growth rate of 7 ERU/year for Sudden Valley and Geneva. The current analysis distributed 4 ERU/year to Sudden Valley and 3 ERU/year to Geneva.

The Sudden Valley build-out number of ERUs is based on the following information. In 2015, there were 2667 water ERUs. The Sudden Valley Community Association determined at this time that there were approximately 600 remaining vacant lots after many lots have either been consolidated or purchased by the community association. It is assumed that all future development will be single family residential with one ERU per vacant lot, putting build-out at 3267 ERUs.

The District holds Surface water rights equivalent to 3.4 cfs maximum instantaneous withdrawal, and a total annual withdrawal of 1,800 acre-feet for the combined Sudden Valley and Geneva areas.

B. Geneva Area

The Geneva area is primarily residential but has two schools and a church complex. There are no projected agricultural or industrial water needs.

Water Demand Forecasting: Water demand forecasting for the Geneva Area is summarized at the end of Section 2. The projected growth rate is as indicated above in the Sudden Valley demand forecasting with 3 ERU/year projected growth.

The Geneva build-out number is based primarily on the build-out analysis performed in the 2014 LWWSD Comprehensive Sewer Plan. This determined that build-out for the Geneva area would be 1219 ERUs. This analysis included all areas where water exists or could be extended to except for the area currently served by the South

D. North Shore - Agate Heights

The Agate Heights System is rural residential in nature. The existing system was designed to supply 52 ERUs.

Water Demand Forecasting: Water demand forecasting for the Agate Heights Area is summarized at the end of Section 2. The projected growth rate is as indicated above in the North Shore - Eagleridge demand forecasting with 2 ERU/year projected growth. This is not taking potential water system consolidation (as detailed in Appendix C) into account.

Tables are shown both without conservation savings and with projected conservation savings. The tables indicate that with the projected growth, the existing system capacity of 77 ERUs will not be reached in the 10 year planning period but may be reached in the 20 year planning period. The existing system capacity is not limited by water rights but by treatment as explained in Section 3.3.2.

Build-out for the Northshore Area Consolidation is also shown in the tables (See Appendix C for full description and discussion) because this would be served by the Agate Heights water source. As indicated in the table, this demand can be met either with or without conservation savings assuming the whole system will have the same demands as the Agate Heights system. This assumption may not be appropriate and is discussed in more detail in Appendix C.

The Agate Heights System is supplied by a well with a 60 gpm water right permit (G1-22681P), a 360 gpm water right permit (G1-22763P), and a 18 gpm water right certificate (G1-23449). The G1-22763P water right permit was allocated to the 10-inch Geisbrecht (Agate Heights) well through a water right transfer which was completed in 2003. Ownership of the G1-23449 Water Right Certificate was transferred from the Lake Whatcom Residential and Treatment Center to the District when the Center became a District water customer, and the Place of Withdrawal was changed to the 10-inch well.

SECTION 2

Water Demand Forecasting

SUDDEN VALLEY WATER SYSTEM

Water Demand Forecasting		With Conservation Savings (existing demand, conservation program is mature)	
	ERUs**	Total Average Volume -GPD (based on ADD= 150 gpd/ERU)	Maximum Daily Volume-GPD (based on MDD*= 250 gpd/ERU)
2016	2676	401,400	669,000
2017	2687	403,050	671,750
2018	2691	403,650	672,750
2019	2695	404,250	673,750
2020	2699	404,850	674,750
2021	2703	405,450	675,750
2022	2707	406,050	676,750
2023	2711	406,650	677,750
2024	2715	407,250	678,750
2025	2719	407,850	679,750
2026	2723	408,450	680,750
2036	2763	414,450	690,750
Full build-out	3267	490,050	816,750
Water Rights – Annual / Instant. (shared with Geneva)		Annual (Daily Avg) = 1,607,178 GPD Instantaneous = 2,197,472 GPD	

GENEVA WATER SYSTEM

Water Demand Forecasting		With Conservation Savings (existing demand, conservation program is mature)	
	ERUs**	Total Average Volume -GPD (based on ADD= 175 gpd/ERU)	Maximum Daily Volume-GPD (based on MDD*= 370 gpd/ERU)
2016	1136	198,800	420,320
2017	1132	198,100	418,840
2018	1135	198,625	419,950
2019	1138	199,150	421,060
2020	1141	199,675	422,170
2021	1144	200,200	423,280
2022	1147	200,725	424,390
2023	1150	201,250	425,500
2024	1153	201,775	426,610
2025	1156	202,300	427,720
2026	1159	202,825	428,830
2036	1189	208,075	439,930
Full build-out	1239	216,825	458,430
Water Rights – Annual / Instant. (shared with Sudden Valley)		Annual (Daily Avg) = 1,607,178 GPD Instantaneous = 2,197,472 GPD	

* ADD and MDD values are based on source data which includes distribution system leakage.

** ERU growth projections match 2014 LWWSD Comprehensive Sewer Plan
7 ERU/year for Sudden Valley and Geneva

SECTION 2

Water Demand Forecasting

NORTH SHORE /EAGLERIDGE WATER SYSTEM

Water Demand Forecasting	ERUs	Without Conservation Savings (Existing)	
		Total Average Volume -GPD (based on ADD= 250 gpd/ERU)	Maximum Daily Volume-GPD (based on MDD*= 800 gpd/ERU)
2016	68	17,000	54,400
2017	68	17,000	54,400
2018	69	17,250	55,200
2019	70	17,500	56,000
2020	71	17,750	56,800
2021	72	18,000	57,600
2022	73	18,250	58,400
2023	74	18,500	59,200
2024	75	18,750	60,000
2025	76	19,000	60,800
2026	77	19,250	61,600
2036	87	21,750	69,600
Maximum Number of ERUs**	85	21,250	68,000
City Connection – 150 gpm**	85	216,000 gpd	

NORTH SHORE /EAGLERIDGE WATER SYSTEM

Water Demand Forecasting	ERUs	With Projected Conservation Savings	
		Total Average Volume -GPD (based on ADD= 210 gpd/ERU)	Maximum Daily Volume-GPD (based on MDD*= 600 gpd/ERU)
2016	68	14,280	40,800
2017	68	14,280	40,800
2018	69	14,490	41,400
2019	70	14,700	42,000
2020	71	14,910	42,600
2021	72	15,120	43,200
2022	73	15,330	43,800
2023	74	15,540	44,400
2024	75	15,750	45,000
2025	76	15,960	45,600
2026	77	16,170	46,200
2036	87	18,270	52,200
Maximum Number of ERUs**	120	25,200	72,000
City Connection – 150 gpm**	120	216,000 gpd	

* ADD and MDD values are based on source data which includes distribution system leakage.

** Based on the City Connection limit of 150 gpm and Peak Hourly Demand, as calculated by Equation 5-1 from the DOH Water System Design Manual

3. System Analysis

3.1 System Design Standards

The District has adopted the Design Standards set forth in WAC 246-290-200 through 246-290-250 and the Whatcom County Coordinated Water System Plan (CWSP) (September 2016). The *Standards Incorporated by Reference* into the CWSP are also adopted by the District and incorporated into this Plan. The District's standards can be found in Appendix H.

LWWSD adopts and establishes the following standards for construction and operation of its Group A water systems.

PARAMETER	STANDARD		
	Sudden Valley	Geneva	North Shore
Water Quality	In accordance with the federal Safe Drinking Water Act (SDWA), DOH criteria specified in WAC 246-290, and Whatcom County CWSP, all as amended from time to time.		
Average Daily Demands	150 gpd/ERU	175 gpd/ERU	250 gpd/ERU (Eagleridge) 230 gpd/ERU (Agate Heights)
Maximum Daily Demands	250 gpd/ERU	370 gpd/ERU	800 gpd/ERU (Eagleridge) 500 gpd/ERU (Agate Heights)
Peak Hour Demand	Pressure zone – dependent	Pressure zone - dependent	Pressure zone - dependent
Storage Requirements: Standby	300 gallons/ERU	350 gallons/ERU	500 gallons/ERU (Eagleridge) 460 gallons/ERU (Agate Heights)
Fire Flow Rate and Duration	Res.: 500 gpm/60 min. Commercial/Condos: 750 gpm/60 minutes	750 gpm/60 minutes	Eagleridge and Agate Heights: 500 gpm/60 minutes
Minimum System Pressure	In accordance with WAC 246-290-230 and the Whatcom County CWSP		
Minimum Pipe Sizes	See <i>LWWSD Design and Construction Standards – 2017</i> .		
Telemetry Systems	PLC, PC-based, <i>Intellution</i> , open architecture SCADA		
Backup Power Requirements	Reviewed on a case-by-case basis.		
Valve Spacing	Every 500 feet.		
Hydrant Spacing	Every 600 feet.		
Other System Policies that Affect Performance and Design	See <i>LWWSD Design and Construction Standards – 2017</i> .		

were inspected in 2012 and found to be in good condition. The raw water pumps were replaced in 1992, and the motors were replaced/rebuilt in 2012. Capacity of the transmission main is sufficient. The intake pipe is 12-inch "Lock Tyton" pipe and extends 390 feet from the on-shore check valve vault. It is approximately another 260 feet to the water treatment plant. The intake is a three-foot by 30-inch diameter concrete pipe with metal inlet screens on both ends. The inlet is supported on concrete about 5 feet above the lake floor. The intake pipe is connected at the center bottom of the concrete pipe.

Treatment – The Sudden Valley Treatment Plant was upgraded in 1992 to increase raw water and transmission pumping capacities to match the capacity of the 2-MGD filtration system. Additional objectives included increasing the reliability of the plant and complying with the EPA's Surface Water Treatment Rules (SWTR). The plant is capable of producing 2 MGD of treated, disinfected water and delivering it to the distribution system, with 100% backup capacity of all pumping systems, and natural gas standby power capable of operating the plant at full capacity. The treatment plant is a direct filtration treatment plant with disinfection provided by gas chlorine.

Table 3.3-1 Sudden Valley Water Treatment Plant Pumps and South Shore Transmission / Booster Pumps		
Type of Pump	System Capacities	Current Operations
Raw Water	2 - 1400gpm each	700 gpm
Transfer	2 - 1400 gpm each	700 gpm
Transmission – Div. 7	2- 840 gpm @ 390 feet TDH each	840 gpm
Transmission – Div. 22	2- 700 gpm @ 608 feet TDH each	725 gpm
Transmission – Div. 30	2 – 170 gpm @ 520 feet TDH	168 gpm
Transmission – Geneva (Beecher)	2 – 150 gpm @ 135 feet TDH	268 gpm
Booster – South Geneva	2 – 41 gpm @ 255 feet TDH	42 gpm
Booster – LID W5	2 – 12 gpm @ 177 feet TDH	12 gpm

A baffled, welded steel, 0.22 MG above grade storage tank was constructed at the plant site in 1992 to provide disinfection contact time to meet SWTR requirements. Transfer pumps move the water from the clearwell to the contact time storage tank. The transmission pumps then pump water from the storage tank to the portions of the distribution systems that feed the Division 7 and Division 22 reservoirs.

to the CT reservoir. The transfer pump is a constant rate pump that pumps at 1400 gpm and operates based on an on and off level in the clearwell. The flow rate out of the CT reservoir is dictated by the transmission pump flow rates (either 725 gpm to Div 22 or 840 to Div 7). The greater of the flow in to or out of the CT reservoir (averaged over one hour) dictates contact time. The current average flow rate is 700 gpm based on the operating flow rate of the plant.

But if the plant were to be operated at 1400 gpm, the transfer pump would operate at 1400 gpm constantly and would not need to be cycled on and off. The transmission pumps to both Div 22 and Div 7 could be operated (and throttled to 700 gpm each) so that flow in and flow out of the CT reservoir were both 1400 gpm. As long as the above parameters were met (minimum level of 21.1 ft and chlorine concentration of 1.2 mg/L), the required CT would be provided.

The plant is typically operated at half its capacity, approximately 700 gpm. Because the transfer pump that pumps into the CT reservoir is a constant speed pump that pumps at 1400 gpm and is operates on and off while the plant is operating based on a float, the Department of Health has set a minimum contact tank depth of 16.5 ft (155,000 gallons) based on a flow rate of 1,000 gpm on a 60-minute basis. Options could be investigated to utilize additional water system components for the calculation of contact time. Because the plant pre-chlorinates with a low chlorine dose, additional CT could be calculated for the flocculation basin and filters. There is some pipe between the outlet of the CT tank and the first customer. There is a substantial length of pipe between the outlet of the CT tank and the first customer on the line going toward the Division 22 reservoir (approximately 23 minutes of hydraulic residence time). But there is much less pipe between the outlet of the CT tank and the first customer on the line going toward the Division 7 reservoir (approximately 2.5 minutes of hydraulic residence time). Because of the limited additional benefit of the 2.5 minutes of time toward the CT calculation, it would not be worth the cost to add monitoring stations at each of the two entry to distribution points.

The 2-MGD treatment train includes the following functions:

- Screened raw water pumping
- Addition of alum as flocculating agent
- Coagulation and flocculation
- Pre-chlorination
- Filtration
- Automated filter backwash (to equalization tank, then sanitary sewer)
- Filter to Waste (to sanitary sewer)
- Chlorine disinfection in baffled contact reservoir

A more detailed description of the treatment plant process is included in the *Sudden Valley Water Treatment Plant Operations Plan* (revised 2017).

Storage – The Sudden Valley Area includes three older and one new distribution reservoirs and a finished water reservoir for disinfectant contact time at the treatment plant. A second reservoir has recently been constructed at Division 22 to improve

appeared to be point loading of the pipe against rock, indicating improper or shifted bedding.

The 47 PRV stations are maintained annually, and are included in an on-going repair/replacement program. Replacing aging customer services is also part of the on-going maintenance program. Radio-read retrofit for all the residential service meters was completed in 2007. Retrofitting the radio-read meters for commercial services was completed around 2010.

Throughout the Sudden Valley water system, only minor distribution system deficiencies were identified. See Section 3.3.3, Hydraulic Models for a discussion of the distribution system and potential deficiencies.

TABLE 3.3-4 SUDDEN VALLEY AREA PIPE MATERIAL QUANTITIES		
Material	Range (Inches)	Length (Ft)
PVC	2	2,000
Ductile Iron/Cast Iron	3-12	219,196

B. Geneva Area:

Source – An intertie between the Sudden Valley and Geneva has been installed and is now the primary supply source to Geneva. The old City of Bellingham intertie remains in-place as an emergency backup. The City recently increased its operating pressure in the area by intertie such that the intertie can now be changed from a pump station to a PRV because the City pressure is higher than the operating pressure in Geneva. The water intakes for the City's surface water treatment plant and the District's Sudden Valley surface water treatment plant are approximately four miles apart.

Treatment – Sudden Valley source; See Sudden Valley section for treatment description. See City of Bellingham Water System Plan for treatment description for water fed through emergency intertie.

Storage – The Geneva Area has a single, welded steel, 0.5-MG reservoir located behind the District office at 1010 Lakeview Street. It has a base elevation of approximately 661.12 ft (NAVD88), a diameter of 52 ft, and a nominal height of 32 ft. As discussed above, the Division 22 reservoir is also serving part of Geneva. This eliminated the need for additional reservoir capacity in Geneva. See Section 3.3.2 for a discussion of storage capacities.

Distribution System – The distribution system in the Geneva Area is a mix of old and new water mains. With the completion of projects in 2000 to replace all old 2" galvanized waterlines, and completion of the service meter replacement program, distribution system losses in Geneva have been reduced.

The remainder of all known asbestos cement (AC) water main in Geneva was replaced in the summer of 2015 (approximately 12,000 ft of pipe). Now most of the

Treatment – The well water quality requires removal of manganese as a secondary contaminant. Manganese removal and a chlorine residual are provided by oxidation of the manganese with chlorine followed by filtration. A package filtration plant was installed to provide this treatment. See Agate Heights Operations and Maintenance Manual (incorporated by reference, updated in 2017) for additional details about this treatment system.

Storage – A 79,300 gallon reservoir was installed in 2000 to supply the Richalou Estates Development (now Agate Heights). This reservoir is made of concrete with a 30 ft diameter, 15 ft height, and base elevation 555.29 ft (NAVD88). A 105,700 gallon reservoir was installed in 2008 to supply the Lake Whatcom Residential Treatment Center and Agate Heights (formerly Richalou Estates). This reservoir is made of concrete with a 30 ft diameter, 20 ft height, and base elevation 824.04 ft (NAVD88). The system has four pressure zones. The 105,700 gallon reservoir directly feeds the treatment center, and it also feeds the zone including houses on Opal Terrace through a PRV. The 79,300 gallon reservoir is used as intermediate storage for the upper system and serves the lower connections, some of which are served by the hydraulic grade of the 79,300 gallon reservoir, and some of which are fed through a PRV in the lowest zone. See Section 3.3.2 for a discussion of the capacities of the storage tanks.

Distribution System – The transmission and distribution system consists of approximately 7,000 LF of 4- to 8- inch ductile iron mains. The pumps that pressurize the package treatment plant also pump the treated, disinfected water to the 79,300 gallon reservoir. With the 2008 improvements, the pressure booster system serving the highest pressure zone was converted to a transmission pump system to pump water from the 79,300 gallon reservoir to the 105,700 gallon reservoir. There are two PRVs to separate the pressure zones. See Section 3.3.3 for further discussion of the distribution system.

Table 3.3-5B Agate Heights Pumps		
Type of Pump	System Capacities	Current Operations
Lower Reservoir	2 – 30 gpm	29 gpm
Upper Reservoir	2 – 21 gpm at 274 feet TDH	21 gpm

3.3.2 System Physical Capacities

A. Sudden Valley: and

B. Geneva:

A detailed physical capacity analysis for Sudden Valley and Geneva can be found in Appendix A. The detailed analysis is summarized below. The recent addition of the new Division 22 reservoir is incorporated in to the analysis.

Appendix A demonstrates that the component that limits the physical capacity of the existing water system is storage. Water rights, pump capacity, treatment capacity, and

annual usage. Water rights are not a consideration because the City holds the water rights for the source. Treatment and storage capacity are also not applicable because the City provides these at the contract flow rate of 150 gpm. The distribution system is designed for fire flow, and residential demands are much lower and therefore the distribution system does not limit physical capacity. The only limiting factors are the contract flow rate of 150 gpm and the pumping capacity. A single residential pump can provide 150 gpm at approximately 20 psi pressure boost, and two residential pumps operating in parallel could easily supply more than 150 gpm. Therefore, pump capacity is not a limiting factor in the physical capacity of the system.

Given the contract limit of 150 gpm and the MDD of 800 gpd/ERU (without conservation savings), the existing 2017 system capacity is **85 ERUs** based on peak hourly demand, equation 5-1 from the DOH Water System Design Manual. Build-out for the Eagleridge subdivision and existing customers is 71 ERUs, so the system has capacity for 14 additional ERUs. If conservation savings is realized and MDD decreases to 600 gpd/ERU, the system capacity would be 120 ERUs based on peak hourly demand. This would then allow for 49 additional ERUs beyond the build-out of the Eagleridge subdivision without construction of additional water system facilities.

See Appendix C, the North Shore Water System Consolidation Feasibility study, for discussion of potentially consolidating the Eagleridge and Agate Heights water systems, with the Agate Heights well providing the water source for the combined system.

D. North Shore - Agate Heights:

The physical capacity of the Agate Heights system is analyzed in the same way the south shore system was analyzed in Appendix A. Water demands are discussed in Section 2.1 – MDD (without conservation savings) is 500 gpd/ERU, and ADD (without conservation savings) is 230 gpd/ERU.

Water rights are discussed in the beginning of Section 3 – in summary, the groundwater rights total 438 gpm instantaneous flow and a maximum annual volume of 506.9 acre-feet. Because the source must provide MDD for the system, the instantaneous water rights could serve 1261 ERUs. Based on ADD, the annual water rights could serve 1967 ERUs.

The existing pumping capacity and treatment capacity are the same at 30 gpm. In order for this to provide MDD, the maximum number of ERUs that could be served would be 86 ERUs.

See Table 3.3-6 for a summary of existing storage capacity for the Agate Heights water system. Note that dead storage only includes the 0.5 ft for the physical raised outlet at the base of the tank for both of the reservoirs. No additional dead storage is needed as both of the bases are substantially higher than 46 ft above the highest residence served (providing the required 30 psi at the service meter). Also note that standby storage is nested within fire suppression storage for the upper reservoir while fire suppression storage is nested within standby storage for the lower reservoir. The Fire suppression storage volume for the upper reservoir was set by the local fire

A. Sudden Valley: and

B. Geneva:

The hydraulic model for Sudden Valley and Geneva was updated since the previous water system plan update. Updates included infrastructure for all Developer Extension Agreements that have been constructed, updates to Maximum Day Demand (MDD) and Peak Hour Demand (PHD), and updates to PRV settings so that the model represents current settings and conditions. Pump curves were updated so that flow rates accurately represented measured flow rates. Fire flow demands were updated to include junctions with new hydrants. The new Division 22 reservoir was added to the model. Elevations were updated to be based on NAVD88 (which is now the vertical datum used by the City of Bellingham).

The modeling performed was for the full anticipated build-out population of Geneva and Sudden Valley based on existing infrastructure (infill of vacant lots). Build-out for Geneva is estimated at 1239 ERUs and build-out for Sudden Valley is estimated at about 3267 ERUs. Scenarios for less than full build-out were not assessed because the system currently has capacity for full build-out.

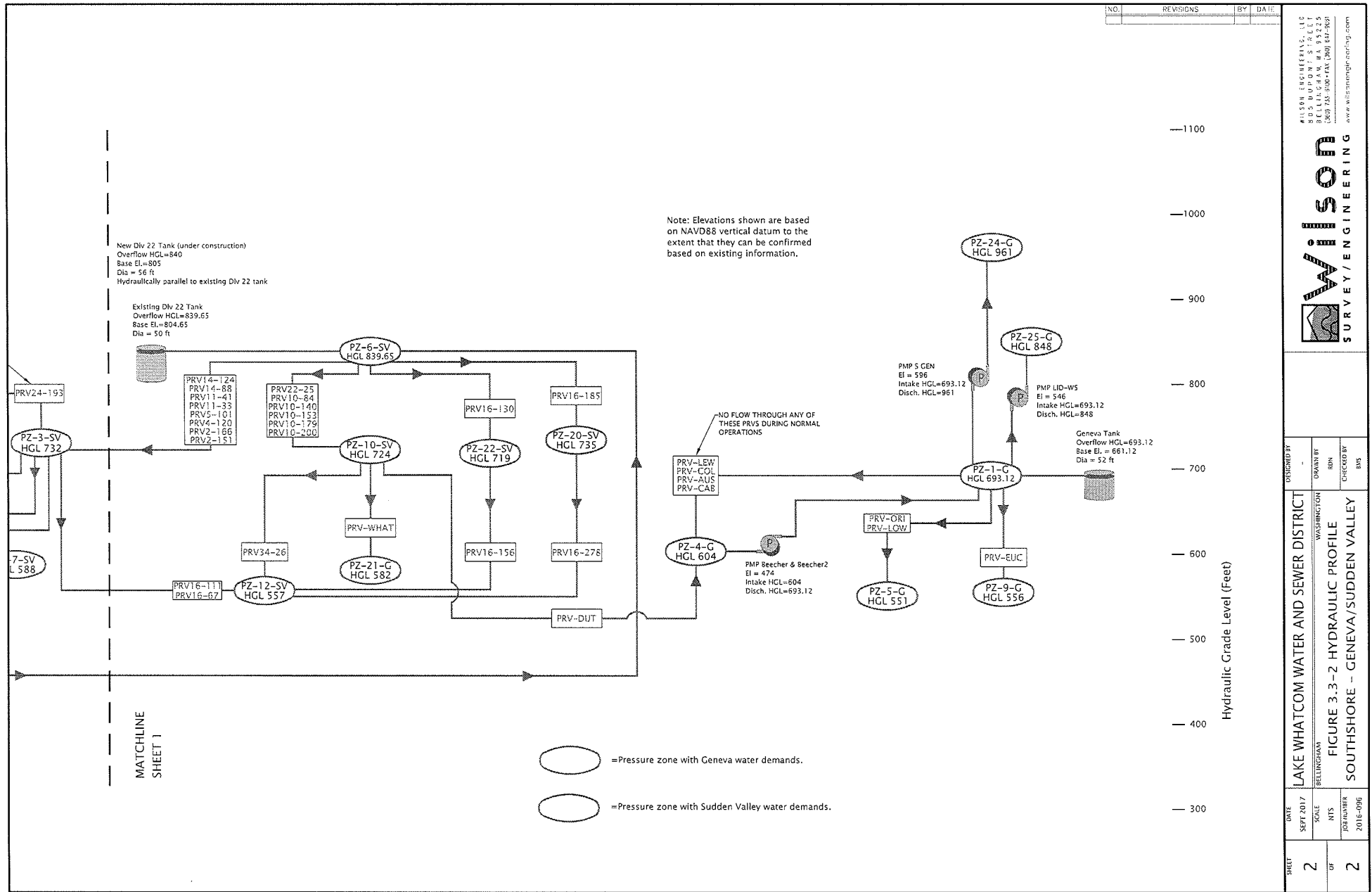
Summary Analysis Results Model results indicate that there is generally sufficient pressure and flow to meet the regulatory requirements of maintaining 30 psi during peak hour demand (PHD) and maintaining 20 psi under maximum day demand (MDD) plus fire flow at all current fire hydrants with some exceptions.

The original system was designed to previous State standards (20 psi residual pressure during PHD instead of the current 30 psi during PHD) and certain lots close to the reservoirs, or areas at elevations similar to the reservoirs, have less than 30 psi residual during peak hourly demand conditions. These lots qualify for reimbursement by the District for the purchase of a residential booster in accordance with District Resolution 410 (and Resolutions 721, 778, Administrative Code 4.2.1). Primarily because of the low pressures without fire flow, there are three fire hydrants that provide less than 400 gpm while maintaining 20 psi and roughly 30 hydrants that provide between 400 and 500 gpm while maintaining 20 psi. There are numerous hydrants that provide between 500 and 750 gpm while maintaining 20 psi. The District may consider labeling hydrants with capacities for this reason, as described further in Appendix E. Full results can be seen in Appendix E.

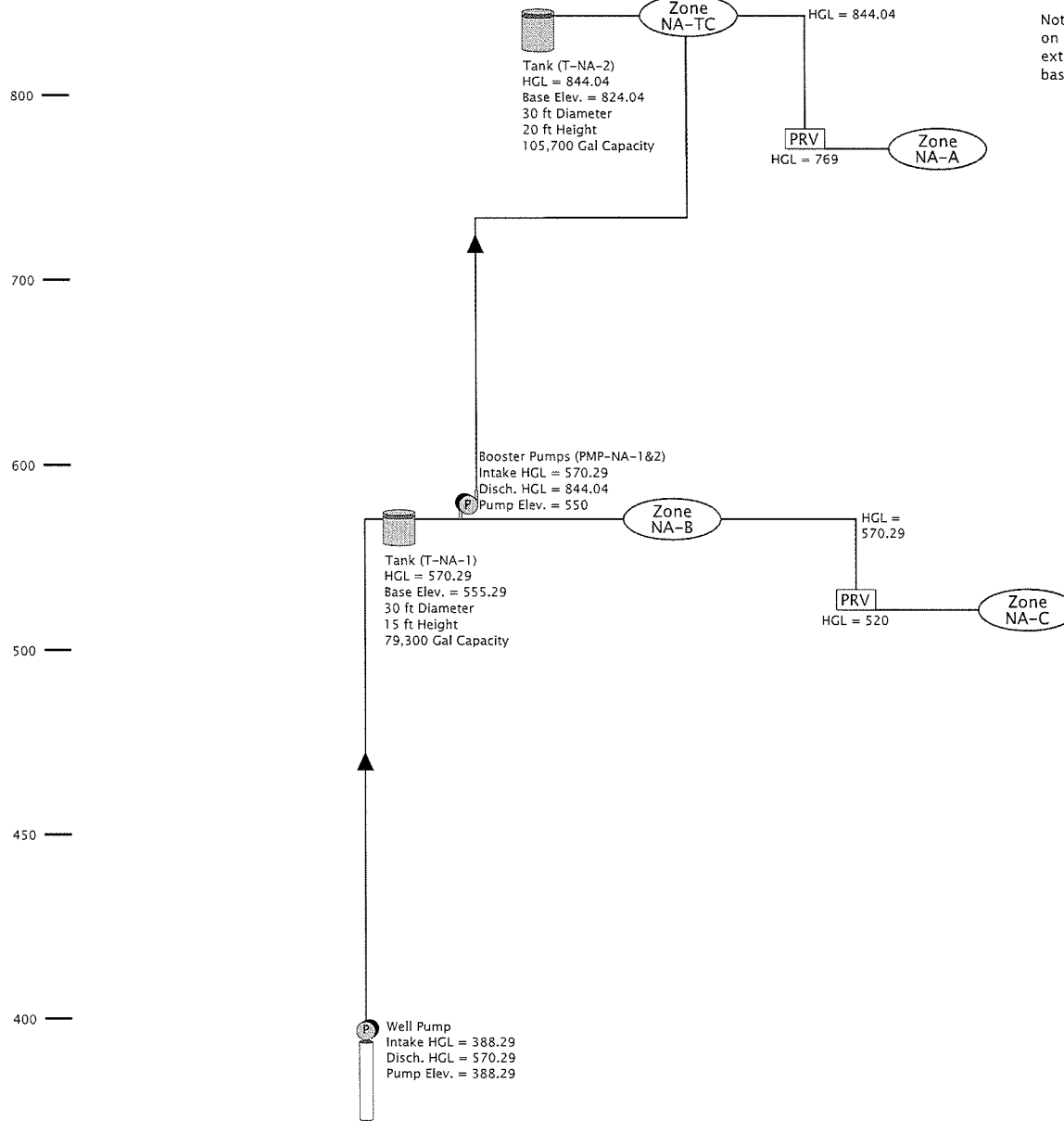
In the previous water system plan, there was an area in Geneva where the system pressure exceeded 100 psi and a portion of the distribution mains in the area were AC mains. Pressure Reducing Valves were installed at Lowell Ave. and Oriental Ave. in 2012 to remedy the high pressure Appendix E also shows that there remain many areas where pressure is between 100 and 140 psi. As of 2015, all known AC mains have been replaced with ductile iron or HDPE water mains, so water main breaks due to fragile pipe under high pressure is less of a concern. In addition, the District has a policy of requiring residential pressure reducing valves on all services (Resolution 784).

have indicated that larger pumps would aid in overall system operations. This upgrade will be coordinated with the proposed project to increase the capacity of the Agate Heights Water Treatment Plant.

Hydraulic profile schematics for the District's three Group A systems (South Shore, Eagleridge and Agate Heights) can be found on the following pages (Figures 3.3-2 through 3.3-4). There is no profile for the Johnson Well system since it only consists of a well and two services, and is not expected to expand.



Hydraulic Grade Level (Feet)



Note: Elevations shown are based on NAVD88 vertical datum to the extent that they can be confirmed based on existing information.

NO.	REVISIONS	BY	DATE

Hydraulic Grade Level (Feet)

Wilson SURVEY/ENGINEERING		WILSON ENGINEERING, LLC 1000 1st Avenue, Suite 100 Everett, WA 98201 (425) 731-4600 • FAX (425) 647-9086 www.wilsonengineering.com	
DESIGNED BY: [Blank] DRAWN BY: BVS CHECKED BY: [Blank]		PROJECT: LAKE WHATCOM WATER AND SEWER DISTRICT LOCATION: BELLINGHAM, WASHINGTON FIGURE 3.3-4 - HYDRAULIC PROFILE NORTHSHORE - AGATE HEIGHTS	
SHEET: 1 OF: 1	DATE: AUG 2017 SCALE: NTS JOB NUMBER: 2016-096		

- Provisions or Limiting Conditions – Supply is limited to 150 gpm domestic, 750 gpm fire flow by agreement with the City of Bellingham.

D. North Shore - Agate Heights:

- Source Type – ground water
- Source Location – Section 24, Township N. 38, Range 3E W.M., Whatcom County
- Purpose of Use – domestic water supply
- Place Of Allowed Use – land within boundaries of LWWSD
- Current Place Of Use – See Retail Service Area, Figure 1-1
- Time Of Use – No limits
- Provisions Or Limiting Conditions – N/A.

3.4 Summary of System Deficiencies

The system analyses did not identify any major deficiencies in any of the service areas. The system deficiencies identified are more areas that could be improved, and are summarized in the following table.

Table 3.4-1 Summary of System Deficiencies				
	Sudden Valley Area	Geneva Area	Eagleridge	Agate Heights
Source	Replace pumps ; improve communications and security	Convert emergency intertie to PRV	None	Improve security; small maintenance tasks (6.10)
Treatment	Replace alum tank; switch disinfection; maintenance tasks (6.10)	N/A	N/A	Additional treatment capacity needed with system expansion
Storage	Reservoir seismic upgrades; Reservoir recoating	Reservoir seismic upgrades; Reservoir recoating; South Geneva reservoir	N/A	Additional storage needed with system expansion
Distribution System	Consider decommissioning some PRVs; install pressure monitoring	Consider decommissioning some PRVs; install pressure monitoring	Consider removing the three low flow pumps and possibly fire pumps	Replace transmission pumps

containment in case of a leak. The replacement tank should include secondary containment to be able to contain the full tank volume in case of a leak.

The only entrance and exit to the WTP building is a man-door, which is not large enough to accommodate a new tank. The treatment plant building will likely need to be retrofitted with a roll-up door to facilitate this project and any future replacement of large equipment in the treatment plant.

Water Treatment Plant Chlorination System – The Sudden Valley Water Treatment Plant currently uses gas chlorine for disinfection. Gas chlorine requires stringent safety protocol to prevent operator and public health emergencies, and while LWWSD has not experienced any problems with the existing system, switching to a liquid sodium hypochlorite system would present a lower safety risk.

Liquid sodium hypochlorite could be delivered in bulk to a storage tank in the SVWTP, or on-site sodium hypochlorite generation equipment could be purchased. A pre-design phase should examine these two alternatives, in addition to comparing the costs and risks to the current gas chlorine system. Risks of leaks, O&M costs, capital costs, reliability, and potential differences in finished water quality (disinfection by-products) should be included in the alternatives analysis.

It may be possible to design a system that used bulk delivery initially and could later be modified to include on-site generation. Bulk delivery and on-site generated sodium hypochlorite have different concentrations (12.5% for bulk delivery, 0.8% for on-site generation), but the storage volume required for either may be similar since more active chemical needs to be stored for bulk delivery than for on-site generation.

Distribution System – As the hydraulic profile indicates, there are many connections between pressure zones that have a large number of PRVs connecting two adjacent pressure zones. Having more than two or three PRVs connecting two pressure zones is generally overly redundant and results in excess maintenance costs. Having too many PRVs also increases the risk that one may fail and over-pressurize the lower zone. The District is investigating decommissioning some of these redundant PRVs.

The many pressure zones in the South Shore system do not have the pressure continually monitored. This would be helpful to determine if a PRV has failed. The District may consider strategically adding pressure monitoring to closed zones (those not directly fed from a reservoir).

Storage – With the addition of the new, second reservoir at Division 22, the South Shore system has sufficient storage for anticipated build-out within the extents of the existing infrastructure.

The Reservoir Seismic Vulnerability Assessment Report details recommended improvements to all of the storage reservoirs in Sudden Valley and Geneva. Before moving forward with performing these improvements, it would be worthwhile to perform an alternatives analysis to compare making seismic and coating

active and functional so that the connection could serve the Geneva area when the 0.5 MG Geneva reservoir is out of service for cleaning/maintenance. As discussed above, making the connection active and functional will require replacement of the existing pump with a PRV.

Distribution - To the best of their knowledge, the District has now replaced all AC water mains. Budgetary numbers are included in the ten-year capital facilities plan for additional distribution system improvements such as replacing fire hydrants, blowoffs, air-release valves, and sample stations.

Expansion of Service Area – The District may investigate serving additional areas that have already been developed in the Geneva area. There have been preliminary discussions of consolidating with the Glen Cove water system to the North of the existing service area along Euclid Avenue. The District may also investigate expanding to serve the residences along Lake Whatcom Boulevard between Strawberry Point and Sudden Valley.

C. North Shore - Eagleridge:

Storage – The existing Eagleridge water system currently relies on storage provided by the City of Bellingham. It is anticipated that this will remain until the Eagleridge system is consolidated with the Agate Heights system. See Appendix C for more information on the North Shore Consolidation study.

Distribution - The District will need to replace the pumps and controls at Eagleridge if they are not able to rely on City pressures for normal demands, and/or fire flows.

D. North Shore - Agate Heights:

There have been inquiries over the years by individual residents regarding the possibility of expanding the public water system on the North Shore. Several individual wells and Group B systems suffer seasonal shortages of water. See Appendix C for a thorough discussion on the potential for consolidation of the north shore water systems. In general, the Agate Heights well source has sufficient capacity and water rights to serve all of the development along North Shore Road, including Eagleridge and existing private Group A and Group B water systems. This would require new pipe and additional treatment and storage capacity depending on the extent of the consolidation.

A three phase approach to the consolidation is envisioned. The first phase would replace the existing treatment plant with one with twice the existing capacity and multiple filter units. This would switch the system's limiting capacity factor from treatment to storage and would allow for over 50 additional connections.

A second phase may include extending the distribution main to the two closest Group A water systems and would include adding a storage reservoir and a second water treatment plant module.

A third phase may include extending the distribution main to the west to connect to the Eagleridge system and potentially to the east to the end of North Shore Road. This

4. Water Resource Analysis

4.1 Water Use Efficiency Plan Development and Implementation

The District has had a conservation plan in effect since 1988. The District adopted its current Water Use Efficiency Plan in February 2016. The Plan outlines current and future water conservation measures and relevant data. The WUE plan is incorporated here in Appendix B.

The Sudden Valley area had a history of high levels of distribution system losses. The 3 year average distribution system losses (DSL) (2005-2007) were 27.59%. The District has taken actions to decrease DSL, and the 2012-2014 3 year average DSL was 12.86%. Current goals for further improvements in water use efficiency for Sudden Valley include reducing DSL to less than 10%, reducing summer peak usage to 55 gallons per capita per day by 2020, and reducing average annual usage by 2% by 2020. Because current DSL is greater than 10%, the District is implementing water use efficiency measures as detailed in Appendix B.

The Geneva area's 3 year average DSL for 2012-2014 was 9.1%. Current goals for water use efficiency include maintaining less than 10% DSL, reducing summer peak usage to 65 gallons per capita per day by 2020, and reducing average annual usage by 2% by 2020. After replacing over 12,000 feet of asbestos concrete mains in 2015, the District anticipates the DSL to continue going down.

Distribution system losses in North Shore - Eagleridge have been minimal, averaging 2.87% from 2012 to 2014. Current goals for water use efficiency include maintaining low DSL, reducing summer peak usage to 100 gallons per capita per day by 2020, and reducing average annual usage by 10% by 2020.

The North Shore - Agate Heights distribution system losses in 2012-2014 averaged 2.83%. Current goals for water use efficiency include maintaining low DSL, reducing summer peak usage to 75 gallons per capita per day by 2020, and reducing average annual usage by 10% by 2020.

The decreases in distribution system losses is a result of the concerted effort by the District and show the effectiveness of their water use efficiency plan.

4.2 Source of Supply

A. Sudden Valley Area:

The District does not anticipate pursuing additional water rights for the Sudden Valley Area within the next 20 years. The District received Department of Health approval in 1996 for a reduction in source criteria and documented further decreases in water demand that should allow the existing water rights to support full build-out (Appendix B). The Sudden Valley Community Association actively pursued population density reduction in the watershed by acquiring and restricting properties, and reducing dues for consolidated lots. As of August 2015, 1439 of the original lots have either been purchased by the Sudden Valley Community Association and placed under restrictive covenant or consolidated with other lots, which allows the water rights to adequately service full build out (including the Geneva area).

4.3 Interties

Existing Interties

A. Sudden Valley :

Sudden Valley has an intertie with Geneva, which is used to supply Geneva. This is a connection between two District service areas that are now considered one water system (with one DOH system ID number).

B. Geneva :

The Geneva water source is an intertie with the Sudden Valley. The location is from Topper Drive, along Dutch Harbor Road, connecting at Lake Whatcom Blvd., near Strawberry Point. There is also a back-up, emergency intertie with the City of Bellingham, which used to be the primary supply to Geneva. The emergency intertie is located on Lakeway Boulevard at the City limits (Scenic Ave).

C. North Shore - Eagleridge:

The water source for the Eagleridge Water System is an intertie with the City of Bellingham. It was first used in 1989. Its purpose is to supply water to the Eagleridge Water System. The physical capacity of the intertie is 750 gpm and is limited by agreement with the City. The District's Eagleridge booster station currently has the combined capacity to pump 750 gpm (to meet fireflow requirements). The intertie agreement is included in Section 10.2 – Agreements.

D. North Shore - Agate Heights:

There are no existing interties between the Agate Bay water system and the Johnson Well.

New Intertie Proposals

A new intertie between the Agate Heights water system and the Eagleridge water system would be considered if there is sufficient interest in a public water system in the North Shore area. This would be an intertie between two separate District water systems, and would most likely result in the discontinuation of purchasing water from the City of Bellingham. This scenario was explored in detail in the North Shore Consolidation Feasibility study (Appendix C).

4.4 Reclaimed Water Opportunities

Lake Whatcom Water and Sewer District currently sends all sewerage collected to the City of Bellingham for wastewater treatment. Since the District does not have any facilities to process wastewater, and the City's treatment plant is over 8 miles from the District's service areas, there are no immediate opportunities for implementing reclaimed water use within the District. The City currently has no plans to implement any reclaimed water projects. It is unlikely that the District will pursue any reclaimed water projects in the next ten years.

The District did include advanced wastewater treatment as one of the alternatives evaluated in the Final Environmental Impact Statement for South Shore Sewage

5. Source Water Protection

5.1. Wellhead Protection Program

The North Shore Area is the only District facility with a well as a Group A water source. The Wellhead Protection Plan has not been reviewed or revised since it was first completed (in 1999). It is recommended that the District review this information every 10 years to verify that land uses have not changed within the wellhead protection area and to ensure that all current property owners have been notified. This is being addressed by the District in the near future.

5.2. Watershed Control Program

The District is a member of the Planning Unit for WRIA 1 and is a member of the Water District Caucus. The District also works with Whatcom County PUD and Whatcom County small cities on water supply coordination and consistency.

The District has actively participated in preparation of the regional watershed control program via the Lake Whatcom Management Program along with the City of Bellingham and Whatcom County. In May 1998, the "Interlocal Agreement Between the City of Bellingham, Whatcom County, and Water District 10 Concerning Joint Management of Lake Whatcom" was adopted. The on-going efforts of the Lake Whatcom Management Program are documented in the five-year Work Plans and updated annually. The District also participates financially in the Lake Whatcom Tributary Monitoring program, led by Whatcom County.

5.3. System Improvements Analysis, Priority, Alternate Selection

There were no water system improvements identified that are associated with the North Shore - Agate Heights Wellhead Protection Plan or the Regional Watershed Protection Plan.

6.3 System Operation and Control

The District's water system operation and control can be divided into two categories: Water Treatment, and Distribution/Transmission. The District operates the Sudden Valley Water Treatment Plant (SVWTP) which serves the Sudden Valley area and Geneva area; and the Agate Heights Water Treatment Plant (AHWTP) which serves the North Shore - Agate Heights area. Source water for Eagleridge is purchased from the City of Bellingham. The operation and control of the SVWTP is described in detail in the *Sudden Valley Water Treatment Plant Operations Plan* (revised April 2017). The operation and control of the AHWTP is described in detail in the *North Shore Well and Water Treatment System Management and Operations Manual* (revised April 2017). These documents cover the identification of major system components, routine system operation, preventive maintenance program, and equipment, supplies and chemical listing for the water treatment plants, and are incorporated here by reference.

System Operations and Control for the Distribution/Transmission for the water systems in the District's Areas can be addressed together. The District Engineer is responsible for planning routine and preventive maintenance activities. The Tables below summarize the daily, weekly, monthly, and annual activities associated with the major system components. Routine operations also include utility locates, service installations, investigation of customer complaints, and real estate/rental closings on an as-required basis.

Table 6.3-1. Routine System Operations				
Major System Component	Daily	Weekly	Monthly/Bi-monthly	Annual
Master Meter (Agate, Eagleridge, Dutch Harbor)	Record meter reading			
SCADA/Chart Recorders	check data	replace chart		
Pump Stations (Agate, Eagleridge, Lookout, Div 30)		visual inspection, pump operation check		
Generators (Agate, Eagleridge, Div 30)		automated test		
Reservoirs (Agate, Geneva, Sudden Valley)		visual inspection		
Distribution mains (all)	CI residual test	Coliform sample		
Meters (all)			Meter reading (Bi-monthly)	
Maintenance Planning			Monthly calendar	Annual plan

Monitoring Well Levels

The Agate Heights (a.k.a. Giesbrecht) 10-inch well is an artesian well and therefore does not have a traditional well level to be monitored. The District does have a pressure gage on the well supply and they record the static pressure periodically.

The Johnson well is also an artesian well and only has two services connected. Monitoring will not be performed at that location unless use increases.

Summary of System Reliability Efforts by Area

A. Sudden Valley Area:

Source Reliability – The intake depth and location in Basin 3 provides high confidence in the reliability of the water quality and quantity. Lake Whatcom water quality has been, and continues to be, extensively monitored by the City of Bellingham and other groups. The District's Final Environmental Impact Statement (1997) for South Shore Sewage Alternatives presented an extensive literature review of water quality monitoring results.

Water Right Adequacy – Assuming historic usage patterns remain constant, the existing permitted and certificated water rights (shared with Geneva area) are adequate for the current 20-year planning period, and should be adequate for full build-out. (See Section 2.2) On a state-wide basis, the Department of Ecology may attempt to recall portions of certificated water rights not already put to actual beneficial use. Such an agency action might impact the District's ability to make long range commitments to serve vacant, platted lots. The extent of such potential problems and resolutions cannot be predicted at this time because the District has a combination of certificated and permitted water rights.

Facility Reliability – The Sudden Valley water system was originally designed to provide 500 gpm of fire flow throughout the system. The District goals are to meet the standards of the Whatcom County Coordinated Water System Plan (CWSP) - 500 gpm for 60 minutes for UR3 and RR2 zoning; and 750 gpm for 60 minutes for commercial and URM12 zoning. The current system can meet these fire flow requirements on top of the buildout projected Maximum Daily Demand (MDD) for most of the fire hydrants. The Area also includes R5A and Rural forestry zoning for which there is no fire flow requirement in the CWSP.

All water booster stations have redundant pumps and standby power for facility reliability.

B. Geneva Area:

Source Reliability – The water source for Geneva is the same as Sudden Valley, see above for detailed information. An emergency intertie with the City of Bellingham also exists as backup. The City draws its water from Lake Whatcom. Reliability of source water quality is the purview of the City of Bellingham.

Water Right Adequacy – Assuming historic usage patterns remain constant, the existing permitted and certificated water rights (shared with Sudden Valley area) are

Facility Reliability – There were no issues identified with regard to facility reliability associated with the Agate Heights Water System. The Agate Heights water system is capable of providing fire flow capacity of 500 gpm.

6.6 Sanitary Survey Findings

South Shore

The Department of Health performed a sanitary survey of the South Shore water treatment plant in August 2017. This survey did not identify any significant deficiencies or findings. It did recommend items for follow-up action.

One recommendation was to consider adding flow meters in to and out of the CT reservoir to more accurately calculate the T portion of the CT calculation for disinfection. The flow rate out of the CT reservoir is currently measured with flow meters on the transmission lines to Division 7 and Division 22. Adding a flow meter on the pipe flowing in to the CT reservoir would allow the CT calculation to be more accurate in that it could use whichever flow rate was larger (in or out of the CT tank) to calculate the hydraulic residence time. However, using only the flow rate out of the tank will always be either accurate or conservative in the calculation of hydraulic residence time. The cost to add a flow meter on the pipe coming in to the CT tank would not be justified because the currently measured flow rate out of the CT tank is sufficient for the calculation.

Other recommendations in the sanitary survey letter included investigating techniques to lower backwash water use, and investigating Extended Terminal Subfluidization Wash (ETSW).

North Shore - Agate Heights

The Department of Health performed a sanitary survey of the Agate Heights water system in August 2017. The survey did not identify any significant deficiencies or significant findings, but it did identify one observation and two recommendations.

The observation was that the Wellhead Protection Plan has not been reviewed or revised since it was first completed (in 1999). To address this, it was recommended to review this information on some routine schedule to verify that land uses have not changed within the wellhead protection area and to ensure that all current property owners have been notified. This is being addressed by the District in the near future.

The recommendations are that the insulation around the well be cleaned up and re-done if it is still needed, and that the unknown conduit entering the well head be investigated. These maintenance items are added in Section 6.10 below.

- reservoir levels
- equipment maintenance records
- customer service requests
- customer complaints and inquiries
- rainfall

The District follows a formal records retention schedule detailing the type of records, the required statutory retention period, and the District retention period. The District also maintains an active file index and an inactive/archive records index. The Records Retention Policy is incorporated here by reference.

The water plant operator is responsible for scheduling and conforming to all DOH reporting requirements.

6.10 O & M Improvements

The District's asset management program tracks the condition and remaining useful life of the District's assets and assesses maintenance needs to maximize the value of the assets. Some of the more significant maintenance and operational improvements are discussed below.

Sudden Valley and Geneva:

Treatment Plant Maintenance

There are a number of recommended maintenance items within the Sudden Valley Water Treatment Plant, described below.

1. Have a concrete inspector inspect cracks in the concrete walls and inspect the clearwell basin below the filters.
2. Address relatively minor corrosion problems in the upper portion of the flocculation tank.
3. The filter media should be investigated. Media could be sampled throughout the depth of the filter to see if there is any bacterial fouling (unlikely with pre-chlorination), deposition of mineral deposits, or rounding of the media. Media characteristics could be compared to AWWA Standard B100. If the media was sufficiently out of the specification, replacement should be considered. The media has not been replaced in many years, if it ever has. The filter underdrains should also be inspected.
4. Replace hydraulically activated flow control valves (Cla-val) with electronically controlled flow valves (to have better control of flow rate going to filters)
5. Replace all 1720E Hach turbidimeters (either with new Hach turbidimeters or other) (1720E stopping being produced)
6. Replace Hach 9184 chlorine analyzers

7. Distribution Facilities Design and Construction Standards

7.1 Project Review Procedures

For District-initiated projects, the District's project engineer prepares the project reports and construction documents and conducts an internal quality assurance review. The District's staff engineer performs an independent review of the work completed by the project engineer. The District's senior field staff review distribution system plans to confirm that existing system information is correctly shown, and proposed connections are feasible with respect to valve arrangements.

The District's General Manager also reviews project documents to assure that general District goals have been addressed by the project. The General Manager's review is not intended to be a detailed engineering design review such as that performed by the Department of Health project engineer.

For projects covered by Developer Extension Agreements, the developer's engineer prepares the project reports, plans and construction documents, and the District's engineer reviews them. If the project includes more than water distribution mains, the project reports, plans and construction documents are sent to the State Department of Health for review and approval.

The District requests advance approval of their design and construction standards in order to be eligible for project review exception for distribution main projects. This request is noted on the District's water system plan review application.

7.2 Policies and Requirements for Outside Parties

The District's design and construction standards apply to outside parties and include requirements for utility easements and pipe looping. The District has adopted a standard Developer Extension Agreement (DEA) template (included in Appendix G). Each application to enter into a DEA is evaluated against the District's Comprehensive Plans to determine specific requirements that may be imposed, and against Resolutions that may require special fees.

7.3 Design Standards

The District's design and construction standards are included in a stand-alone document titled *Lake Whatcom Water and Sewer Design Standards and Construction Standards and Details – December 2017*. The District requests concurrent DOH approval of these updated design and construction standards, included herein as Appendix H.

7.4 Construction Standards

See 7.3 above and Appendix H.

8. Improvement Program

8.1 Prioritizing Potential Improvements

8.1.1 Identification of Potential System Improvements

The District has compiled a Capital Improvements Plan which is used to track needs, scheduling, and completion of all projects and major activities for the water and sewer missions of the District.

The Capital Improvements Plan list is included in Appendix I – Capital Improvements Plan. This list includes all planned water projects and the proposed schedule for implementing the projects.

Improvement projects are identified and discussed in Section 3.5 of this water system plan.

8.1.2 Assessment of Alternatives

The projects identified in Section 3.5 and the Capital Improvement Plan in Appendix I include descriptions of alternatives that should be assessed as appropriate. The reservoir projects are especially in need of a detailed alternatives analysis comparing rehabilitating the existing reservoirs to building new reservoirs. The project to switch from gas chlorine to liquid sodium hypochlorite should also include a pre-design phase in which alternatives are assessed, as described in Section 3.5.

Most of the other projects listed in the Capital Improvements Plan do not require analysis of alternatives so much as a balancing any emerging urgency of need with the District's ability to respond and pay for it at an appropriate level of rates and charges. Most of the projects listed are to replace aging infrastructure which will be done in accordance with the District's standards. For those larger projects that do need an analysis of alternatives, a pre-design report will be prepared specifically for each project.

Since the District does not initiate developer projects (DEAs), it also does not assess alternatives for DEAs in advance. The schedule for these projects will depend upon the developer's assessment of market demand, cost, and the ability to obtain environmental permits and approvals. When they occur, development projects will be required to fit into a framework that improves, rather than hampers, the District's ability to operate in the public interest, safely and cost-effectively.

8.1.3 Selection of Alternatives

Since there are many factors involved in the sizing, site selection, operational issues, and reservoir allocation, a specific alternative for reservoir rehabilitation (seismic upgrades, re-coating) vs replacing with smaller reservoirs for the Geneva reservoir has not been selected at this time. A detailed analysis will be conducted and included in the Project Report when the project is undertaken. A preliminary alternatives analysis was completed for Division 7 (Appendix J).

9. Financial Program

Lake Whatcom Water and Sewer District is a public water system with 1,000 or more connections, not regulated by the State Utilities and Transportation Commission.

9.1 Past and Present Financial Status

Summaries of the District's operating income and expenses for the past 6 years are included in Appendix F – Financial Data. The reader should note that the District balance sheet includes a large amount of depreciation, and it does not operate with negative cash flow.

The District's 2016 and 2017 operating budgets are also included in Appendix F – Financial Data.

The District's past and present plan for financing major water system improvements is to use a combination of revenue from water rates (General Fund), connection fees (Construction Fund), Utility Local Improvement Districts (ULIDs), and Developer Extension Agreements (developer financed). Both revenue bonds and low-interest Drinking Water State Revolving Fund and Public Works Trust Fund loans have been used for cash flow to construct projects. The long-term debt for both sources is retired with a combination of General Fund (existing customer) and Construction Fund (future customers) moneys.

9.2 Available Revenue Sources

Anticipated revenue sources for making system improvements include connection fees, water rates, utility local improvement districts and developer extension agreements.

9.3 Allocation of Revenue Sources

The District has a combined rate structure applied to all service areas, replacing the previous area-specific rate structure. The District's sewer system rate structure has been combined for all areas since approximately 1994.

The Capital Improvement Plan includes an assessment of the beneficiaries of each improvement and allocates costs by new vs existing customers. Connection fees are used to pay for improvements that benefit new connections; water rates are used to pay for improvements that benefit existing customers; Developer Extension Agreements pay for system extensions/improvements that benefit development (typically new subdivisions or extensions to previously unserved areas). The costs to construct and /or operate improvements that benefit more than one customer class are allocated on a percentage benefit basis.

9.4 Program Justification

Projected revenue requirements are included in the most recent Capital Improvement Plan draft dated November 2017. For District-funded projects, the District has the ability to secure these funds through assessment of rates and charges. Developer extensions are funded directly by the developer, and the District requires a

Table 9.5-1 Detailed Water Utility Results

Operating Reserve Summary	2016	2017	2018	2019	2020	2021
Summary of Existing Operations Before Rate Increases						
Rate Revenues Under Existing Rates	\$ 2,096,538	\$ 2,101,779	\$ 2,107,034	\$ 2,112,301	\$ 2,117,582	\$ 2,122,876
Non-Rate Revenues	52,639	53,217	52,731	52,753	52,926	53,159
Total Revenues	2,149,177	2,154,997	2,159,765	2,165,054	2,170,508	2,176,035
Total Expenditures	(2,048,481)	(2,441,846)	(2,530,651)	(2,601,175)	(2,694,618)	(2,770,248)
Cash Surplus / (Deficiency)	\$ 100,696	\$ (286,849)	\$ (370,886)	\$ (436,121)	\$ (524,110)	\$ (594,213)
Annual Rate Increase		8.75%	8.50%	4.00%	4.00%	4.00%
Cumulative Rate Increase		8.75%	17.99%	22.71%	27.62%	32.73%
Revenues After Rate Increases						
Rate Revenues (Before Rate Increases)	\$ 2,096,538	\$ 2,101,779	\$ 2,107,034	\$ 2,112,301	\$ 2,117,582	\$ 2,122,876
Additional Revenue from Rate Increases	-	183,906	379,134	479,778	584,919	694,752
Other Revenues & Interest	52,639	53,217	52,731	52,753	52,926	53,159
Total Revenues With Rate Increases	\$ 2,149,177	\$ 2,338,902	\$ 2,538,900	\$ 2,644,832	\$ 2,755,427	\$ 2,870,787
Expenses & Transfers						
Cash Operating Expenses	\$ 1,790,638	\$ 1,893,879	\$ 1,955,386	\$ 2,019,294	\$ 2,085,712	\$ 2,154,754
Existing Debt Service	257,843	347,967	345,569	342,411	359,663	356,479
New Debt Service	-	-	19,697	19,470	19,242	19,015
System Reinvestment Funding	-	200,000	210,000	220,000	230,000	240,000
Additional Taxes After Rate Increase	-	9,249	19,067	24,128	29,416	34,939
Transfer of Surplus to Capital	-	-	-	-	-	-
Total Expenses	\$ 2,048,481	\$ 2,451,094	\$ 2,549,718	\$ 2,625,303	\$ 2,724,033	\$ 2,805,187
Additions / (Subtractions) to Operating Reserve	100,696	(112,192)	(10,818)	19,529	31,394	65,599
Impacts to Operating Reserve						
Beginning Operating Balance	\$ 441,527	\$ 542,223	\$ 430,031	\$ 419,213	\$ 438,741	\$ 470,135
Net Cash Flow After Transfers to Capital	100,696	(112,192)	(10,818)	19,529	31,394	65,599
Ending Operating Balance	\$ 542,223	\$ 430,031	\$ 419,213	\$ 438,741	\$ 470,135	\$ 535,735
Minimum Operating Balance Target	\$ 294,351	\$ 311,323	\$ 322,954	\$ 335,073	\$ 346,823	\$ 359,042
Net Cash Flow After Rate Increase	100,696	(112,192)	(10,818)	19,529	31,394	65,599
Coverage After Rate Increase: Bonded Debt	10.50	5.57	7.09	7.59	6.50	6.92
Coverage After Rate Increase: Total Debt	1.73	1.33	1.62	1.74	1.76	1.89
Capital Reserve Summary						
Beginning Capital Balance	\$ 1,418,718	\$ 854,216	\$ 787,117	\$ 1,111,375	\$ 1,140,888	\$ 1,016,696
Capital Revenues:						
System Reinvestment Funding						
Minimum Policy	\$ -	\$ 200,000	\$ 210,000	\$ 220,000	\$ 230,000	\$ 240,000
Operating Surplus	-	-	-	-	-	-
Total	\$ -	\$ 200,000	\$ 210,000	\$ 220,000	\$ 230,000	\$ 240,000
Draws on Existing State Loans	451,298	897,960	-	-	-	-
GFC Revenue Towards Capital	79,381	22,071	22,071	22,071	22,071	22,071
Net Debt Proceeds Available for Projects	-	-	300,000	-	-	-
Interest Earnings	7,525	4,702	4,367	5,988	6,135	5,515
Total Capital Revenues and Beginning Reserve	\$ 1,956,922	\$ 1,978,949	\$ 1,323,555	\$ 1,359,433	\$ 1,399,094	\$ 1,284,281
Capital Project Expenditures	\$ (1,102,705)	\$ (1,191,832)	\$ (212,180)	\$ (218,545)	\$ (382,398)	\$ (256,783)
Ending Capital Balance	\$ 854,216	\$ 787,117	\$ 1,111,375	\$ 1,140,888	\$ 1,016,696	\$ 1,027,498
Minimum Target	\$ 440,004	\$ 451,922	\$ 454,044	\$ 456,229	\$ 460,053	\$ 462,621
Ending Reserve Balances						
Operating Reserve	\$ 542,223	\$ 430,031	\$ 419,213	\$ 438,741	\$ 470,135	\$ 535,735
Capital Reserve	\$ 854,216	\$ 787,117	\$ 1,111,375	\$ 1,140,888	\$ 1,016,696	\$ 1,027,498
Debt Reserve	\$ 86,211	\$ 86,211	\$ 86,211	\$ 86,211	\$ 86,211	\$ 86,211
	\$ 1,482,650	\$ 1,303,359	\$ 1,616,798	\$ 1,665,840	\$ 1,573,042	\$ 1,649,444
Operating Reserve: Minimum Days of O&M	60 days	60 days	60 days	60 days	60 days	60 days
Operating Reserve: Actual Days of O&M	111 days	83 days	78 days	79 days	82 days	91 days
Capital Reserve Minimum Target	\$ 440,004	\$ 451,922	\$ 454,044	\$ 456,229	\$ 460,053	\$ 462,621

HARD COPY OF COMPLETE PLAN
(INCLUDES MAPS, CHARTS, AND
APPENDICES) AVAILABLE FOR
REVIEW IN THE COUNCIL
OFFICE, 311 GRAND AVENUE,
BELLINGHAM, WA.